

# Excavation and Grading Handbook

1. What does RS stand for?

- a. Rate of slope
- b. Road surface
- c. Reference stake
- d. Rear station

2. What do the markings above and below the diagonal lines on a cut stake indicate?

- a. The amount of cut is above the diagonal and the distance is below
- b. Take all measurements below the diagonal from the next cut
- c. The amount of cut is above the diagonal and the fill is below
- d. none of the above

3. What other abbreviation means the same as RS?

- a. PG
- b. IS
- c. EP
- d. RP

4. If the RS distance is followed by a double line, where must the remainder of the grades and distances be established from?

- a. The surveyor's hub
- b. Grade setter's RS hub
- c. Each following cut or distance
- d. The HP

5. How much will a 2 percent slope rise or fall in 20 feet?

- a. 0.20 foot
- b. 0.30 foot
- c. 0.40 foot
- d. 0.60 foot

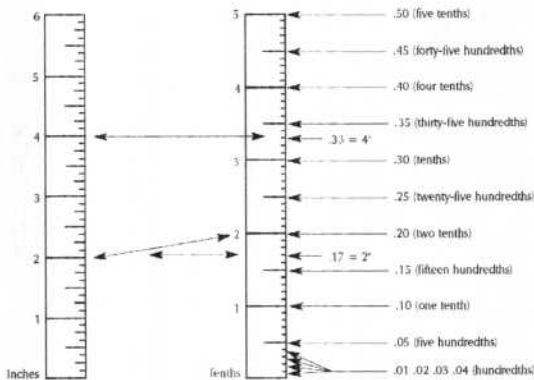
6 Where is the elevation on the side of the surveyor information stake taken from?

- a. The survey hub
- b. The centerline
- c. The reference stake
- d. The catch point

7 What does it mean to the grade setter if every distance on a surveyor's stake is followed by a double line?

- a. He must take the next grade and distance from each preceding point
- b. He must measure back to the survey hub for distance and elevation
- c. He must measure back to the survey stake for distance only
- d. It indicates that all the following measurements are cuts

8 Which of the following is equal to 4 inches?



- a. 0.16 foot
- b. 0.20 foot
- c. 0.33 foot
- d. 0.40 foot

9 What is the purpose of a second horizontal line on a fill stake located 1 foot above the finished grade?

- a. To locate the hub set by the surveyor
- b. To indicate the overfill point to the equipment operator
- c. To help the grade setter set the next fill stake
- d. To help the grade setter establish the elevation at the projected centerline grade

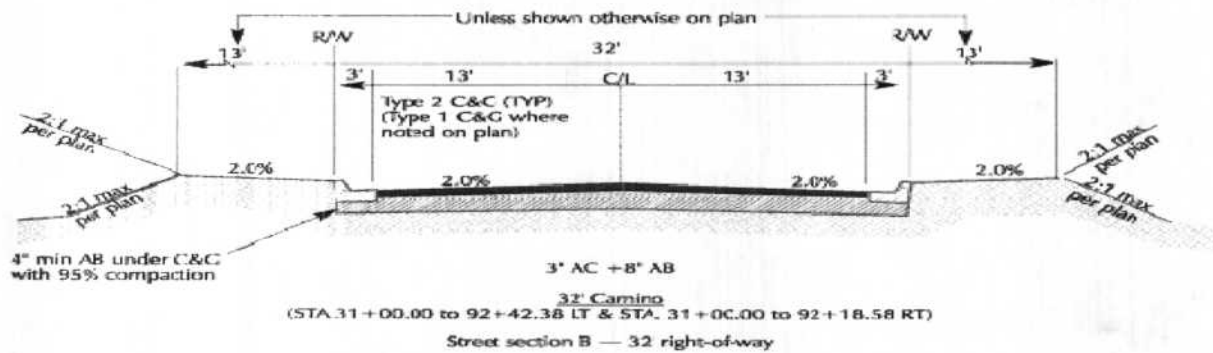
10 What do the west and east toe grades on a ditch channel stake indicate?

- a. The distance across the channel
- b. The amount of fill required at the base of the west and east slopes
- c. The slope of the channel from west to east
- d. The bottom of the slope on each side of the channel

## Excavation & Grading Handbook Chapter 2: Plan Reading

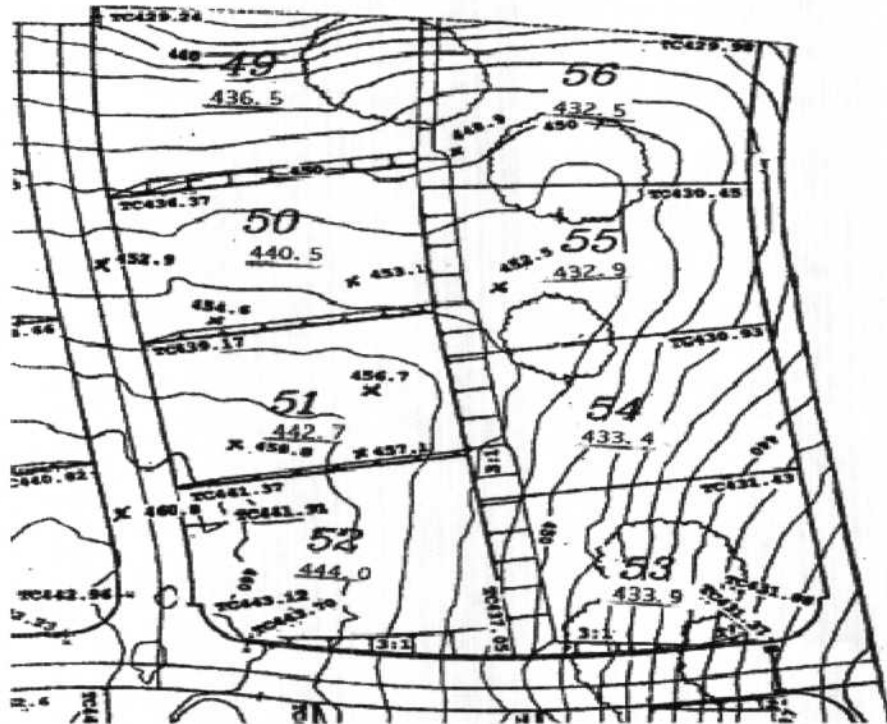
1 If the Camino street section in the figure has a 2 percent slope, how much fall is that from centerline to lip-of-curb?

- a. 0.19
- b. 0.26
- c. 0.27
- d. 0.32



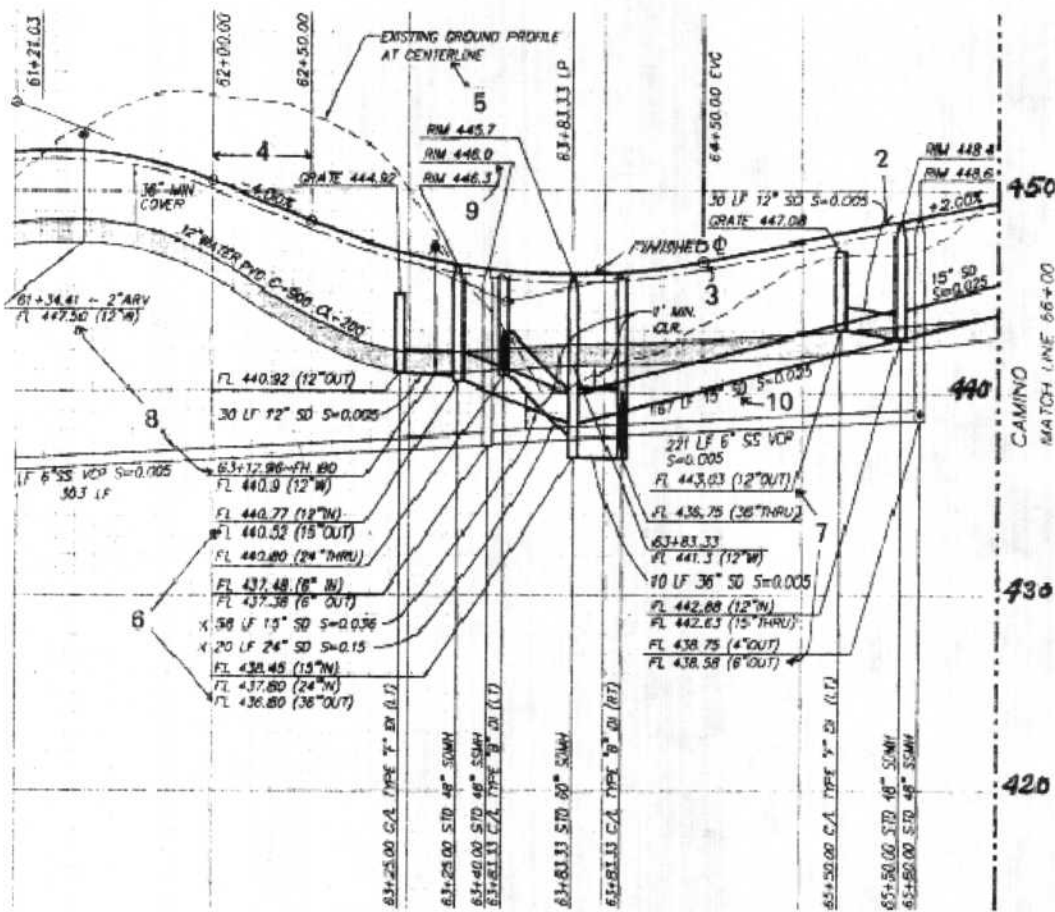
2 What is the elevation difference between lot 51 and lot 54 in the figure?

- a. 7.90 feet
- b. 8.90 feet
- c. 9.30 feet
- d. 10.20 feet



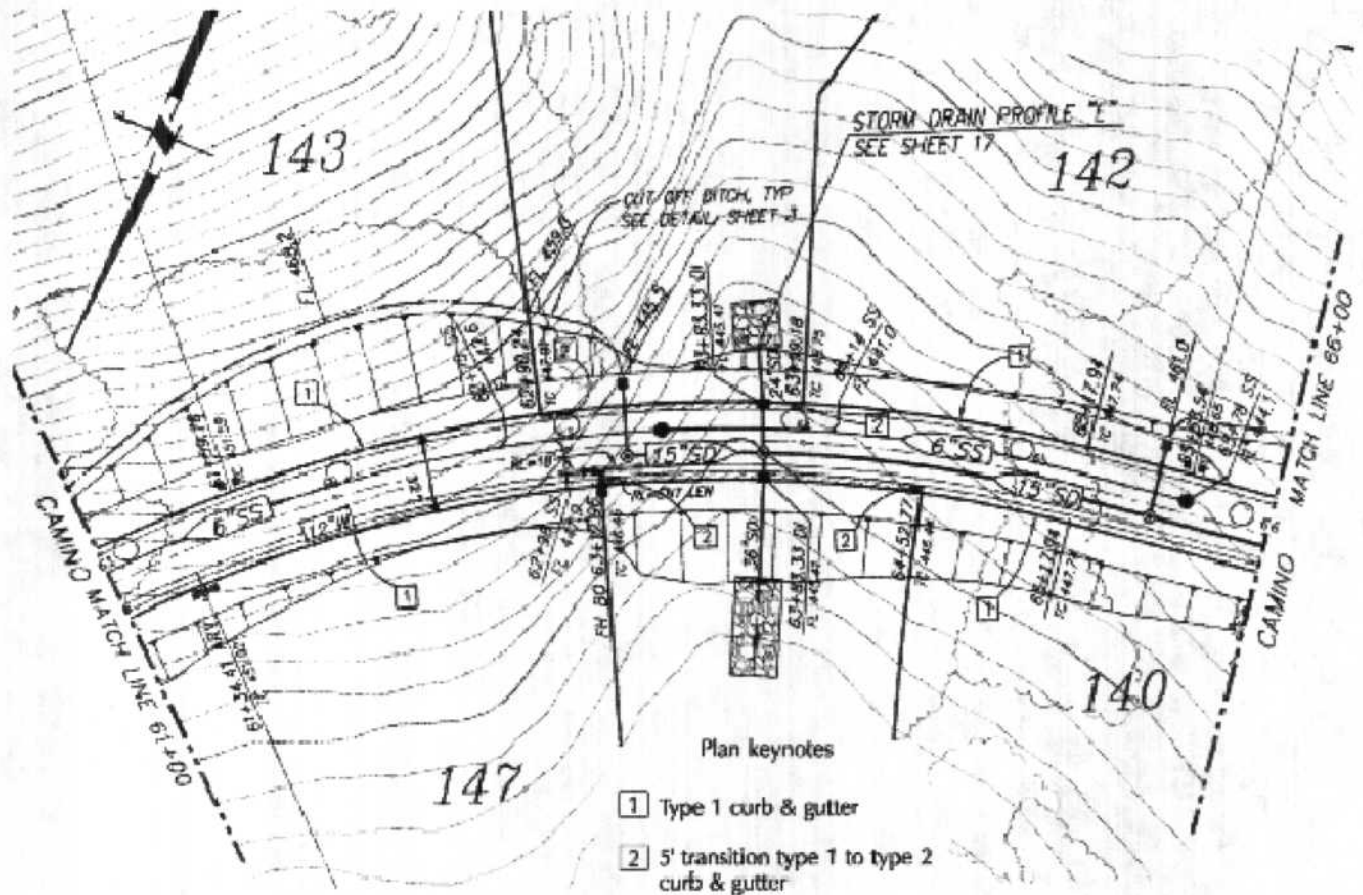
3 What is the manhole rim elevation at station 63+83.33 in the figure?

- a. 445.70
- b. 445.84
- c. 445.85
- d. 446.30



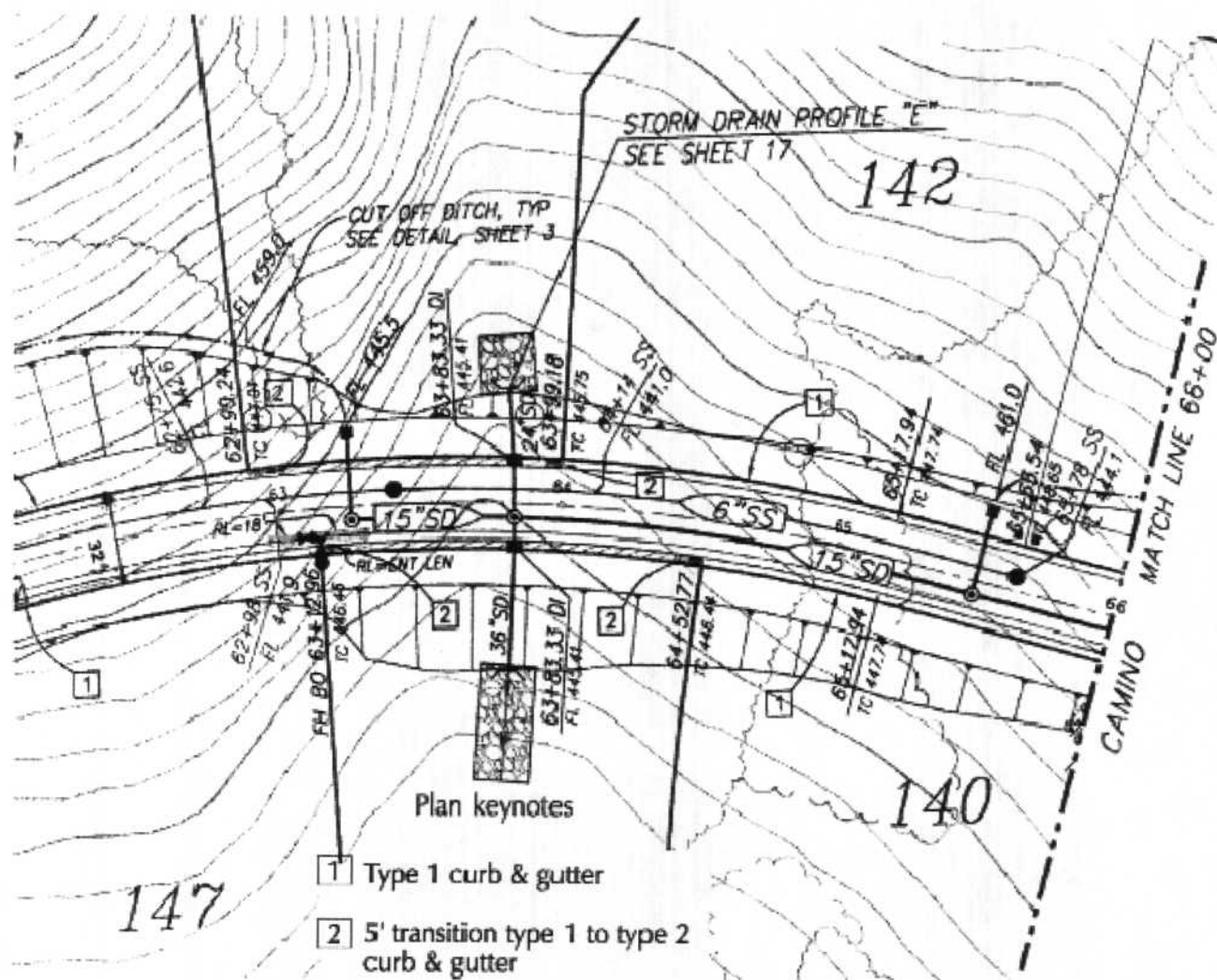
4 What is the length of the transition from type 1 to type 2 curb & gutter in the figure?

- a. 3 feet
- b. 5 feet
- c. 6 feet
- d. 8 feet



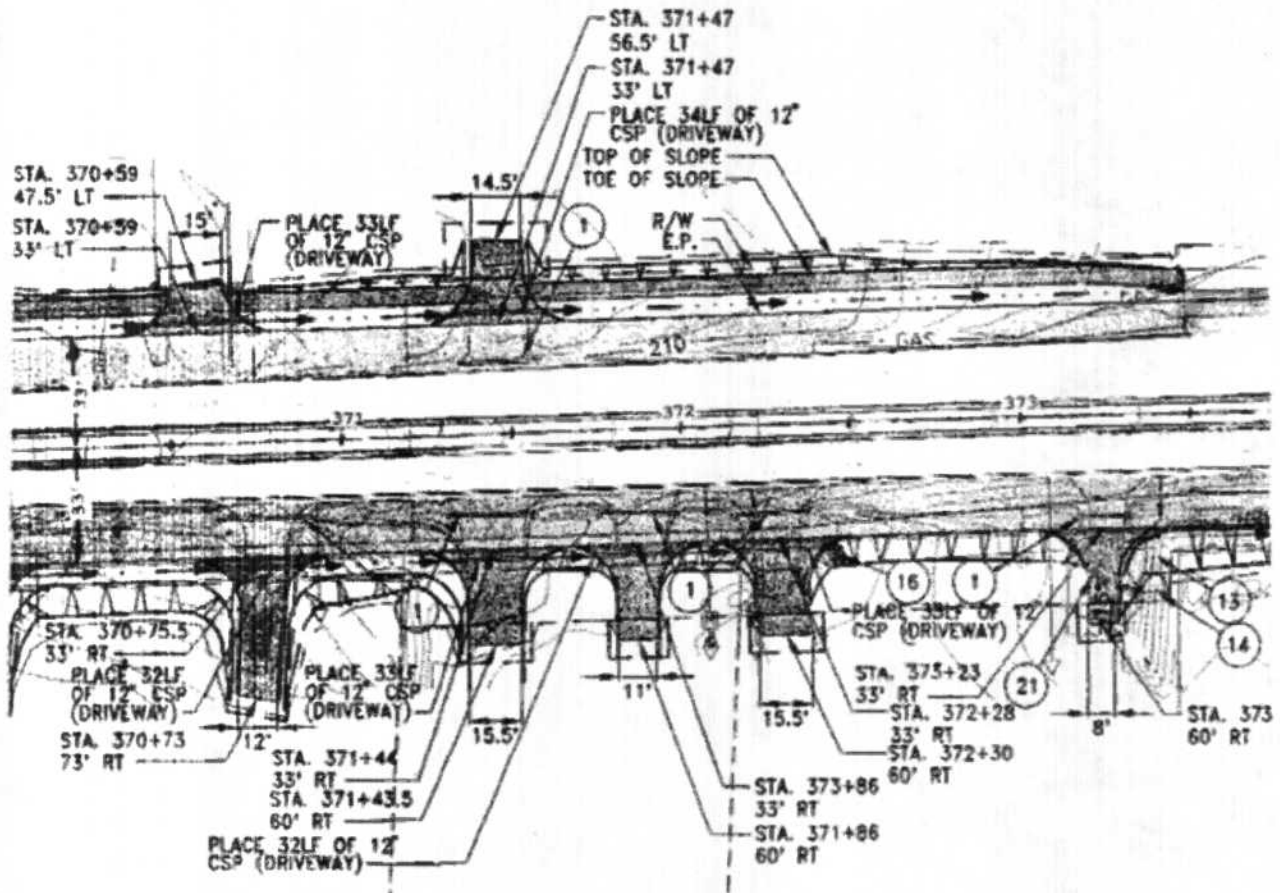
5. What is the flow line elevation of the sewer service line coming from the manhole in the figure?

- a. 439.10
- b. 443.2
- c. 444.1
- d. 461.0



6 How wide is the driveway at Station 371+47 in the figure?

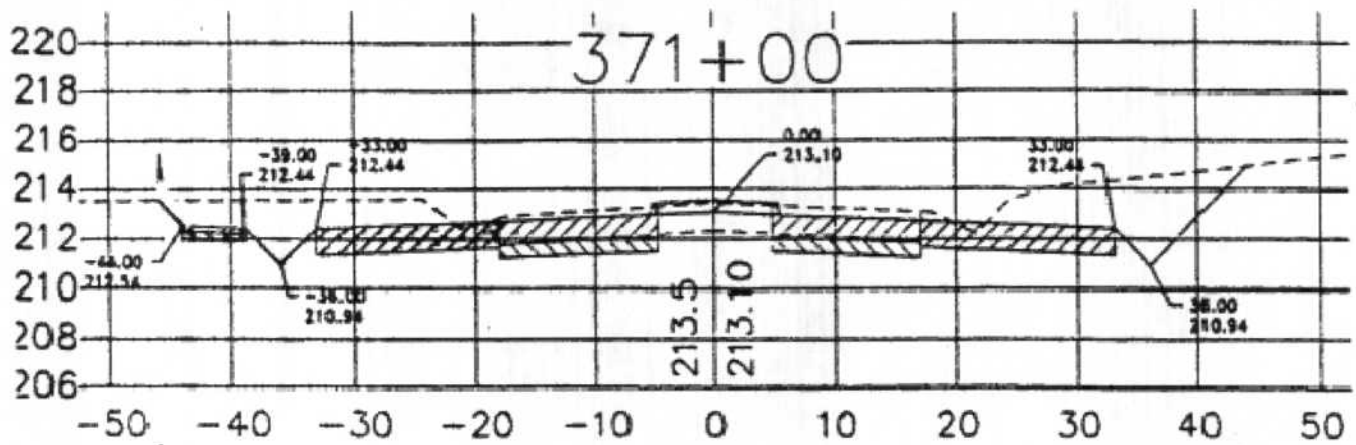
- a. 14 feet
- b. 14.5 feet
- c. 15 feet
- d. 15.5 feet





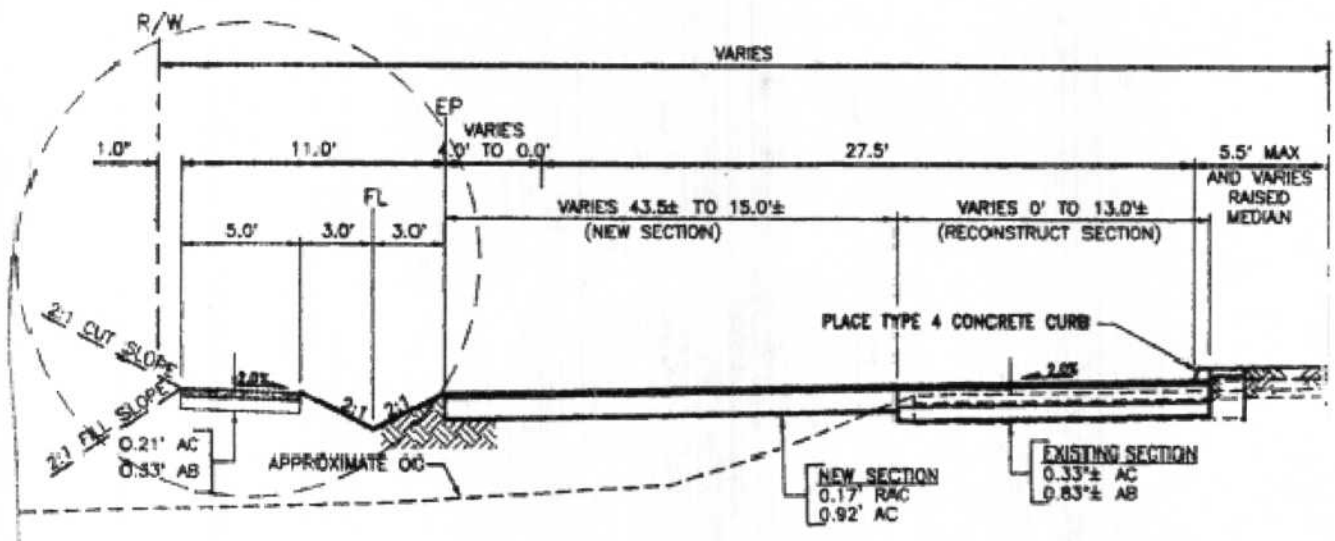
7 What is the distance from centerline to EP, right and left, at Station 371+00 in the figure?

- a. 33 feet
- b. 36 feet
- c. 39 feet
- d. 44 feet



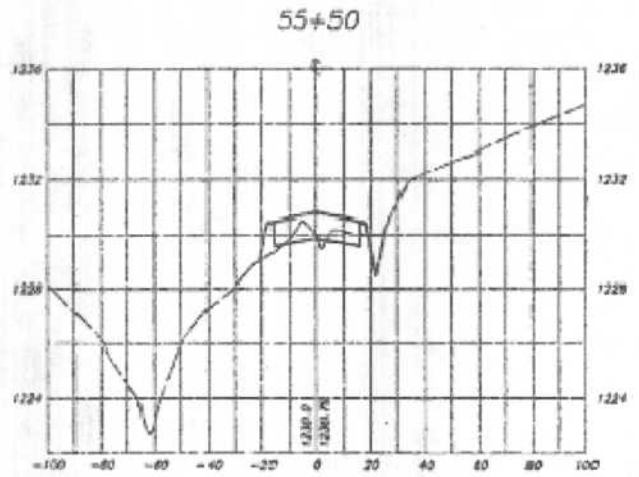
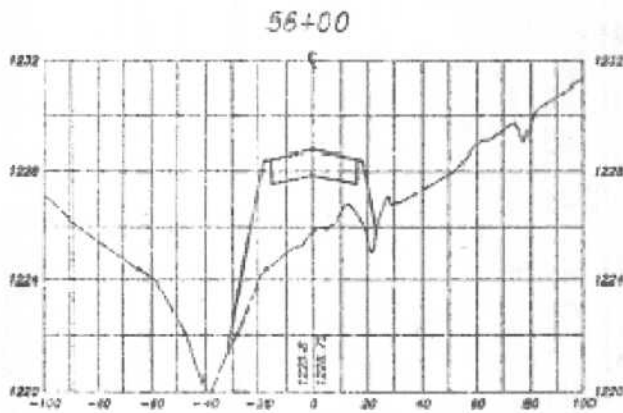
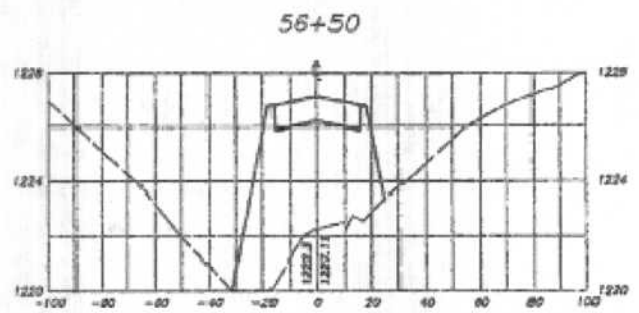
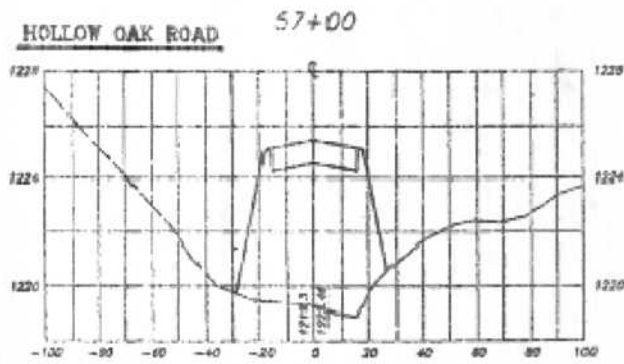
8 How thick is the AC base of the New Section in the figure?

- a. 0.17 foot
- b. 0.58 foot
- c. 0.83 foot
- d. 0.92 foot



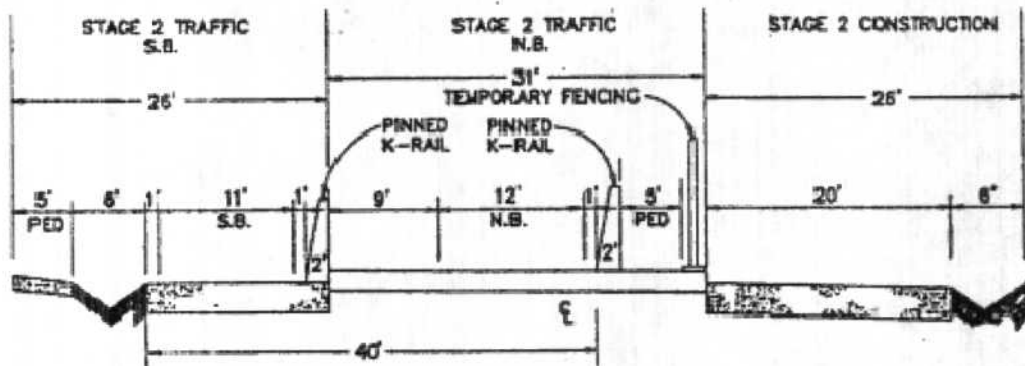
9 Which cross section in the figure shows some cut needed for the road?

- a. 55+50
- b. 56+00
- c. 56+50
- d. 57+00

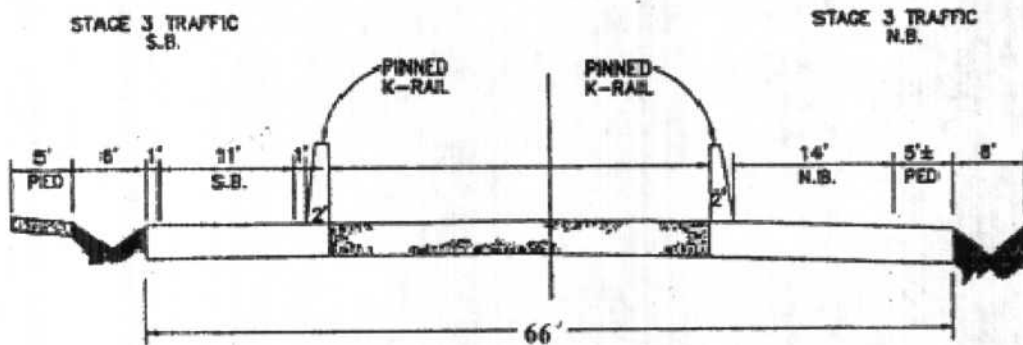


10 When the construction in the figure is finished, what will be the total width of all three completed sections?

- a. 32 feet
- b. 58 feet
- c. 64 feet
- d. 66 feet



**STAGE 2 TYPICAL CROSS SECTION**



**STAGE 3 TYPICAL CROSS SECTION**

# Excavation and Grading Exam 3

1 If you have a 4-foot swede and your finished grade at centerline is 0.30 higher, what should your ruler reading be?

- a. 2.70
- b. 3.70
- c. 3.90
- d. 4.30

2 What do you call a method of setting grade at a center point by sighting across three lath?

- a Setting crows feet
- b Setting swedes
- c Setting swales
- d Setting boots

3 To set an 8-foot string line for a 6.13-foot ditch cut, what must be added to the surveyor's grade in order to mark the grade pin correctly?

- A 0.87 foot
- B 1.69 feet
- C 1.87 feet
- D 2.87 feet

4 What will cause the laser unit to automatically shut off?

- A The receiver is out of range
- B It's bumped off-level
- C Another unit is being operated nearby and the signal is confusing it
- D The beam is blocked by a metal object

5 What is a bench mark?

- A The point at which you begin your cuts
- B The northernmost point of the site, to be used as a beginning point for surveying
- C The center point where you locate the laser level
- D A point of known elevation

6 What should you do if the receiver unit isn't receiving a signal from the laser level?

- a Turn the receiver off and on quickly
- b Make sure the receiver is within 40 feet of the laser level
- c Check the battery and replace it with the spare you should always have with you
- d Slide the receiver up or down

7 If the laser receiver unit shows a straight bar and the rod reading is 7.92, the bench mark cannot be at which elevation?

- A 127.92
- B 717.92
- C 876.92
- D 1037.92

8 When checking a grade, if your rod reading is 1.10 and the grade required at that point is 4.18, what would you mark on your lath?

- A F-3.08
- B F-4.18
- C F-5.28
- D C-3.38

9 What does it mean if a crows foot has a horizontal line drawn across it and there's an arrow with a circle through the tail pointing at that line?

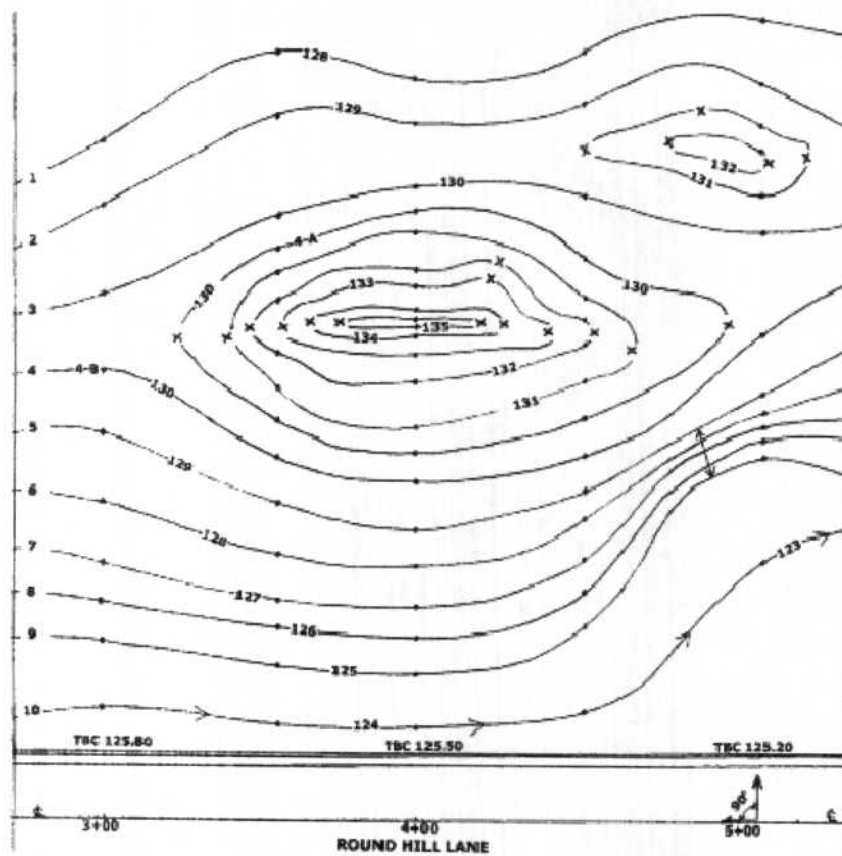
- A The line indicates finish grade
- B The line indicates original grade
- C More cut is needed
- D Overfill is needed

10 If there's a cut of 3.50 and a 4-foot boot is needed, the grade setter measures up and marks the lath where?

- A 3.00
- B 3.50
- C 4.00
- D 4.50

# Excavation & Grading Handbook Chapter 4: Setting Grade Stakes Using a Contour Plan

- 1 What is another name for a contour plan?  
A Profile plan  
B Topographic plan  
C Grading plan  
D Subdivision plan
- 2 How can you tell when contour lines represent a steep slope?  
A They are spread out evenly  
B They turn sharply  
C They connect in a circle  
D They are close together
- 3 How many contour lines in the figure are at elevation 130?  
A 1  
B 2  
C 3  
D 4



4 What is indicated when contour lines connect to form a loop or circle?

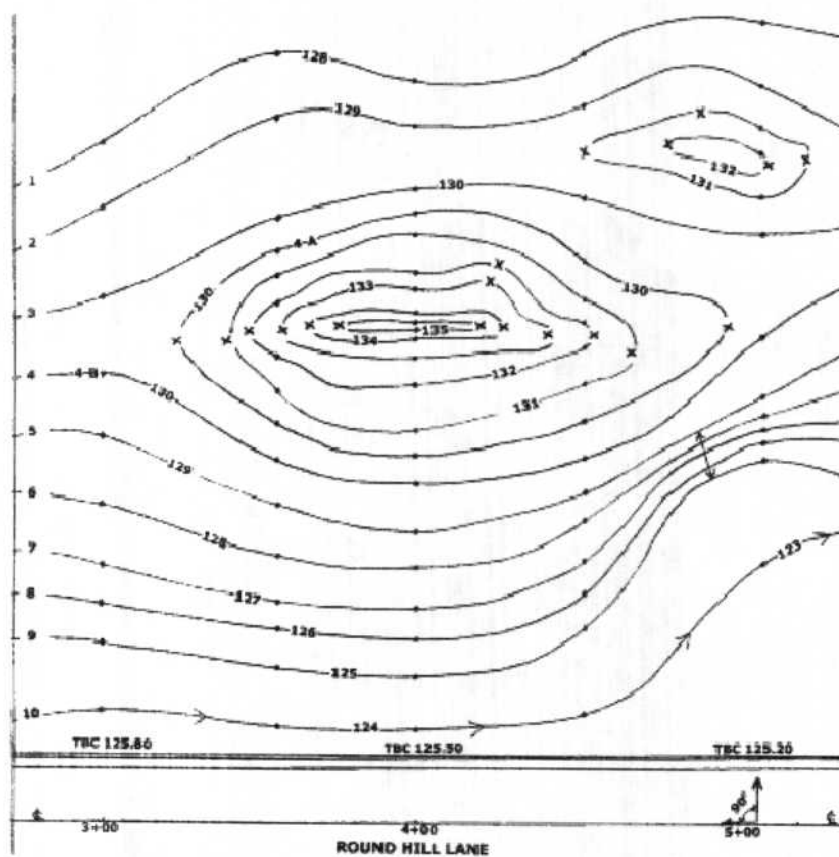
- A A depression or a mound
- B A lake
- C A mound
- D A steep grade

5 When do contour lines change grade?

- A When making a loop
- B Never
- C In a depression
- D At the top-back-curb

6 What line in the figure does not represent a true contour line?

- A 2
- B 4B
- C 7
- D 10





7 In order to correctly mark the cut or fill to produce the finish grade, where must you start your measurements?

- A At the first contour line stake
- B At the edge-of-pavement
- C At a known elevation
- D Only at a bench mark

8 If an elevation is 125.50, which numbers will be set on the surveyor's rod?

- A 5.50
- B 125
- C 125.5
- D 125.50

9 Using 9 feet as a baseline, what combination of measurements will allow you to make a 90-degree angle?

- A 3, 6 and 9 feet
- B 3, 9 and 12 feet
- C 9, 12 and 15 feet
- D 9, 12 and 18 feet

10 Who, other than the surveyor, might set the grades for an industrial tract landscaping project?

- A The architect
- B The general contractor
- C The equipment operator
- D The excavation contractor

# Excavation and Grading handbook Exam 5

1. If checking a road section with a laser, how many elevations should be marked on the lath by the grade setter?
  - A. One
  - B. Two
  - C. Three
  - D. Four
  
2. If your rod reading on the hub is 3.50 and the stake shows a 0.70 fill with a road section depth of 0.75, what rod reading would you want to read for subgrade?
  - A. 2.0
  - B. 3.55
  - C. 3.45
  - D. None of the above
  
3. When using a laser with a sloping beam, what's the maximum distance from the trench centerline you'd want to set up to ensure accuracy?
  - A. 6 feet
  - B. 8 feet
  - C. 10 feet
  - D. 12 feet
  
4. When setting up a grade rod for trenching using a laser, if the cut is 7.58 and you measure up from the hub and get a steady signal on the receiver at 2.92, where on the rod do you place a mark for flow-line grade?
  - A. 10.50
  - B. 10.58
  - C. 10.92
  - D. 11.84
  
5. If the survey rod has a 10.50-foot measurement for flow line and you need a 0.50 undercut, where would you set the rod elevation?
  - A. 9.50
  - B. 10.00
  - C. 11.00
  - D. 12.50

6. How do you figure the undercut when determining trench depth for laying pipe?
- A. It's provided in the specifications or plans
  - B. Add the thickness of the pipe bedding to the trench cut
  - C. Add the thickness of the pipe bedding to the inside pipe diameter
  - D. Add the thickness of the pipe to the thickness of the pipe bedding
7. What do you calibrate the cutting blade on a scraper to when using an on-board laser?
- A. The laser transmitter
  - B. The finish elevation
  - C. The system is automatically controlled
  - D. A bench mark or known elevation
8. When setting a GPS base station, what must always be set up plumb, level and in the same location each day?
- A. The GPS screen
  - B. The GPS receiver unit
  - C. The radio antenna
  - D. The rover unit
9. What is the minimum number of satellites you should be able to access to ensure the accuracy of a GPS signal?
- A. Eight
  - B. Seven
  - C. Six
  - D. Five
10. What is the most difficult part of using GPS?
- A. Connecting the rover to a portable radio and satellite antenna
  - B. The initial base unit set up and model building
  - C. Training operators to use the equipment
  - D. Transferring information to the rover unit

# Excavation and Grading Handbook Exam 6

1. What is the primary cost-cutting feature of concrete curb machines?
  - A. No form crew is needed
  - B. No finishers are needed
  - C. They cut their own grade
  - D. They pour the curb and road at the same time
  
2. What is the primary use for a profilograph?
  - A. Sloping concrete
  - B. Striking off concrete
  - C. Checking road grade
  - D. Cutting grooves in concrete
  
3. What equipment is used to pour concrete roadways?
  - A. Profiler
  - B. Slip-form paver
  - C. Concrete curb machine
  - D. Reclaiming machine
  
4. What does an auger-driven curb machine use for grade?
  - A. A string line
  - B. A laser beam
  - C. Sonar
  - D. The asphalt base
  
5. The type of surface produced by a concrete slip-form paver is a smooth concrete mat that needs which of the following?
  - A. No finishing
  - B. A tined finish
  - C. Hand finishing
  - D. Only a groove-cutting machine
  
6. A profiler can mill which type of road surfacing material?
  - A. Asphalt only
  - B. Concrete only
  - C. Both concrete and asphalt
  - D. Only aggregate within the size parameters of the profiler
  
7. What is the function of a grizzly?
  - A. Sizing material
  - B. Crushing rock
  - C. Trimming aggregate
  - D. Ripping asphalt

8. Which of the following is not done by a reclaiming machine?
- A. Grind up asphalt
  - B. Mix dirt
  - C. Mix aggregate
  - D. Trim to grade
9. What is the purpose of carbide teeth on a trencher?
- A. To dig more precisely
  - B. To dig through hard materials
  - C. To increase the trenching speed
  - D. To protect the edge of the trenching blade
10. What is probably the most important element to consider in operating an excavation and grading business?
- A. Proper estimating and bidding techniques
  - B. Selecting the right equipment for each job
  - C. Communication among the foreman, superintendent, and estimator
  - D. Safety

# Excavation and Grading Handbook Exam 7

1. What determines the size of equipment you choose for a particular job?
  - A. The amount of excavation
  - B. The length of haul
  - C. The amount of fill
  - D. The time allotted for the job
  
2. What determines the number of scrapers needed for a job?
  - A. The depth of cut
  - B. The amount of excavation
  - C. The length of haul
  - D. The size of the scrapers
  
3. How should push-pull scrapers load?
  - A. The rear scraper first
  - B. The front scraper first
  - C. Both scrapers at the same time
  - D. With a dozer pushing for a faster load
  
4. How should a haul road be maintained?
  - A. It must be kept moist to cool the tires
  - B. It must have a separate passing lane for fast-moving equipment
  - C. Any curves must be banked
  - D. It must be smooth, wide, and not dusty
  
5. What is the typical loading time for an open-bowl scraper being pushed under average conditions?
  - A. 40 seconds
  - B. 60 seconds
  - C. 80 seconds
  - D. None of the above
  
6. Under what circumstances would you choose a paddle-wheel scraper?
  - A. If all the cuts are short and deep
  - B. If the soil is very sandy
  - C. If all the cuts are shallow
  - D. If the soil is very muddy
  
7. In which situation are you least likely to use a dozer?
  - A. Excavating downhill to fill
  - B. Excavating on an all rock ripped slope
  - C. Excavating in good soil using a paddle-wheel scraper
  - D. Excavating muddy areas

8. What might cause haul trucks to start bunching up?
- A. A slow driver who won't be passed
  - B. Not enough trucks on the haul
  - C. A traffic light near the fill site
  - D. Too many trucks on the haul
9. Who would you check with to find out about soil conditions on your job?
- A. The equipment operator
  - B. The local building department
  - C. The property owner
  - D. The estimator who bid the job
10. What situation do you not want to find yourself in on an excavation job?
- A. Working with underpowered equipment
  - B. Working with overpowered equipment
  - C. Working without a paddle-wheel scraper
  - D. Working without a Cat D11 dozer

# Excavating and Grading Handbook Exam 8

1. What is the best equipment for cutting a rocky slope?
  - A. Grader
  - B. Hoe
  - C. Dozer with a slope bar
  - D. Scraper with ripper teeth
  
2. If an existing slope must be cut back 15 feet at a 1:1 slope, how far back will the first cut be made?
  - A. 1 foot
  - B. 10 feet
  - C. 14 feet
  - D. 16 feet
  
3. What is the usual slope tolerance of a rocky slope?
  - A. 0.60 foot
  - B. 1.00 foot
  - C. 1.50 feet
  - D. 2.00 feet
  
4. What should the operator on the scraper do when he's being pushed while loading rock?
  - A. Turn slightly from side to side for better traction
  - B. Add little or no power while being pushed
  - C. Take a deep cut with the apron wide open
  - D. Apply more power than when loading dirt
  
5. What position should the scraper apron be in when loading rock?
  - A. Opened wider than if you were loading dirt
  - B. Opened as far as possible
  - C. Closed; the rock will force it open
  - D. Only slightly open
  
6. If the scraper operator notices he only has a three-quarter load and it seems to have quit loading, what should he do?
  - A. Move the bowl up and down until full
  - B. Lower the bowl for a deeper cut
  - C. Raise the apron
  - D. Not try to load any longer
  
7. What should you do while dumping if you have a boulder so big it won't pass under the bowl?
  - A. Pull forward slowly at a 90-degree turn angle
  - B. Back up slowly at a 90-degree turn angle
  - C. Pull ahead slowly until it rolls under the bowl
  - D. Have the dozer push it away



8. What is the standard compaction percentage required for a compaction test on a rock fill?
- A. You can't do a compaction test on a rock fill
  - B. 80 percent
  - C. 90 percent
9. What's the biggest advantage of using a compactor on rock fill?
- A. To help grind down sharp rock points
  - B. To get the percentage of compaction on the fill
  - C. To push boulders over the edge of the slope
  - D. To help the dozer cut the slope
10. What is a grizzly used for?
- A. To compact fill
  - B. To separate fines from rock
  - C. To rip hard rock
  - D. To crush rock into smaller pieces

# Excavating and Grading Handbook Exam 9

1. What is one of the best ways to keep your excavating costs down?
  - A. Use only the smallest equipment that can handle the job
  - B. Use one large water truck instead of several smaller ones
  - C. Use several grade setters on each job
  - D. None of the above
  
2. Why is it important for the compactor operator to keep dozing dirt as he works?
  - A. To break up large chunks
  - B. To mix the moisture evenly
  - C. To keep from getting ahead of the grader
  - D. To keep the soil from compacting too soon
  
3. What is the grader's most important job when rough excavation starts?
  - A. Grade haul roads
  - B. Start lot pad grading
  - C. Outline street cuts
  - D. Cut sidewalk grade
  
4. Why would you choose to use a water tank rather than a standpipe?
  - A. To keep an accurate load count
  - B. To decrease loading time
  - C. To have extra water on hand
  - D. To load two trucks in tandem
  
5. What is the most efficient equipment for stripping?
  - A. A grader
  - B. A compactor
  - C. An open-bowl scraper
  - D. A paddle-wheel scraper
  
6. What is the only area trimmed to finish grade during rough excavation?
  - A. Sidewalk grade
  - B. Curb grade
  - C. Lot pad
  - D. Street grade
  
7. Fill lots should be overfilled by how much for trim?
  - A. 0.05 to 0.10 foot
  - B. 0.10 to 0.20 foot
  - C. 0.20 to 0.30 foot
  - D. 0.30 to 0.40 foot

8. When must you have erosion control measures in place?
- A. Any time you're excavating in developed areas
  - B. Always
  - C. Any time there's a threat of rain
  - D. Any time there are steep slopes
9. What are the usual compaction requirements for sidewalk and curb subgrade?
- A. 85%
  - B. 90%
  - C. 95%
  - D. 100%
10. What are the usual compaction requirements for street subgrade?
- A. 85%
  - B. 90%
  - C. 95%
  - D. 100%

# Excavation and Grading Handbook Exam 10

1. What's the biggest difference between staking a commercial site and staking a road project?
  - A. The stakes are set every 100 feet
  - B. There are fewer stakes
  - C. There are more stakes
  - D. The surveyor will mark the boots
  
2. Which item listed below will not be found in the job specifications or soils report?
  - A. What to do with stripped topsoil
  - B. The amount of contour grading required
  - C. How much to overbuild the pads
  - D. The staking diagram
  
3. What type of island curb is placed on finished asphalt?
  - A. 6-inch glue-down curb
  - B. 10-inch asphalt dike
  - C. 14-inch barrier curb
  - D. None of these
  
4. What must be done to a fill area before any excavation can be placed on it?
  - A. It must be leveled for dumping
  - B. It must be disked under and the vegetation burned off
  - C. It must be ripped, watered and compacted
  - D. It must be undercut with a grader
  
5. How much are commercial building pads overbuilt?
  - A. 2 feet
  - B. 3 feet
  - C. 5 feet
  - D. 10 feet
  
6. How can you make the rough grading of parking areas easier?
  - A. Excavate through the island noses
  - B. Rip the entire area first
  - C. Cut the islands with a grader
  - D. Use a dozer to shape the islands
  
7. How much should you overbuild pad elevations during rough grading?
  - A. 0.03 to 0.04
  - B. 0.05 to 0.10
  - C. 0.10 to 0.25
  - D. 0.15 to 0.30

8. What should you have the surveyor do when the initial excavation is completed?
- A. Set a benchmark to be used for finished grading
  - B. Stake for curbs
  - C. Stake for underground work
  - D. Verify the parking area and pad grades
9. When is it best to rip and compact the subgrade for parking areas?
- A. Before the curbs are poured
  - B. Before the aggregate is placed
  - C. After watering has partly evaporated
  - D. Before the rough trim
10. What must be done about any unsuitable soil discovered during excavation?
- A. It should be brought to the attention of the soils engineer
  - B. It should be brought to the attention of the owner
  - C. It should be removed and replaced with dry dirt
  - D. It should be removed and replaced with rock

# Excavation and Grading Handbook Exam 11

1. What should be done first before any work begins on a highway project?
  - A. The crew and equipment should be directed to the largest cut area
  - B. The foreman and grade setter should go over the plans and staking
  - C. The surveyor should run three rows of stakes for the grade setter
  - D. The traffic should be detoured so the work area is clear
  
2. Why are right-of-way stakes set?
  - A. For the surveyors' use
  - B. For the grade setters' use
  - C. To indicate limits of the work area
  - D. For centerline control
  
3. Where do you start the fill on a 2:1 fill slope if the RS point is a foot low after clearing?
  - A. 1 foot back of the RS point
  - B. 2 feet back of the RS point
  - C. 4 feet back of the RS point
  - D. None of these
  
4. What do double horizontal lines marked on a survey stake mean?
  - A. Information above the lines is for the surveyors' use only
  - B. "And then"
  - C. The grade setter must double the distance to ditch
  - D. The plus or minus amount tolerance allowed for the grader
  
5. How does the grade setter set the fill slope lath on a large fill slope?
  - A. At 90 degrees from the surveyor's stake
  - B. Exactly plumb with the slope
  - C. In even rows 10 feet apart
  - D. At a uniform height
  
6. What is the usual tolerance on a fill slope?
  - A. 0.05 foot
  - B. 0.10 foot
  - C. 0.20 foot
  - D. 0.50 foot
  
7. It's good practice to overbuild a fill slope by how much?
  - A. 2 to 4 inches
  - B. 4 to 6 inches
  - C. 6 to 8 inches
  - D. 8 to 10 inches

8. Which slope angle is the most difficult to cut with a grader?
- A. 1:1 slope
  - B. 2:1 slope
  - C. 3:1 slope
  - D. 4:1 slope
9. When cutting a slope that has a ditch at toe-of-slope, to what elevation must the initial cut be made?
- A. The road subgrade
  - B. The bottom of the ditch
  - C. The shoulder subgrade
  - D. The centerline of road
10. What must be done with the road subgrade when building a road fill that has chokers?
- A. It should be ripped for compacting
  - B. It should be left low for the choker excess
  - C. It should be built to choker level
  - D. It should be compacted to 95 percent

# Excavation and Grading Handbook Exam 12

1. What should be quickly repaired if cut or damaged during the road-widening preparation process?
  - A. Fences
  - B. Walks
  - C. Shrubs
  - D. Sprinkler lines
  
2. When is it acceptable to work beyond the right-of-way line?
  - A. When you find, after beginning work on the job, that it's necessary
  - B. When a note on the plans instructs you to do so
  - C. When the property owner asks you to do a little extra paving
  - D. When the inspector thinks it will look better
  
3. Some agencies don't approve of using too many of which road safety device?
  - A. K-rail
  - B. Delineators
  - C. Barricades with flashers
  - D. Cones
  
4. How many methods are generally used to tie out manholes, water valves, and cleanouts?
  - A. Two
  - B. Three
  - C. Four
  - D. Five
  
5. How can you protect a saw cut in the shoulder pavement that will be run over by trucks and scrapers?
  - A. Back it with aggregate
  - B. Make the cut only half-way through the asphalt
  - C. Make two cuts, 6 inches apart, and leave the pavement between them
  - D. Don't make the saw cut until the equipment has finished excavating
  
6. What should be done with mailboxes on posts that are in the work area?
  - A. They should be returned to the post office
  - B. They should be given to the property owner until the work is complete
  - C. They should be cut off and placed in portable 5-gallon buckets
  - D. They should be hauled away and then replaced later
  
7. When the preparations are complete, which of these work items is the first to be done?
  - A. Cut roadside ditches
  - B. Lay driveway culverts
  - C. Pour walks
  - D. Repair fences



8. What determines your choice of excavating equipment for a 15-foot road section?

- A. Where you must haul the excess dirt
- B. The depth of the road section
- C. The equipment the estimator assumed would be used
- D. The length of the job

9. Why should you overfill a fill slope even though it can't be track-walked?

- A. Because it will help prevent slope erosion
- B. So a compacted surface is left after trimming
- C. So there will be excess dirt for the shoulder fill
- D. So the landscaper will have topsoil for planters

10. If a road section is so narrow that 95 percent compaction is difficult to achieve, how might you reduce the required compaction rate to 90 percent?

- A. Deepen the aggregate section
- B. Use a hoe compaction wheel
- C. Use only asphalt and no aggregate
- D. Use crushed rock in place of aggregate

# Excavation and Grading Handbook Exam 13

1. Why are narrow embankments more difficult to build than wide embankments?
  - A. The compaction requirements are greater
  - B. The confined area makes passing difficult for the equipment
  - C. Compaction water applied tends to flow off the area
  - D. The slopes must be kept to a closer tolerance
  
2. After the stripping and clearing is done, what is the next order of work?
  - A. Rip and compact the original ground
  - B. Have the grader set slope stakes
  - C. Track-walk the original slope
  - D. Have the scrapers start hauling fill
  
3. Cutting a 3-foot vertical bench into an existing 2:1 slope adds how much horizontal space?
  - A. 4 feet
  - B. 6 feet
  - C. 8 feet
  - D. 12 feet
  
4. Where does the first fill on a narrow road widening come from?
  - A. It's hauled in from the closest cut area
  - B. It's usually dumped from the road above
  - C. It's generated from the bench cut
  - D. It's generated from the stripping operation
  
5. What method should you use to gain extra fill width for your equipment?
  - A. Cut turnouts
  - B. Cut a 10-foot bench cut
  - C. Make a 5-foot vertical cut
  - D. Overfill the shoulder
  
6. Why do you need to cut a bench into the existing slope?
  - A. To make room for the equipment to work
  - B. To properly tie into the existing fill
  - C. To generate more fill
  - D. To provide a mark for the scrapers to fill to
  
7. What important safety factor should you remember while building any fill?
  - A. Make sure the fill is compacted with a vibratory compactor
  - B. Never make a vertical cut into the existing slope
  - C. Always keep the fill area level
  - D. Always build the outside edge higher

8. What is the possible disadvantage of using bottom dump trucks?
- A. Heavy clay and large chunks may not dump
  - B. They need a 60-foot turning radius
  - C. They are slower than graders
  - D. The truck must stop for a bottom dump
9. If you're dumping fill from the road above, what must you do before the lane is reopened for traffic each night?
- A. Advise the local agency of your progress
  - B. Remove all signs related to the road work
  - C. Scrape and clean the roadbed
  - D. Post a guard at the edge of the work area
10. What type of compactor works fastest on a narrow fill?
- A. A pad-drum roller
  - B. A pad-foot compactor with a center wheel
  - C. A Cat 815 pad-foot compactor
  - D. A sheepsfoot compactor

# Excavation and Grading Handbook Exam 14

1. How are channels usually staked?
  - A. Every 50 feet on both sides
  - B. Every 50 feet on the right, looking downstream
  - C. Every 100 feet on each side
  - D. Every 25 feet down the center of the channel
  
2. How should a diversion trench be dug?
  - A. From upstream to downstream
  - B. From downstream to upstream
  - C. At least 1 foot deeper than the existing channel
  - D. At least 6 feet deeper than the existing channel
  
3. How can you ensure an even flow through a long detour channel?
  - A. Use a trencher to excavate the detour channel
  - B. Make sure the detour channel is at least 6 feet deep its entire length
  - C. Set hubs and cuts for grade
  - D. Use scrapers equipped with a laser to excavate the detour channel
  
4. What type of pumping setup is best to use in a residential area?
  - A. Gas water pumps
  - B. Diesel water pumps
  - C. A diesel generator and submersible electric pumps
  - D. Utility-supplied power and submersible electric pumps
  
5. How can you be sure the water is maintained at the proper level if you're using a pumping setup?
  - A. Install a float switch system
  - B. Have a maintenance person to control the pumps
  - C. Set the pumps on timers
  - D. Make sure there's an adequate fuel supply to maintain the pumps
  
6. Where will the grade setter paint the line for the first cut of a bench cut at top-of-slope on a 1-3/4:1 slope?
  - A. 1 foot out from the top of slope
  - B. 1.50 feet out from the top of slope
  - C. 1.75 feet out from the top of slope
  - D. 2 feet out from the top of slope
  
7. What equipment would you use to fill in a narrow, washed-out slope?
  - A. A hoe with a grading bucket
  - B. A hoe with a compaction wheel
  - C. A small dozer
  - D. A dump truck

8. Never fill against what type of slope?

- A. A slope that has been benched
- B. An undisturbed slope
- C. A 1:1 slope
- D. A slope less than 3 feet high

9. How do you finish a channel slope?

- A. Track roll it two times
- B. Hydroseed it
- C. Trim it to a firm surface
- D. Back-drag it with a dozer blade

10. What can you do to eliminate most ground water during a channel excavation?

- A. Sink wellpoint pumps
- B. Pump lime into the soil
- C. Set up a sump pump
- D. Dig a small drainage ditch

# Excavation and Grading Handbook Exam 15

1. What do you call an area that's too soft to cover with base rock or asphalt?
  - A. Muddy
  - B. Pumped
  - C. Unsaturated
  - D. Saturated
  
2. Who covers the cost for removing unsuitable material below subgrade during excavation?
  - A. It's billed as extra work
  - B. It's the contractor's responsibility
  - C. The cost is shared by the contractor and owner
  - D. No one; it should be allowed to sit until it dries and firms up
  
3. What should you use to test roll movement on subgrade?
  - A. A water truck
  - B. A grader
  - C. A scraper
  - D. A steel drum roller
  
4. How much soft soil was excavated if 4,000 tons of aggregate is needed to fill the hole?
  - A. 1,800 cubic yards
  - B. 2,000 cubic yards
  - C. 2,400 cubic yards
  - D. 4,000 cubic yards
  
5. How long should you wait to place the top lift when plugging soft areas with asphalt?
  - A. 8 hours
  - B. 12 hours
  - C. 24 hours
  - D. 36 hours
  
6. What is the best equipment choice for removing unsuitable soil in a thin bridged area?
  - A. Hoe and small dump trucks
  - B. Cat 613 scraper
  - C. Grader
  - D. Dozer
  
7. What is the main reason for using filter fabric?
  - A. Stabilize mud
  - B. Keep mud from penetrating the aggregate
  - C. Keep water from penetrating the aggregate
  - D. Eliminate trimming

8. Which of the following will not help stabilize an unsuitable subgrade?

- A. Cement
- B. Filter fabric
- C. Lime
- D. Rolling

9. Which type of utility line is less likely to break in unsuitable areas?

- A. Telephone ducts
- B. Steel water mains
- C. Plastic or steel gas mains
- D. Clay sewer lines

10. How much sand or light gravel backfill do most utility agencies require you to place around excavated utility lines?

- A. 4 to 6 inches
- B. 6 to 12 inches
- C. 12 to 18 inches
- D. 18 to 24 inches

# Excavation and Grading Handbook Exam 16

1. What is the most important element for achieving good soil compaction?
  - A. The weight of the compaction equipment
  - B. The type of drum used
  - C. The amount of mixing done
  - D. The amount of water used
  
2. What does the amount of compaction actually measure?
  - A. The water in the soil
  - B. The weight of the soil
  - C. The density of the soil
  - D. The volume of the soil
  
3. Why has nuclear testing replaced sand cone testing?
  - A. It's more accurate
  - B. It's faster
  - C. It tests much deeper
  - D. No compaction curve is needed
  
4. How will a nuclear test gauge indicate tightly-compacted soil?
  - A. A low reading on the gauge
  - B. A high reading on the gauge
  - C. The impulses will return almost instantly
  - D. There will be a delay as the impulses slow due to the compression in the soil
  
5. What is the compaction requirement for most embankments?
  - A. 80 percent
  - B. 85 percent
  - C. 90 percent
  - D. 95 percent
  
6. Before taking a compaction test on an embankment fill in progress, the grader or compactor should cut down how many inches to a level spot for testing?
  - A. 4 inches
  - B. 6 inches
  - C. 8 inches
  - D. 10 inches
  
7. What are the compaction requirements for a road subgrade?
  - A. 80 percent
  - B. 85 percent
  - C. 90 percent
  - D. 95 percent



8. Which of the following materials compacts most readily to 95 percent?

- A. Aggregate
- B. Clay
- C. Hardpan
- D. Sand

9. What equipment should you use first to roll subgrade on a large job?

- A. A smooth-drum vibratory roller
- B. A pad-drum vibratory roller
- C. A disc
- D. A rubber-tired roller

10. What would be the last choice for rolling a large fill being built?

- A. A pad-drum vibratory roller
- B. A pad-foot self-propelled roller
- C. A sheepsfoot self-propelled roller
- D. A smooth-drum vibratory roller

# Excavation and Grading Handbook Exam 17

1. What must the grade setter do before he can check grade with an eye level?
  - A. Set a string line
  - B. Set boots
  - C. Offset the grades 2 feet
  - D. Set a swede at flow line
  
2. How much offset is needed when a barrier curb is staked for forming?
  - A. 1 foot
  - B. 2 feet
  - C. 3 feet
  - D. 4 feet
  
3. What is the minimum the grader should cut behind the curb?
  - A. 0.35 foot
  - B. 0.50 foot
  - C. 0.75 foot
  - D. 1.00 foot
  
4. How much offset is needed when a concrete machine is used for a Type 2 or Type 1-A curb?
  - A. 1 foot
  - B. 2 feet
  - C. 3 feet
  - D. 4 feet
  
5. If the curb is 3.00 feet wide and the slope is 7 percent, what is the rise?
  - A. 0.17
  - B. 0.18
  - C. 0.20
  - D. 0.21
  
6. What happens if the concrete machine pours over an undercut subgrade?
  - A. It will fill the undercut with concrete
  - B. The concrete will crack
  - C. The concrete will sag
  - D. The concrete machine will not hold on the string line
  
7. How should the sidewalk grade be left when using a concrete machine?
  - A. 0.03 to 0.05 low
  - B. 0.03 to 0.05 high
  - C. 0.05 to 0.08 high
  - D. 0.08 to 0.10 high

8. How should the grade be left if the concrete machine is cutting a 3-foot-wide curb only?

- A. 0.03 to 0.08 low
- B. 0.08 to 0.015 low
- C. 0.03 to 0.08 high
- D. 0.08 to 0.15 high

9. What is the slope if the grade is 8 percent in 2.17 feet?

- A. 0.1227
- B. 0.1340
- C. 0.1736
- D. 0.1825

10. If you're adding a 0.50 undercut to all the surveyor's cuts and one stake has a fill of 0.30, what would be the correct distance above or below the surveyor's hub?

- A. 0.20 below
- B. 0.60 below
- C. 0.20 above
- D. 0.60 above

# Excavation and Grading Handbook Exam 18

1. How should the rough subgrade be cut before compacting?
  - A. 0.00 to 0.05 high
  - B. 0.05 to 0.10 high
  - C. 0.10 to 0.20 high
  - D. On grade
  
2. What may need to be done when processing subgrade with extremely dry soil?
  - A. The grader may need to turn the soil over several times
  - B. The water truck may need to flood the subgrade so the water will penetrate
  - C. The compactor may need to do the mixing with his dozer
  - D. The scraper may need to remove the top layer and replace it with better
  
3. To what depth is the subgrade of a road section usually required to be 95 percent compacted?
  - A. 4 inches
  - B. 6 inches
  - C. 8 inches
  - D. 10 inches
  
4. What must you ensure that your grader has before beginning fine trimming?
  - A. Equal pressure in all tires
  - B. Sonar set to maximum sensitivity
  - C. A good cutting edge with no worn ends
  - D. GPS
  
5. What must the grade setter do if the grader is not equipped with slope control or sonar?
  - A. Paint a line at centerline
  - B. Set centerline crows feet
  - C. Set centerline hubs
  - D. Paint grades at centerline
  
6. If a road that's 15 feet to the centerline has a 2 percent slope and a 0.75-foot road section, what would the centerline reading be to get the correct subgrade when shooting to a 4-foot boot at lip-of-curb?
  - A. 0.75
  - B. 3.75
  - C. 4.00
  - D. 4.45
  
7. If the grade you require at centerline is 3.75 and you shoot 3.90, what is needed to shoot 3.75?
  - A. A fill of 0.15
  - B. A fill of 0.30
  - C. A cut of 0.15
  - D. A cut of 0.30

8. What must the roller operator do if the water truck sprays the grade just ahead of the roller?
- A. Roll quickly before it dries
  - B. Turn the vibrator off
  - C. Re-roll the grade
  - D. Wait until the water soaks in
9. What is indicated when each bank plug has only one nail?
- A. The road has a crown
  - B. The road is level
  - C. The road has a constant super
  - D. The road has a curb on only one side
10. What's the most accurate way to carry grade if you're running sonar on a road job with no curbs?
- A. Trim one side over the hubs then use that grade to run the sonar on
  - B. Set a string line on each side to run sonar on
  - C. Don't use sonar, just slope control
  - D. Start at centerline first

# Excavation and Grading handbook Exam 19

1. Using the author's quick calculation method, how many tons of aggregate would you order to cover 12,000 square feet with 6 inches of gravel?
  - A. 250 tons
  - B. 300 tons
  - C. 350 tons
  - D. 450 tons
  
2. What type of gravel trucks should you use in large parking lots?
  - A. End dumps and bottoms
  - B. Bottom dumps
  - C. Semi bottoms
  - D. End Dumps
  
3. What happens to gravel if it's overworked?
  - A. It'll become bony
  - B. It'll lump together and become unusable
  - C. It'll need an extra pass by the water truck
  - D. It'll break up and will need to be replaced
  
4. How do you keep aggregate fines from separating from the rock?
  - A. Roll it with a vibratory roller
  - B. Roll it with a rubber-tired roller
  - C. Keep it dry
  - D. Keep it very moist
  
5. What is the most common tool used for setting hubs in a parking lot?
  - A. Swedes
  - B. Hand level
  - C. Eye level
  - D. Laser level
  
6. How far out from the edge of asphalt should the grade setter set his crows foot grade stake on an open-shoulder road with a 12-inch aggregate section?
  - A. 3 inches
  - B. 5 inches
  - C. 6 inches
  - D. 8 inches

7. When dumping aggregate with bottom dumps, for the best results, how many feet should the gravel be spread?

- A. 50 feet
- B. 75 feet
- C. 100 feet
- D. 125 feet

8. How many feet before the spot the gravel is needed must the dump person give a bottom dump the signal to dump?

- A. On the spot
- B. 5 feet
- C. 10 feet
- D. 15 feet

9. How far in from the choker or open shoulder should the first windrow of aggregate on a highway job be dumped?

- A. 3 feet
- B. 5 feet
- C. 10 feet
- D. 20 feet

10. What is the usual tolerance allowed on aggregate grade?

- A. 0.05
- B. 0.08
- C. 0.10
- D. 0.15

# Excavation and Grading Handbook Exam 20

1. Which type of soil is best suited for lime treatment?
  - A. Sandy
  - B. Rocky
  - C. Hard pan
  - D. Clay
  
2. To what tolerance should you trim lime-treated subgrade?
  - A. 0.08
  - B. 0.10
  - C. 0.12
  - D. 0.15
  
3. What percentage of lime is most commonly added to the soil for lime treatment?
  - A. 1 to 2 percent
  - B. 3 to 5 percent
  - C. 6 to 8 percent
  - D. 9 to 15 percent
  
4. What is the first step in lime treatment?
  - A. Pre-rototill the subgrade
  - B. Spread lime
  - C. Water subgrade
  - D. Rip subgrade
  
5. Below what temperature should you not apply lime treatment?
  - A. 29 degrees Fahrenheit
  - B. 35 degrees Fahrenheit
  - C. 40 degrees Fahrenheit
  - D. 45 degrees Fahrenheit
  
6. How many passes of the lime machine are usually required for lime subgrade treatment?
  - A. Two
  - B. Three
  - C. Four
  - D. Five
  
7. For best results, how soon after the initial compaction should you start trimming lime-treated soil?
  - A. 6 hours
  - B. 12 hours
  - C. 18 hours
  - D. 24 hours



8. What type of roller may not be allowed for rolling lime base?

- A. Steel drum
- B. Sheepsfoot
- C. Vibratory
- D. Pad foot

9. With which type of soil would you most likely use cement-treated base?

- A. Sandy soil
- B. Hardpan
- C. Cobbles
- D. Clay soil

10. How long after the final mixing of cement-treated base should you complete compaction?

- A. After 30 minutes but no more than one hour
- B. Within two hours
- C. Within four hours
- D. Within eight hours

# Excavation and Grading Handbook Exam 21

1. What is the most efficient way to remove an old road surface?
  - A. Rip it with a dozer
  - B. Grind and load with a profiler
  - C. Load it with a hoe
  - D. Grind with a reclaimer
  
2. What is the best choice for asphalt removal in a small parking area?
  - A. A profiler
  - B. A reclaimer
  - C. A track hoe with a bucket thumb
  - D. A rubber-tired hoe with a 4-in-1 bucket
  
3. What's the advantage of using a bottom dump truck with a pickup machine?
  - A. The paver doesn't have to stop
  - B. The paver can start and stop anytime
  - C. The asphalt has time to cool
  - D. A smoother grade can be carried
  
4. What is the acceptable temperature range for asphalt when paving?
  - A. 200 to 250 degrees
  - B. 285 to 350 degrees
  - C. 325 to 450 degrees
  - D. 400 to 525 degrees
  
5. Open-graded asphalt shouldn't be placed when the weather drops below what temperature?
  - A. 32 degrees
  - B. 40 degrees
  - C. 50 degrees
  - D. 60 degrees
  
6. When the paver is using sonar to follow a curb grade, what should control the grade on the other side?
  - A. Nothing else is needed
  - B. Sonar
  - C. The screed man
  - D. Slope control
  
7. What is the purpose of a stab rod?
  - A. To lower the screed
  - B. To check asphalt temperature
  - C. To check asphalt thickness
  - D. To check the asphalt density

8. When rolling asphalt, where should the first pass be made?

- A. Down the center
- B. On the lowest side
- C. On the highest side
- D. On a diagonal

9. Unless specifications say otherwise, what size asphalt mix should you use for skin patches that must match existing areas?

- A. 1/4 inch
- B. 3/8 inch
- C. 5/8 inch
- D. 3/4 inch

10. What is the usual spread rate for chips when chip sealing?

- A. 15 to 30 pounds per square yard
- B. 5 pounds per square foot
- C. 1 pound per square foot per inch of asphalt depth
- D. 10 to 15 pounds per square yard for chips less than 1/4 inch; 15 to 20 for larger chips

# Excavation and Grading Handbook Exam 22

1. When would you use a Vermeer trencher?

- A. For deep trenches
- B. For shallow digging
- C. For hardpan and rock
- D. For very soft soil

2. How long must the pressure in a water pipe pressure test hold?

- A. One hour
- B. Two hours
- C. Four hours
- D. It depends on the size of the pipe, the number of service runs, and the length.

3. A trapezoid bucket is used for what type of trenching?

- A. Deep trenching
- B. Wide trenching
- C. Hard rock trenching
- D. Slope trenching

4. What must be done if the trench bottom is soft?

- A. It must be filled with crushed rock
- B. It must be undercut to a stable grade
- C. It must be lime treated
- D. It must be cement treated

5. When an agency uses a camera to check sewer pipe flow, what's the maximum amount of ponding they'll accept inside the pipe?

- A. 1/4 inch
- B. 1/2 inch
- C. 1 inch
- D. An amount equal to the amount of fall in the pipe run

6. How high above the pipe is the water level in the manhole required to be for a sewer pipe water test?

- A. 3 feet
- B. 4 feet
- C. 5 feet
- D. 6 feet

7. What's the advantage of using air testing over other methods in testing sewer pipe?

- A. The equipment needed is always handy
- B. No manholes are needed
- C. There's no mess involved to drain it
- D. An air leak won't soften the grade

8. How do you usually repair a broken pipe along a sewer main?

- A. Buckle in a new pipe section
- B. Cut the pipe on each side of the break and snap in a double-collar pipe
- C. Place a caulder coupling over the break
- D. Cover the break with a concrete collar

9. What's the main advantage of trench sloping?

- A. It's faster to trench
- B. It's easier to work with in a confined space
- C. No shoring is needed
- D. The pipe can be placed closer to the trench

10. How is cast-in-place trench dug?

- A. Only over-dug 2 inches
- B. Extra deep to allow for the equipment
- C. Always sloped to allow access for a worker
- D. The exact shape and grade of the pipe

# Excavation and Grading Handbook Exam 23

1. At what depth must a vertical trench always be shored?
  - A. 4 feet
  - B. 5 feet
  - C. 6 feet
  - D. 7 feet
  
2. What's the best method to ensure that a trench 7 feet deep or less is stable?
  - A. Use sheet shoring
  - B. Use a shield
  - C. Slope the sides
  - D. Use hydraulic shoring
  
3. What's the main problem with using a shield in loose cobble?
  - A. It's hard to keep a straight trench
  - B. It's likely to wedge against the wall
  - C. It's hard to keep cobbles from entering the shield
  - D. It's hard to keep a smooth grade
  
4. What do you need when setting two 6-foot shores, one under the other?
  - A. A long release tool
  - B. Five people
  - C. A larger pump
  - D. A grappling hook
  
5. How high above the trench bottom should you place shoring?
  - A. High enough for the initial backfill
  - B. High enough so the pipe won't hit the shoring
  - C. High enough so the crew can reach the quick coupler
  - D. High enough so the pipe crew can work under the hydraulic cylinders
  
6. When attaching a hydraulic pump hose to the shore, how should you position the quick coupler?
  - A. Facing toward the right side
  - B. Facing toward the left side
  - C. Facing up
  - D. Facing down
  
7. How can you prevent damage to the shore planks if there's a void in the trench wall?
  - A. Place the jack over the void
  - B. Increase the pressure on the jack to keep it away from the void
  - C. Place a 2 x 10 wood plank behind the shore
  - D. Place the planks at an angle to avoid the indentation

8. When should you use sheeting with the shoring?

- A. When you're working in clay
- B. When the ground is damp
- C. When the wall crumbles between shores
- D. When you're working in hardpan

9. How is a shield moved along in the trench?

- A. It's pulled by a hoe
- B. It's pushed by a dozer
- C. It runs on tracks
- D. It's set by a crane

10. What should you do if a manhole shield is set between vertical trench walls?

- A. Slope the trench walls
- B. Backfill around it
- C. Allow a 2-foot clearance on each side
- D. Set shores on each side

# Excavation and Grading Handbook Exam 24

1. A 48-inch manhole has what size opening?
  - A. 24 inches
  - B. 36 inches
  - C. 42 inches
  - D. 48 inches
  
2. What's the largest pipe size that should be laid through a manhole?
  - A. 10 inches
  - B. 12 inches
  - C. 14 inches
  - D. 16 inches;
  
3. How far above the pipe should you pour the concrete on a poured sewer manhole bottom?
  - A. 1 inch
  - B. 2 inches
  - C. 3 inches
  - D. 5 inches
  
4. How long should a poured concrete bottom be allowed to set before the top of the pipe is broken away?
  - A. 3 hours
  - B. 5 hours
  - C. 9 hours
  - D. 12 hours
  
5. What is the minimum amount of gravel that should be placed under a precast manhole bottom?
  - A. 6 inches
  - B. 8 inches
  - C. 10 inches
  - D. 1 foot
  
6. What's the major difference between sewer and drain manholes?
  - A. The sewer manhole is deeper
  - B. The drain manhole has no side outlets
  - C. The drain manhole usually has a sump
  - D. The sewer inlets are always smaller pipe
  
7. What material is used in the joints between manhole barrels to get a good seal?
  - A. Ram-Nek
  - B. Cement mortar
  - C. Epoxy and sand
  - D. Plastic cement



8. What's the maximum neck height, including the casting, allowed on a manhole?

- A. 12 inches
- B. 18 inches
- C. 24 inches
- D. 30 inches

9. Manholes are vacuum-tested to how many pounds?

- A. 1 pound
- B. 2 pounds
- C. 3 pounds
- D. 5 pounds

10. What's the best percentage of calcium chloride to use for a quick concrete set?

- A. 8 percent
- B. 5 percent
- C. 2 percent
- D. 1 percent

# Excavation and Grading Handbook Exam 24

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1. Where are underdrains usually placed?
  - A. On the low side of the road
  - B. Down the centerline
  - C. In the median
  - D. Under the choker
  
2. At what point during the subgrade operation are underdrains placed?
  - A. After 4 inches of aggregate have been placed and rolled
  - B. When the subgrade fill is first made
  - C. After the subgrade is rough trimmed, but before the fine trimming
  - D. When the subgrade has been fine trimmed and it's ready for aggregate
  
3. Where is the water from the underdrain line carried?
  - A. To roadside drop inlets
  - B. To the median ditch
  - C. To a roadside ditch
  - D. To the nearest culvert line
  
4. What covers the top of the underdrain pipe?
  - A. 3/4-inch crushed rock
  - B. Type 1 asphalt
  - C. 3/4-inch aggregate base
  - D. 1- to 1-1/2-inch permeable material
  
5. What is an underdrain trench lined with?
  - A. Plastic sheeting
  - B. Construction fabric
  - C. Sand
  - D. Chopped straw
  
6. When should the culverts be placed if there's a deep fill?
  - A. When the fill is finished
  - B. When the fill is 6 feet deep
  - C. When the fill is 3 feet above the top of the pipe
  - D. When the fill reaches subgrade
  
7. What part of a culvert usually requires a dirt cap?
  - A. Just the downstream end
  - B. Both the ends and top
  - C. Only the top
  - D. Just the upstream end

8. What type pipe is seldom used as culvert pipe?

- A. Clay
- B. Concrete
- C. Ribbed plastic
- D. Corrugated metal

9. What type of runoff are downdrains designed to handle?

- A. Runoff from the road and shoulder
- B. Runoff from the median
- C. Runoff from the fill slope
- D. Runoff from the roadside ditch

10. What can happen if a downdrain isn't properly anchored?

- A. It may not drain
- B. It may break apart
- C. It may fill up with dirt and debris
- D. It may slide down the slope