

PRACTICE EXAM 11: TRANSPORTATION CIVIL PE SIMULATION (100 QUESTIONS)

This expanded practice exam contains 100 questions aligned with the NCEES PE Civil-Transportation specification effective April 2024. The official computer-based exam contains 80 questions and provides 8 hours of examination time within a 9-hour appointment. For this 100-question simulation, allow 10 hours to preserve the official six-minutes-per-question pace. Use SI and U.S. customary units as stated. NCEES does not publish a fixed passing percentage; evaluate performance by domain and review every explanation.

1. During an alternatives screening review, a roadway pay item has an estimated quantity of 1,520 units and a unit price of \$34.00 per unit. What is the estimated item cost? Select the nearest listed value.

- A. 41,344.00
- B. 62,016.00
- C. 51,680.00
- D. 77,520.00

2. For a regional arterial project, a grading operation includes 4,950 cubic yards. At a sustained production rate of 390 cubic yards per day, how many working days are required? Select the nearest listed value.

- A. 12.69
- B. 10.15
- C. 15.23
- D. 19.04

3. During a multimodal performance study, a future rehabilitation cost of \$600,000 occurs in 5 years. Using an annual discount rate of 6.0%, what is its present worth? Select the nearest listed value.

- A. 358,683.92
- B. 538,025.88
- C. 672,532.35
- D. 448,354.90

4. For a neighborhood access improvement, a contractor assigns 5 identical crews for 23 days. Each crew installs 295 linear feet per day. What total length can be installed? Select the nearest listed value.

- A. 27,140.00
- B. 33,925.00
- C. 40,710.00
- D. 50,887.50

5. During a bid-document technical check, a roadway pay item has an estimated quantity of 1,680 units and a unit price of \$42.00 per unit. What is the estimated item cost? Select the nearest listed value.

- A. 70,560.00
- B. 56,448.00
- C. 84,672.00
- D. 105,840.00

6. During an alternatives screening review, a grading operation includes 5,550 cubic yards. At a sustained production rate of 430 cubic yards per day, how many working days are required? Select the nearest listed value.

- A. 10.33
- B. 15.49
- C. 19.37
- D. 12.91

7. For a regional arterial project, a future rehabilitation cost of \$640,000 occurs in 6 years. Using an annual discount rate of 6.8%, what is its present worth? Select the nearest listed value.

- A. 345,018.55
- B. 431,273.19
- C. 517,527.83
- D. 646,909.79

8. During a multimodal performance study, a contractor assigns 3 identical crews for 27 days. Each crew installs 315 linear feet per day. What total length can be installed? Select the nearest listed value.

- A. 20,412.00
- B. 30,618.00
- C. 25,515.00
- D. 38,272.50

9. For a neighborhood access improvement, a roadway pay item has an estimated quantity of 1,840 units and a unit price of \$50.00 per unit. What is the estimated item cost? Select the nearest listed value.

- A. 73,600.00
- B. 110,400.00
- C. 92,000.00
- D. 138,000.00

10. During a bid-document technical check, during the peak hour, 960 vehicles are counted, and the highest 15-minute volume is 260 vehicles. What is the peak-hour factor? Select the nearest listed value.

- A. 0.74
- B. 1.10
- C. 1.38
- D. 0.92

11. During an alternatives screening review, a freeway lane carries 1725 vehicles per hour at an average speed of 46 miles per hour. Assuming the fundamental relation $q = kv$, what is density? Select the nearest listed value.

- A. 30.00
- B. 37.50
- C. 45.00
- D. 56.25

12. For a regional arterial project, a segment experienced 28 crashes during 42 million vehicle-miles of travel. What is the crash rate in crashes per million vehicle-miles? Select the nearest listed value.

- A. 0.67
- B. 0.54
- C. 0.80
- D. 1.01

13. During a multimodal performance study, current daily traffic is 13,100 vehicles. With compound annual growth of 3.6% for 11 years, what is the forecast daily traffic? Select the nearest listed value.

- A. 19,329.86
- B. 15,463.89
- C. 23,195.83
- D. 28,994.79

14. For a neighborhood access improvement, during the peak hour, 1040 vehicles are counted, and the highest 15-minute volume is 280 vehicles. What is the peak-hour factor? Select the nearest listed value.

- A. 0.74
- B. 1.12
- C. 1.40
- D. 0.93

15. During a bid-document technical check, a freeway lane carries 1825 vehicles per hour at an average speed of 50 miles per hour. Assuming the fundamental relation $q = kv$, what is density? Select the nearest listed value.

- A. 29.20
- B. 43.80
- C. 36.50
- D. 54.75

16. During an alternatives screening review, a segment experienced 32 crashes during 50 million vehicle-miles of travel. What is the crash rate in crashes per million vehicle-miles? Select the nearest listed value.

- A. 0.51
- B. 0.64
- C. 0.77
- D. 0.96

17. For a regional arterial project, current daily traffic is 13,500 vehicles. With compound annual growth of 4.0% for 11 years, what is the forecast daily traffic? Select the nearest listed value.

- A. 16,626.10
- B. 24,939.16
- C. 20,782.63
- D. 31,173.94

18. During a multimodal performance study, during the peak hour, 1120 vehicles are counted, and the highest 15-minute volume is 300 vehicles. What is the peak-hour factor? Select the nearest listed value.

- A. 0.93
- B. 0.74
- C. 1.12
- D. 1.40

19. For a neighborhood access improvement, a freeway lane carries 1925 vehicles per hour at an average speed of 46 miles per hour. Assuming the fundamental relation $q = kv$, what is density? Select the nearest listed value.

- A. 33.48
- B. 41.85
- C. 50.22
- D. 62.78

20. During a bid-document technical check, a segment experienced 36 crashes during 58 million vehicle-miles of travel. What is the crash rate in crashes per million vehicle-miles? Select the nearest listed value.

- A. 0.50
- B. 0.74
- C. 0.93
- D. 0.62

21. During an alternatives screening review, current daily traffic is 13,900 vehicles. With compound annual growth of 4.4% for 11 years, what is the forecast daily traffic? Select the nearest listed value.

- A. 22,321.34
- B. 17,857.07
- C. 26,785.61
- D. 33,482.01

22. For a regional arterial project, during the peak hour, 1200 vehicles are counted, and the highest 15-minute volume is 320 vehicles. What is the peak-hour factor? Select the nearest listed value.

- A. 0.75
- B. 1.13
- C. 1.41
- D. 0.94

23. During a multimodal performance study, a freeway lane carries 2025 vehicles per hour at an average speed of 50 miles per hour. Assuming the fundamental relation $q = kv$, what is density? Select the nearest listed value.

- A. 32.40
- B. 48.60
- C. 40.50
- D. 60.75

24. For a neighborhood access improvement, a traveled lane is 12 feet wide with a uniform cross slope of 3.0%. What is the elevation drop from crown to lane edge? Select the nearest listed value.

- A. 0.29
- B. 0.36
- C. 0.43
- D. 0.54

25. During a bid-document technical check, a cross section has 2 lanes, each 12 feet wide, plus two 8-foot shoulders. What is the total paved width? Select the nearest listed value.

- A. 32.00
- B. 40.00
- C. 48.00
- D. 60.00

26. During an alternatives screening review, a recoverable roadside slope descends 3 foot vertically over 50 feet horizontally. What is its horizontal-to-vertical ratio? Select the nearest listed value.

- A. 16.67
- B. 13.34
- C. 20.00
- D. 25.01

27. For a regional arterial project, a sidewalk segment is 250 feet long and 7 feet wide. What plan area must be constructed? Select the nearest listed value.

- A. 1,400.00
- B. 2,100.00
- C. 1,750.00
- D. 2,625.00

28. During a multimodal performance study, a traveled lane is 12 feet wide with a uniform cross slope of 2.0%. What is the elevation drop from crown to lane edge? Select the nearest listed value.

- A. 0.19
- B. 0.29
- C. 0.36
- D. 0.24

29. For a neighborhood access improvement, a cross section has 3 lanes, each 12 feet wide, plus two 9-foot shoulders. What is the total paved width? Select the nearest listed value.

- A. 54.00
- B. 43.20
- C. 64.80
- D. 81.00

30. During a bid-document technical check, a recoverable roadside slope descends 4 foot vertically over 58 feet horizontally. What is its horizontal-to-vertical ratio? Select the nearest listed value.

- A. 11.60
- B. 17.40
- C. 21.75
- D. 14.50

31. During an alternatives screening review, a sidewalk segment is 290 feet long and 5 feet wide. What plan area must be constructed? Select the nearest listed value.

- A. 1,160.00
- B. 1,450.00
- C. 1,740.00
- D. 2,175.00

32. For a regional arterial project, a traveled lane is 12 feet wide with a uniform cross slope of 2.5%. What is the elevation drop from crown to lane edge? Select the nearest listed value.

- A. 0.24
- B. 0.36
- C. 0.30
- D. 0.45

33. During a multimodal performance study, a cross section has 4 lanes, each 12 feet wide, plus two 10-foot shoulders. What is the total paved width? Select the nearest listed value.

- A. 54.40
- B. 68.00
- C. 81.60
- D. 102.00

34. For a neighborhood access improvement, a simple circular curve has radius 980 feet and central angle 36 degrees. What is its arc length? Select the nearest listed value.

- A. 492.60
- B. 738.90
- C. 923.62
- D. 615.75

35. During a bid-document technical check, a simple circular curve has radius 1015 feet and intersection angle 38 degrees. What is the tangent length? Select the nearest listed value.

- A. 279.59
- B. 419.39
- C. 349.49
- D. 524.24

36. During an alternatives screening review, for a circular curve with radius 1050 feet and central angle 40 degrees, what is the middle ordinate? Select the nearest listed value.

- A. 63.32
- B. 50.66
- C. 75.98
- D. 94.98

37. For a regional arterial project, for a circular curve with radius 1085 feet and central angle 42 degrees, what is the long chord? Select the nearest listed value.

- A. 777.66
- B. 622.13
- C. 933.19
- D. 1,166.49

38. During a multimodal performance study, a simple circular curve has radius 1120 feet and central angle 44 degrees. What is its arc length? Select the nearest listed value.

- A. 688.08
- B. 1,032.12
- C. 1,290.15
- D. 860.10

39. For a neighborhood access improvement, a simple circular curve has radius 1155 feet and intersection angle 46 degrees. What is the tangent length? Select the nearest listed value.

- A. 392.22
- B. 588.32
- C. 490.27
- D. 735.40

40. During a bid-document technical check, for a circular curve with radius 1190 feet and central angle 48 degrees, what is the middle ordinate? Select the nearest listed value.

- A. 82.30
- B. 102.88
- C. 123.46
- D. 154.32

41. During an alternatives screening review, for a circular curve with radius 1225 feet and central angle 50 degrees, what is the long chord? Select the nearest listed value.

- A. 828.33
- B. 1,035.41
- C. 1,242.49
- D. 1,553.12

42. For a regional arterial project, a simple circular curve has radius 1260 feet and central angle 52 degrees. What is its arc length? Select the nearest listed value.

- A. 1,143.54
- B. 914.83
- C. 1,372.25
- D. 1,715.31

43. During a multimodal performance study, a simple circular curve has radius 1295 feet and intersection angle 54 degrees. What is the tangent length? Select the nearest listed value.

- A. 527.87
- B. 791.81
- C. 659.84
- D. 989.76

44. For a neighborhood access improvement, for a circular curve with radius 1330 feet and central angle 56 degrees, what is the middle ordinate? Select the nearest listed value.

- A. 124.54
- B. 186.82
- C. 233.52
- D. 155.68

45. During a bid-document technical check, a vertical curve connects grades of -0.70% and +3.70%. What is the algebraic grade difference A? Select the nearest listed value.

- A. 4.40
- B. 3.52
- C. 5.28
- D. 6.60

46. During an alternatives screening review, a vertical curve is 825 feet long and has an algebraic grade difference of 8%. What is its K value? Select the nearest listed value.

- A. 82.50
- B. 123.74
- C. 103.12
- D. 154.68

47. For a regional arterial project, a tangent begins at elevation 530.00 feet and rises at 3.00% for 400 feet. What is the ending elevation? Select the nearest listed value.

- A. 433.60
- B. 650.40
- C. 813.00
- D. 542.00

48. During a multimodal performance study, an overhead structure has a low-chord elevation of 17.60 feet above a datum. The roadway surface is at elevation 6.50 feet. What is the vertical clearance? Select the nearest listed value.

- A. 8.88
- B. 11.10
- C. 13.32
- D. 16.65

49. For a neighborhood access improvement, a vertical curve connects grades of -0.30% and +4.30%. What is the algebraic grade difference A? Select the nearest listed value.

- A. 3.68
- B. 5.52
- C. 4.60
- D. 6.90

50. During a bid-document technical check, a vertical curve is 925 feet long and has an algebraic grade difference of 7%. What is its K value? Select the nearest listed value.

- A. 132.14
- B. 105.71
- C. 158.57
- D. 198.21

51. During an alternatives screening review, a tangent begins at elevation 542.00 feet and rises at 3.40% for 440 feet. What is the ending elevation? Select the nearest listed value.

- A. 445.57
- B. 556.96
- C. 668.35
- D. 835.44

52. For a regional arterial project, an overhead structure has a low-chord elevation of 18.00 feet above a datum. The roadway surface is at elevation 4.50 feet. What is the vertical clearance? Select the nearest listed value.

- A. 10.80
- B. 16.20
- C. 20.25
- D. 13.50

53. During a multimodal performance study, a vertical curve connects grades of 0.10% and +4.90%. What is the algebraic grade difference A? Select the nearest listed value.

- A. 3.84
- B. 5.76
- C. 4.80
- D. 7.20

54. For a neighborhood access improvement, a vertical curve is 1025 feet long and has an algebraic grade difference of 6%. What is its K value? Select the nearest listed value.

- A. 170.83
- B. 136.66
- C. 205.00
- D. 256.25

55. During a bid-document technical check, a tangent begins at elevation 554.00 feet and rises at 3.80% for 480 feet. What is the ending elevation? Select the nearest listed value.

- A. 457.79
- B. 686.69
- C. 858.36
- D. 572.24

56. During an alternatives screening review, a vehicle approaches an intersection at 46 miles per hour. If the design gap is 6 seconds, what distance does it travel during the gap? Select the nearest listed value.

- A. 323.84
- B. 404.80
- C. 485.76
- D. 607.20

57. For a regional arterial project, a left-turn bay must store 17 passenger vehicles. Using 25 feet of storage per vehicle, what storage length is required? Select the nearest listed value.

- A. 340.00
- B. 510.00
- C. 425.00
- D. 637.50

58. During a multimodal performance study, a channelized intersection uses a circular curb return with radius 65 feet through 80 degrees. What is the curb-return arc length? Select the nearest listed value.

- A. 72.61
- B. 90.76
- C. 108.91
- D. 136.14

59. For a neighborhood access improvement, an arterial intersection has 4 through lanes in each direction, 12-foot lanes, and a 27-foot median. What is the curb-to-curb crossing width, excluding shoulders? Select the nearest listed value.

- A. 123.00
- B. 98.40
- C. 147.60
- D. 184.50

60. During a bid-document technical check, a vehicle approaches an intersection at 54 miles per hour. If the design gap is 6 seconds, what distance does it travel during the gap? Select the nearest listed value.

- A. 380.16
- B. 570.24
- C. 712.80
- D. 475.20

61. During an alternatives screening review, a left-turn bay must store 21 passenger vehicles. Using 25 feet of storage per vehicle, what storage length is required? Select the nearest listed value.

- A. 420.00
- B. 630.00
- C. 525.00
- D. 787.50

62. For a regional arterial project, a channelized intersection uses a circular curb return with radius 73 feet through 84 degrees. What is the curb-return arc length? Select the nearest listed value.

- A. 85.62
- B. 128.42
- C. 160.53
- D. 107.02

63. During a multimodal performance study, an arterial intersection has 2 through lanes in each direction, 12-foot lanes, and a 31-foot median. What is the curb-to-curb crossing width, excluding shoulders? Select the nearest listed value.

- A. 79.00
- B. 63.20
- C. 94.80
- D. 118.50

64. For a neighborhood access improvement, a vehicle approaches an intersection at 62 miles per hour. If the design gap is 6 seconds, what distance does it travel during the gap? Select the nearest listed value.

- A. 436.48
- B. 545.60
- C. 654.72
- D. 818.40

65. During a bid-document technical check, a left-turn bay must store 25 passenger vehicles. Using 25 feet of storage per vehicle, what storage length is required? Select the nearest listed value.

- A. 500.00
- B. 750.00
- C. 937.50
- D. 625.00

66. During an alternatives screening review, a signal has a 130-second cycle, 40 seconds of displayed green, and 4 seconds of phase lost time. What effective-green ratio applies to the phase? Select the nearest listed value.

- A. 0.28
- B. 0.22
- C. 0.34
- D. 0.42

67. For a regional arterial project, a lane group has saturation flow of 1900 vehicles per hour of green and an effective-green ratio of 0.53. What is its capacity? Select the nearest listed value.

- A. 805.60
- B. 1,007.00
- C. 1,208.40
- D. 1,510.50

68. During a multimodal performance study, a pedestrian must cross 80 feet. Using a 7-second start interval and walking speed of 3.5 feet per second, what total pedestrian timing is required? Select the nearest listed value.

- A. 23.89
- B. 35.83
- C. 29.86
- D. 44.79

69. For a neighborhood access improvement, a four-phase signal has 4.60 seconds of lost time per phase. What is the total lost time per cycle? Select the nearest listed value.

- A. 14.72
- B. 18.40
- C. 22.08
- D. 27.60

70. During a bid-document technical check, a signal has a 150-second cycle, 44 seconds of displayed green, and 4 seconds of phase lost time. What effective-green ratio applies to the phase? Select the nearest listed value.

- A. 0.22
- B. 0.32
- C. 0.27
- D. 0.41

71. During an alternatives screening review, a lane group has saturation flow of 1900 vehicles per hour of green and an effective-green ratio of 0.61. What is its capacity? Select the nearest listed value.

- A. 927.20
- B. 1,390.80
- C. 1,738.50
- D. 1,159.00

72. For a regional arterial project, a pedestrian must cross 88 feet. Using a 7-second start interval and walking speed of 3.5 feet per second, what total pedestrian timing is required? Select the nearest listed value.

- A. 32.14
- B. 25.71
- C. 38.57
- D. 48.21

73. During a multimodal performance study, for a work-zone taper on a roadway operating at 50 mph, use $L = WS^2/60$ with offset $W = 12$ feet. What taper length results? Select the nearest listed value.

- A. 500.00
- B. 400.00
- C. 600.00
- D. 750.00

74. For a neighborhood access improvement, a channelizing line contains 18 devices at 170-foot spacing. What distance separates the first and last device? Select the nearest listed value.

- A. 2,312.00
- B. 3,468.00
- C. 4,335.00
- D. 2,890.00

75. During a bid-document technical check, a broken lane line extends 1700 feet using a 10-foot stripe and 30-foot gap. Approximately how many complete stripe-gap cycles fit in the segment? Select the nearest listed value.

- A. 34.00
- B. 42.50
- C. 51.00
- D. 63.75

76. During an alternatives screening review, a temporary warning sequence should provide 10 seconds of preview at 56 mph. What advance distance corresponds to that travel time? Select the nearest listed value.

- A. 657.06
- B. 985.60
- C. 821.33
- D. 1,232.00

77. For a regional arterial project, for a work-zone taper on a roadway operating at 45 mph, use $L = WS^2/60$ with offset $W = 12$ feet. What taper length results? Select the nearest listed value.

- A. 324.00
- B. 405.00
- C. 486.00
- D. 607.50

78. During a multimodal performance study, a channelizing line contains 22 devices at 210-foot spacing. What distance separates the first and last device? Select the nearest listed value.

- A. 4,410.00
- B. 3,528.00
- C. 5,292.00
- D. 6,615.00

79. For a neighborhood access improvement, a broken lane line extends 1900 feet using a 10-foot stripe and 30-foot gap. Approximately how many complete stripe-gap cycles fit in the segment? Select the nearest listed value.

- A. 38.00
- B. 57.00
- C. 71.25
- D. 47.50

80. During a bid-document technical check, compacted soil has moist unit weight 141.00 pcf and water content 12.0%. What is its dry unit weight? Select the nearest listed value.

- A. 100.71
- B. 151.07
- C. 125.89
- D. 188.84

81. During an alternatives screening review, a field dry unit weight is 136.00 pcf and laboratory maximum dry unit weight is 142.00 pcf. What is relative compaction? Select the nearest listed value.

- A. 76.62
- B. 95.77
- C. 114.92
- D. 143.66

82. For a regional arterial project, a soil element contains 0.62 cubic foot of voids and 0.68 cubic foot of solids. What is the void ratio? Select the nearest listed value.

- A. 0.73
- B. 1.09
- C. 1.36
- D. 0.91

83. During a multimodal performance study, a design lane carries 1120 trucks per day, and the adopted equivalency factor is 2.35 ESAL per truck. What is the daily ESAL loading? Select the nearest listed value.

- A. 2,105.60
- B. 3,158.40
- C. 2,632.00
- D. 3,948.00

84. For a neighborhood access improvement, compacted soil has moist unit weight 149.00 pcf and water content 14.0%. What is its dry unit weight? Select the nearest listed value.

- A. 130.70
- B. 104.56
- C. 156.84
- D. 196.05

85. During a bid-document technical check, a field dry unit weight is 144.00 pcf and laboratory maximum dry unit weight is 150.00 pcf. What is relative compaction? Select the nearest listed value.

- A. 76.80
- B. 96.00
- C. 115.20
- D. 144.00

86. During an alternatives screening review, a soil element contains 0.70 cubic foot of voids and 0.72 cubic foot of solids. What is the void ratio? Select the nearest listed value.

- A. 0.78
- B. 1.16
- C. 0.97
- D. 1.46

87. For a regional arterial project, a design lane carries 1200 trucks per day, and the adopted equivalency factor is 2.55 ESAL per truck. What is the daily ESAL loading? Select the nearest listed value.

- A. 2,448.00
- B. 3,672.00
- C. 4,590.00
- D. 3,060.00

88. During a multimodal performance study, compacted soil has moist unit weight 157.00 pcf and water content 16.0%. What is its dry unit weight? Select the nearest listed value.

- A. 135.34
- B. 108.27
- C. 162.41
- D. 203.01

89. For a neighborhood access improvement, using $Q = CiA$, find peak runoff for $C = 0.73$, rainfall intensity $i = 4.00$ inches per hour, and drainage area $A = 26$ acres. Select the nearest listed value.

- A. 60.74
- B. 75.92
- C. 91.10
- D. 113.88

90. During a bid-document technical check, a circular storm drain has inside diameter 3.40 feet. What is its full cross-sectional flow area? Select the nearest listed value.

- A. 7.26
- B. 10.90
- C. 9.08
- D. 13.62

91. During an alternatives screening review, a culvert conveys 68.00 cubic feet per second through a flow area of 8.00 square feet. What is mean velocity? Select the nearest listed value.

- A. 8.50
- B. 6.80
- C. 10.20
- D. 12.75

92. For a regional arterial project, a rectangular roadside channel carries water 2.60 feet deep across a bottom width of 19 feet. What is the flow area, neglecting side-slope contribution? Select the nearest listed value.

- A. 39.52
- B. 59.28
- C. 74.10
- D. 49.40

93. During a multimodal performance study, using $Q = CiA$, find peak runoff for $C = 0.77$, rainfall intensity $i = 4.40$ inches per hour, and drainage area $A = 30$ acres. Select the nearest listed value.

- A. 81.31
- B. 121.97
- C. 152.46
- D. 101.64

94. For a neighborhood access improvement, a circular storm drain has inside diameter 3.80 feet. What is its full cross-sectional flow area? Select the nearest listed value.

- A. 11.34
- B. 9.07
- C. 13.61
- D. 17.01

95. During a bid-document technical check, a culvert conveys 76.00 cubic feet per second through a flow area of 8.80 square feet. What is mean velocity? Select the nearest listed value.

- A. 6.91
- B. 8.64
- C. 10.37
- D. 12.96

96. During an alternatives screening review, a rectangular roadside channel carries water 3.00 feet deep across a bottom width of 23 feet. What is the flow area, neglecting side-slope contribution? Select the nearest listed value.

- A. 55.20
- B. 82.80
- C. 69.00
- D. 103.50

97. For a regional arterial project, using $Q = CiA$, find peak runoff for $C = 0.81$, rainfall intensity $i = 4.80$ inches per hour, and drainage area $A = 34$ acres. Select the nearest listed value.

- A. 105.75
- B. 158.63
- C. 198.28
- D. 132.19

98. During a multimodal performance study, a circular storm drain has inside diameter 4.20 feet. What is its full cross-sectional flow area? Select the nearest listed value.

- A. 11.08
- B. 13.85
- C. 16.62
- D. 20.77

99. For a neighborhood access improvement, a culvert conveys 84.00 cubic feet per second through a flow area of 9.60 square feet. What is mean velocity? Select the nearest listed value.

- A. 8.75
- B. 7.00
- C. 10.50
- D. 13.12

100. During a bid-document technical check, a rectangular roadside channel carries water 3.40 feet deep across a bottom width of 27 feet. What is the flow area, neglecting side-slope contribution? Select the nearest listed value.

- A. 73.44
- B. 110.16
- C. 91.80
- D. 137.70

Practice Exam 11: Answer Key and Explanations

1. C — Using the stated data, the cost is quantity times unit price: $1,520 \times \$34.00 = \$51,680.00$. Therefore, the keyed value is the only option consistent with the governing relationship. A quantity takeoff becomes a cost only after multiplication by the applicable bid or planning unit price. The distractors represent omitted factors, reversed operations, or failure to discount or scale the.

2. A — Using the stated data, duration equals work divided by production, or $4,950/390 = 12.69$ days. Therefore, the keyed value is the only option consistent with the governing relationship. Production-based duration links measured scope to schedule time before logic ties are applied. The distractors represent omitted factors, reversed operations, or failure to discount or scale the work correctly.

3. D — Using the stated data, discounting gives $\$600,000/(1+0.060)^5 = \$448,354.90$. Therefore, the keyed value is the only option consistent with the governing relationship. Present worth converts a future expenditure to an equivalent value at the analysis date. The distractors represent omitted factors, reversed operations, or failure to discount or scale the work correctly.

4. B — Using the stated data, total output is $5 \times 23 \times 295 = 33,925.00$ feet. Therefore, the keyed value is the only option consistent with the governing relationship. Total planned output is the product of crew count, available days, and daily productivity. The distractors represent omitted factors, reversed operations, or failure to discount or scale the work correctly.

5. A — Using the stated data, the cost is quantity times unit price: $1,680 \times \$42.00 = \$70,560.00$. Therefore, the keyed value is the only option consistent with the governing relationship. A quantity takeoff becomes a cost only after multiplication by the applicable bid or planning unit price. The distractors represent omitted factors, reversed operations, or failure to discount or scale the.

6. D — Using the stated data, duration equals work divided by production, or $5,550/430 = 12.91$ days. Therefore, the keyed value is the only option consistent with the governing relationship. Production-based duration links measured scope to schedule time before logic ties are applied. The distractors represent omitted factors, reversed operations, or failure to discount or scale the work correctly.

7. B — Using the stated data, discounting gives $\$640,000/(1+0.068)^6 = \$431,273.19$. Therefore, the keyed value is the only option consistent with the governing relationship. Present worth converts a future expenditure to an equivalent value at the analysis date. The distractors represent omitted factors, reversed operations, or failure to discount or scale the work correctly.

8. C — Using the stated data, total output is $3 \times 27 \times 315 = 25,515.00$ feet. Therefore, the keyed value is the only option consistent with the governing relationship. Total planned output is the product of crew count, available days, and daily productivity. The distractors represent omitted factors, reversed operations, or failure to discount or scale the work correctly.

9. C — Using the stated data, the cost is quantity times unit price: $1,840 \times \$50.00 = \$92,000.00$. Therefore, the keyed value is the only option consistent with the governing relationship. A quantity takeoff becomes a cost only after multiplication by the applicable bid or planning unit price. The distractors represent omitted factors, reversed operations, or failure to discount or scale the.

10. D — Using the stated data, $PHF = 960/(4 \times 260) = 0.92$. Therefore, the keyed value is the only option consistent with the governing relationship. The factor compares the full-hour volume with the hourly equivalent of the most intense quarter hour. The incorrect choices reflect common mistakes involving peak conversion, exposure, unit consistency, or simple rather than compound growth.

11. B — Using the stated data, density is flow divided by speed: $1725/46 = 37.50$ vehicles per mile. Therefore, the keyed value is the only option consistent with the governing relationship. The fundamental traffic-flow relationship requires consistent hourly flow and speed units. The incorrect choices reflect common mistakes involving peak conversion, exposure, unit consistency, or simple rather than compound growth.

12. A — Using the stated data, the normalized crash rate is $28/42 = 0.67$ crashes per million vehicle-miles. Therefore, the keyed value is the only option consistent with the governing relationship. Exposure normalization permits safety comparisons among facilities carrying different traffic volumes over different lengths. The incorrect choices reflect common mistakes involving peak conversion, exposure, unit consistency, or simple rather than compound.

13. A — Using the stated data, compound growth gives $13,100(1+0.036)^{11} = 19,329.86$ vehicles per day. Therefore, the keyed value is the only option consistent with the governing relationship. Compound forecasting applies growth to the increasing total each year rather than only to the original base. The incorrect choices reflect common mistakes involving peak conversion, exposure, unit consistency, or simple rather than compound.

14. D — Using the stated data, $PHF = 1040/(4 \times 280) = 0.93$. Therefore, the keyed value is the only option consistent with the governing relationship. The factor compares the full-hour volume with the hourly equivalent of the most intense quarter hour. The incorrect choices reflect common mistakes involving peak conversion, exposure, unit consistency, or simple rather than compound growth.

15. C — Using the stated data, density is flow divided by speed: $1825/50 = 36.50$ vehicles per mile. Therefore, the keyed value is the only option consistent with the governing relationship. The fundamental traffic-flow relationship requires consistent hourly flow and speed units. The incorrect choices reflect common mistakes involving peak conversion, exposure, unit consistency, or simple rather than compound growth.

16. B — Using the stated data, the normalized crash rate is $32/50 = 0.64$ crashes per million vehicle-miles. Therefore, the keyed value is the only option consistent with the governing relationship. Exposure normalization permits safety comparisons among facilities carrying different traffic volumes over different lengths. The incorrect choices reflect common mistakes involving peak conversion, exposure, unit consistency, or simple rather than compound.

17. C — Using the stated data, compound growth gives $13,500(1+0.040)^{11} = 20,782.63$ vehicles per day. Therefore, the keyed value is the only option consistent with the governing relationship. Compound forecasting applies growth to the increasing total each year rather than only to the original base. The incorrect choices reflect common mistakes involving peak conversion, exposure, unit consistency, or simple rather than compound.

18. A — Using the stated data, $PHF = 1120/(4 \times 300) = 0.93$. Therefore, the keyed value is the only option consistent with the governing relationship. The factor compares the full-hour volume with the hourly equivalent of the most intense quarter hour. The incorrect choices reflect common mistakes involving peak conversion, exposure, unit consistency, or simple rather than compound growth.

19. B — Using the stated data, density is flow divided by speed: $1925/46 = 41.85$ vehicles per mile. Therefore, the keyed value is the only option consistent with the governing relationship. The fundamental traffic-flow relationship requires consistent hourly flow and speed units. The incorrect choices reflect common mistakes involving peak conversion, exposure, unit consistency, or simple rather than compound growth.

20. D — Using the stated data, the normalized crash rate is $36/58 = 0.62$ crashes per million vehicle-miles. Therefore, the keyed value is the only option consistent with the governing relationship. Exposure normalization permits safety comparisons among facilities carrying different traffic volumes over different lengths. The incorrect choices reflect common mistakes involving peak conversion, exposure, unit consistency, or simple rather than compound.

21. A — Using the stated data, compound growth gives $13,900(1+0.044)^{11} = 22,321.34$ vehicles per day. Therefore, the keyed value is the only option consistent with the governing relationship. Compound forecasting applies growth to the increasing total each year rather than only to the original base. The incorrect choices reflect common mistakes involving peak conversion, exposure, unit consistency, or simple rather than compound.

22. D — Using the stated data, $PHF = 1200/(4 \times 320) = 0.94$. Therefore, the keyed value is the only option consistent with the governing relationship. The factor compares the full-hour volume with the hourly equivalent of the most intense quarter hour. The incorrect choices reflect common mistakes involving peak conversion, exposure, unit consistency, or simple rather than compound growth.

23. C — Using the stated data, density is flow divided by speed: $2025/50 = 40.50$ vehicles per mile. Therefore, the keyed value is the only option consistent with the governing relationship. The fundamental traffic-flow relationship requires consistent hourly flow and speed units. The incorrect choices reflect common mistakes involving peak conversion, exposure, unit consistency, or simple rather than compound growth.

24. B — Using the stated data, drop equals width times decimal slope: $12 \times 0.030 = 0.36$ feet. Therefore, the keyed value is the only option consistent with the governing relationship. Cross slope is a dimensionless rise-over-run ratio, so percent must be converted to decimal form. The distractors arise from ignoring one side, treating percent as a whole number, or confusing a.

25. B — Using the stated data, paved width is $2 \times 12 + 2 \times 8 = 40.00$ feet. Therefore, the keyed value is the only option consistent with the governing relationship. Every traveled lane and both shoulders contribute to the full paved platform width. The distractors arise from ignoring one side, treating percent as a whole number, or confusing a ratio.

26. A — Using the stated data, the H:V ratio is $50/3 = 16.67$ to 1. Therefore, the keyed value is the only option consistent with the governing relationship. Roadside slopes are commonly described as horizontal distance for each unit of vertical change. The distractors arise from ignoring one side, treating percent as a whole number, or confusing a ratio with its reciprocal.

27. C — Using the stated data, rectangular area is $250 \times 7 = 1,750.00$ square feet. Therefore, the keyed value is the only option consistent with the governing relationship. Plan area supports material quantity calculations when thickness is handled as a separate dimension. The distractors arise from ignoring one side, treating percent as a whole number, or confusing a ratio with its.

28. D — Using the stated data, drop equals width times decimal slope: $12 \times 0.020 = 0.24$ feet. Therefore, the keyed value is the only option consistent with the governing relationship. Cross slope is a dimensionless rise-over-run ratio, so percent must be converted to decimal form. The distractors arise from ignoring one side, treating percent as a whole number, or confusing a.

29. A — Using the stated data, paved width is $3 \times 12 + 2 \times 9 = 54.00$ feet. Therefore, the keyed value is the only option consistent with the governing relationship. Every traveled lane and both shoulders contribute to the full paved platform width. The distractors arise from ignoring one side, treating percent as a whole number, or confusing a ratio.

30. D — Using the stated data, the H:V ratio is $58/4 = 14.50$ to 1. Therefore, the keyed value is the only option consistent with the governing relationship. Roadside slopes are commonly described as horizontal distance for each unit of vertical change. The distractors arise from ignoring one side, treating percent as a whole number, or confusing a ratio with its reciprocal.

31. B — Using the stated data, rectangular area is $290 \times 5 = 1,450.00$ square feet. Therefore, the keyed value is the only option consistent with the governing relationship. Plan area supports material quantity calculations when thickness is handled as a separate dimension. The distractors arise from ignoring one side, treating percent as a whole number, or confusing a ratio with its.

32. C — Using the stated data, drop equals width times decimal slope: $12 \times 0.025 = 0.30$ feet. Therefore, the keyed value is the only option consistent with the governing relationship. Cross slope is a dimensionless rise-over-run ratio, so percent must be converted to decimal form. The distractors arise from ignoring one side, treating percent as a whole number, or confusing a.

33. B — Using the stated data, paved width is $4 \times 12 + 2 \times 10 = 68.00$ feet. Therefore, the keyed value is the only option consistent with the governing relationship. Every traveled lane and both shoulders contribute to the full paved platform width. The distractors arise from ignoring one side, treating percent as a whole number, or confusing a ratio.

34. D — Using the stated data, arc length is $\pi(980)(36)/180 = 615.75$ feet. Therefore, the keyed value is the only option consistent with the governing relationship. The degree angle must be converted through the pi-over-180 factor when computing circular arc length. The alternatives correspond to using the full angle instead of the half angle, omitting conversion, or selecting a different curve element.

35. C — Using the stated data, $T = R \tan(\delta/2) = 1015 \tan(38/2) = 349.49$ feet. Therefore, the keyed value is the only option consistent with the governing relationship. The tangent distance runs from the point of intersection to either tangent point. The alternatives correspond to using the full angle instead of the half angle, omitting conversion, or selecting a different curve.

36. A — Using the stated data, $M = R[1 - \cos(\delta/2)] = 63.32$ feet. Therefore, the keyed value is the only option consistent with the governing relationship. The middle ordinate is measured from the midpoint of the long chord to the curve along the radial line. The alternatives correspond to using the full angle instead of the half angle, omitting conversion, or selecting a.

37. A — Using the stated data, $LC = 2R \sin(\delta/2) = 777.66$ feet. Therefore, the keyed value is the only option consistent with the governing relationship. The long chord directly joins the beginning and end points of the circular curve. The alternatives correspond to using the full angle instead of the half angle, omitting conversion, or selecting a different curve element.

38. D — Using the stated data, arc length is $\pi(1120)(44)/180 = 860.10$ feet. Therefore, the keyed value is the only option consistent with the governing relationship. The degree angle must be converted through the pi-over-180 factor when computing circular arc length. The alternatives correspond to using the full angle instead of the half angle, omitting conversion, or selecting a different curve element.

39. C — Using the stated data, $T = R \tan(\delta/2) = 1155 \tan(46/2) = 490.27$ feet. Therefore, the keyed value is the only option consistent with the governing relationship. The tangent distance runs from the point of intersection to either tangent point. The alternatives correspond to using the full angle instead of the half angle, omitting conversion, or selecting a different curve.

40. B — Using the stated data, $M = R[1 - \cos(\delta/2)] = 102.88$ feet. Therefore, the keyed value is the only option consistent with the governing relationship. The middle ordinate is measured from the midpoint of the long chord to the curve along the radial line. The alternatives correspond to using the full angle instead of the half angle, omitting conversion, or selecting a.

41. B — Using the stated data, $LC = 2R \sin(\delta/2) = 1035.41$ feet. Therefore, the keyed value is the only option consistent with the governing relationship. The long chord directly joins the beginning and end points of the circular curve. The alternatives correspond to using the full angle instead of the half angle, omitting conversion, or selecting a different curve element.

42. A — Using the stated data, arc length is $\pi(1260)(52)/180 = 1143.54$ feet. Therefore, the keyed value is the only option consistent with the governing relationship. The degree angle must be converted through the pi-over-180 factor when computing circular arc length. The alternatives correspond to using the full angle instead of the half angle, omitting conversion, or selecting a different curve element.

43. C — Using the stated data, $T = R \tan(\delta/2) = 1295 \tan(54/2) = 659.84$ feet. Therefore, the keyed value is the only option consistent with the governing relationship. The tangent distance runs from the point of intersection to either tangent point. The alternatives correspond to using the full angle instead of the half angle, omitting conversion, or selecting a different curve.

44. D — Using the stated data, $M = R[1 - \cos(\delta/2)] = 155.68$ feet. Therefore, the keyed value is the only option consistent with the governing relationship. The middle ordinate is measured from the midpoint of the long chord to the curve along the radial line. The alternatives correspond to using the full angle instead of the half angle, omitting conversion, or selecting a.

45. A — Using the stated data, A is the absolute grade difference: $|3.70 - (-0.70)| = 4.40\%$. Therefore, the keyed value is the only option consistent with the governing relationship. Opposite-signed grades add in magnitude when determining the vertical curve's algebraic grade difference. The distractors reflect sign errors, percent conversion mistakes, reciprocal K calculations, or addition where an elevation difference is required.

46. C — Using the stated data, K equals length divided by algebraic grade difference: $825/8 = 103.12$ feet per percent. Therefore, the keyed value is the only option consistent with the governing relationship. K expresses the horizontal length supplied for each percentage point of grade change. The distractors reflect sign errors, percent conversion mistakes, reciprocal K calculations, or addition where an elevation.

47. D — Using the stated data, elevation change is $0.030 \times 400 = 12.00$ feet, yielding 542.00 feet. Therefore, the keyed value is the only option consistent with the governing relationship. A positive decimal grade increases elevation in the direction of stationing. The distractors reflect sign errors, percent conversion mistakes, reciprocal K calculations, or addition where an elevation difference is required.

48. B — Using the stated data, clearance is the elevation difference: $17.60 - 6.50 = 11.10$ feet. Therefore, the keyed value is the only option consistent with the governing relationship. Vertical clearance is measured between the roadway surface and the controlling overhead obstruction. The distractors reflect sign errors, percent conversion mistakes, reciprocal K calculations, or addition where an elevation difference is required.

49. C — Using the stated data, A is the absolute grade difference: $|4.30 - (-0.30)| = 4.60\%$. Therefore, the keyed value is the only option consistent with the governing relationship. Opposite-signed grades add in magnitude when determining the vertical curve's algebraic grade difference. The distractors reflect sign errors, percent conversion mistakes, reciprocal K calculations, or addition where an elevation difference is required.

50. A — Using the stated data, K equals length divided by algebraic grade difference: $925/7 = 132.14$ feet per percent. Therefore, the keyed value is the only option consistent with the governing relationship. K expresses the horizontal length supplied for each percentage point of grade change. The distractors reflect sign errors, percent conversion mistakes, reciprocal K calculations, or addition where an elevation.

51. B — Using the stated data, elevation change is $0.034 \times 440 = 14.96$ feet, yielding 556.96 feet. Therefore, the keyed value is the only option consistent with the governing relationship. A positive decimal grade increases elevation in the direction of stationing. The distractors reflect sign errors, percent conversion mistakes, reciprocal K calculations, or addition where an elevation difference is required.

52. D — Using the stated data, clearance is the elevation difference: $18.00 - 4.50 = 13.50$ feet. Therefore, the keyed value is the only option consistent with the governing relationship. Vertical clearance is measured between the roadway surface and the controlling overhead obstruction. The distractors reflect sign errors, percent conversion mistakes, reciprocal K calculations, or addition where an elevation difference is required.

53. C — Using the stated data, A is the absolute grade difference: $|4.90 - (0.10)| = 4.80\%$. Therefore, the keyed value is the only option consistent with the governing relationship. Opposite-signed grades add in magnitude when determining the vertical curve's algebraic grade difference. The distractors reflect sign errors, percent conversion mistakes, reciprocal K calculations, or addition where an elevation difference is required.

54. A — Using the stated data, K equals length divided by algebraic grade difference: $1025/6 = 170.83$ feet per percent. Therefore, the keyed value is the only option consistent with the governing relationship. K expresses the horizontal length supplied for each percentage point of grade change. The distractors reflect sign errors, percent conversion mistakes, reciprocal K calculations, or addition where an elevation.

55. D — Using the stated data, elevation change is $0.038 \times 480 = 18.24$ feet, yielding 572.24 feet. Therefore, the keyed value is the only option consistent with the governing relationship. A positive decimal grade increases elevation in the direction of stationing. The distractors reflect sign errors, percent conversion mistakes, reciprocal K calculations, or addition where an elevation difference is required.

56. B — Using the stated data, distance is $46 \times 1.4667 \times 6 = 404.80$ feet. Therefore, the keyed value is the only option consistent with the governing relationship. The speed conversion from miles per hour to feet per second is required before multiplying by time. The alternatives result from omitting a direction, forgetting the median, failing to convert speed, or using.

57. C — Using the stated data, storage length is $17 \times 25 = 425.00$ feet. Therefore, the keyed value is the only option consistent with the governing relationship. Queue storage is the product of design vehicle count and the adopted effective space per queued vehicle. The alternatives result from omitting a direction, forgetting the median, failing to convert speed, or using degrees.

58. B — Using the stated data, arc length is $\pi(65)(80)/180 = 90.76$ feet. Therefore, the keyed value is the only option consistent with the governing relationship. Curb-return length follows the same circular arc relation used for other horizontal curves. The alternatives result from omitting a direction, forgetting the median, failing to convert speed, or using degrees directly without circular conversion.

59. A — Using the stated data, width is $2 \times 4 \times 12 + 27 = 123.00$ feet. Therefore, the keyed value is the only option consistent with the governing relationship. The crossing includes directional traveled ways on both sides plus the central median. The alternatives result from omitting a direction, forgetting the median, failing to convert speed, or using degrees directly.

60. D — Using the stated data, distance is $54 \times 1.4667 \times 6 = 475.20$ feet. Therefore, the keyed value is the only option consistent with the governing relationship. The speed conversion from miles per hour to feet per second is required before multiplying by time. The alternatives result from omitting a direction, forgetting the median, failing to convert speed, or using.

61. C — Using the stated data, storage length is $21 \times 25 = 525.00$ feet. Therefore, the keyed value is the only option consistent with the governing relationship. Queue storage is the product of design vehicle count and the adopted effective space per queued vehicle. The alternatives result from omitting a direction, forgetting the median, failing to convert speed, or using degrees.

62. D — Using the stated data, arc length is $\pi(73)(84)/180 = 107.02$ feet. Therefore, the keyed value is the only option consistent with the governing relationship. Curb-return length follows the same circular arc relation used for other horizontal curves. The alternatives result from omitting a direction, forgetting the median, failing to convert speed, or using degrees directly without circular conversion.

63. A — Using the stated data, width is $2 \times 2 \times 12 + 31 = 79.00$ feet. Therefore, the keyed value is the only option consistent with the governing relationship. The crossing includes directional traveled ways on both sides plus the central median. The alternatives result from omitting a direction, forgetting the median, failing to convert speed, or using degrees directly.

64. B — Using the stated data, distance is $62 \times 1.4667 \times 6 = 545.60$ feet. Therefore, the keyed value is the only option consistent with the governing relationship. The speed conversion from miles per hour to feet per second is required before multiplying by time. The alternatives result from omitting a direction, forgetting the median, failing to convert speed, or using.

65. D — Using the stated data, storage length is $25 \times 25 = 625.00$ feet. Therefore, the keyed value is the only option consistent with the governing relationship. Queue storage is the product of design vehicle count and the adopted effective space per queued vehicle. The alternatives result from omitting a direction, forgetting the median, failing to convert speed, or using degrees.

66. A — Using the stated data, effective green ratio is $(40-4)/130 = 0.28$. Therefore, the keyed value is the only option consistent with the governing relationship. Only effective green, after subtracting lost time, contributes to the usable fraction of the cycle. The distractors reflect use of displayed rather than effective green, omission of startup time, or division where proportional capacity requires multiplication.

67. B — Using the stated data, capacity is saturation flow times green ratio: $1900 \times 0.53 = 1007.00$ vehicles per hour. Therefore, the keyed value is the only option consistent with the governing relationship. Signalized capacity scales the ideal discharge rate by the share of cycle effectively available. The distractors reflect use of displayed rather than effective green, omission of startup time,.

68. C — Using the stated data, timing is $7 + 80/3.5 = 29.86$ seconds. Therefore, the keyed value is the only option consistent with the governing relationship. Total timing combines the initial interval with the time needed to traverse the crossing distance. The distractors reflect use of displayed rather than effective green, omission of startup time, or division where proportional capacity requires.

69. B — Using the stated data, cycle lost time is $4 \times 4.60 = 18.40$ seconds. Therefore, the keyed value is the only option consistent with the governing relationship. Total cycle lost time accumulates the startup and clearance losses associated with each phase. The distractors reflect use of displayed rather than effective green, omission of startup time, or division where proportional capacity.

70. C — Using the stated data, effective green ratio is $(44-4)/150 = 0.27$. Therefore, the keyed value is the only option consistent with the governing relationship. Only effective green, after subtracting lost time, contributes to the usable fraction of the cycle. The distractors reflect use of displayed rather than effective green, omission of startup time, or division where proportional capacity requires multiplication.

71. D — Using the stated data, capacity is saturation flow times green ratio: $1900 \times 0.61 = 1159.00$ vehicles per hour. Therefore, the keyed value is the only option consistent with the governing relationship. Signalized capacity scales the ideal discharge rate by the share of cycle effectively available. The distractors reflect use of displayed rather than effective green, omission of startup time,.

72. A — Using the stated data, timing is $7 + 88/3.5 = 32.14$ seconds. Therefore, the keyed value is the only option consistent with the governing relationship. Total timing combines the initial interval with the time needed to traverse the crossing distance. The distractors reflect use of displayed rather than effective green, omission of startup time, or division where proportional capacity requires.

73. A — Using the stated data, $L = 12(50)^2/60 = 500.00$ feet. Therefore, the keyed value is the only option consistent with the governing relationship. The stated low-speed taper relation makes length proportional to offset and to the square of speed. The alternatives commonly omit a gap, count devices instead of spaces, misuse the speed conversion, or fail to square speed in.

74. D — Using the stated data, there are 17 spaces, so distance is $17 \times 170 = 2890.00$ feet. Therefore, the keyed value is the only option consistent with the governing relationship. The number of intervals between objects is one less than the number of objects. The alternatives commonly omit a gap, count devices instead of spaces, misuse the speed conversion, or.

75. B — Using the stated data, cycle length is $10+30 = 40$ feet, so count is $1700/40 = 42.50$. Therefore, the keyed value is the only option consistent with the governing relationship. Both the marked stripe and following gap occupy longitudinal distance in each repeating cycle. The alternatives commonly omit a gap, count devices instead of spaces, misuse the speed conversion, or.

76. C — Using the stated data, distance is $56 \times 1.4667 \times 10 = 821.33$ feet. Therefore, the keyed value is the only option consistent with the governing relationship. Preview distance follows from converting operating speed to feet per second and multiplying by available time. The alternatives commonly omit a gap, count devices instead of spaces, misuse the speed conversion, or fail.

77. B — Using the stated data, $L = 12(45)^2/60 = 405.00$ feet. Therefore, the keyed value is the only option consistent with the governing relationship. The stated low-speed taper relation makes length proportional to offset and to the square of speed. The alternatives commonly omit a gap, count devices instead of spaces, misuse the speed conversion, or fail to square speed in.

78. A — Using the stated data, there are 21 spaces, so distance is $21 \times 210 = 4410.00$ feet. Therefore, the keyed value is the only option consistent with the governing relationship. The number of intervals between objects is one less than the number of objects. The alternatives commonly omit a gap, count devices instead of spaces, misuse the speed conversion, or.

79. D — Using the stated data, cycle length is $10+30 = 40$ feet, so count is $1900/40 = 47.50$. Therefore, the keyed value is the only option consistent with the governing relationship. Both the marked stripe and following gap occupy longitudinal distance in each repeating cycle. The alternatives commonly omit a gap, count devices instead of spaces, misuse the speed conversion, or.

80. C — Using the stated data, dry unit weight is $141.00/(1+0.120) = 125.89$ pcf. Therefore, the keyed value is the only option consistent with the governing relationship. Moist unit weight includes water mass, so dividing by one plus decimal water content isolates dry solids. The distractors result from reversing density ratios, confusing void ratio with porosity, treating percent as decimal, or dividing.

81. B — Using the stated data, relative compaction is $100(136.00/142.00) = 95.77\%$. Therefore, the keyed value is the only option consistent with the governing relationship. Relative compaction compares achieved field density directly with the specified laboratory maximum. The distractors result from reversing density ratios, confusing void ratio with porosity, treating percent as decimal, or dividing by the equivalency factor.

82. D — Using the stated data, void ratio is void volume divided by solids volume: $0.62/0.68 = 0.91$. Therefore, the keyed value is the only option consistent with the governing relationship. Void ratio uses solids volume in the denominator, unlike porosity, which uses total volume. The distractors result from reversing density ratios, confusing void ratio with porosity, treating percent as decimal, or.

83. C — Using the stated data, daily loading is $1120 \times 2.35 = 2632.00$ ESAL. Therefore, the keyed value is the only option consistent with the governing relationship. Equivalent axle loading converts mixed truck repetitions into a common pavement-damage measure. The distractors result from reversing density ratios, confusing void ratio with porosity, treating percent as decimal, or dividing by the equivalency factor.

84. A — Using the stated data, dry unit weight is $149.00/(1+0.140) = 130.70$ pcf. Therefore, the keyed value is the only option consistent with the governing relationship. Moist unit weight includes water mass, so dividing by one plus decimal water content isolates dry solids. The distractors result from reversing density ratios, confusing void ratio with porosity, treating percent as decimal, or dividing.

85. B — Using the stated data, relative compaction is $100(144.00/150.00) = 96.00\%$. Therefore, the keyed value is the only option consistent with the governing relationship. Relative compaction compares achieved field density directly with the specified laboratory maximum. The distractors result from reversing density ratios, confusing void ratio with porosity, treating percent as decimal, or dividing by the equivalency factor.

86. C — Using the stated data, void ratio is void volume divided by solids volume: $0.70/0.72 = 0.97$. Therefore, the keyed value is the only option consistent with the governing relationship. Void ratio uses solids volume in the denominator, unlike porosity, which uses total volume. The distractors result from reversing density ratios, confusing void ratio with porosity, treating percent as decimal, or.

87. D — Using the stated data, daily loading is $1200 \times 2.55 = 3060.00$ ESAL. Therefore, the keyed value is the only option consistent with the governing relationship. Equivalent axle loading converts mixed truck repetitions into a common pavement-damage measure. The distractors result from reversing density ratios, confusing void ratio with porosity, treating percent as decimal, or dividing by the equivalency factor.

88. A — Using the stated data, dry unit weight is $157.00/(1+0.160) = 135.34$ pcf. Therefore, the keyed value is the only option consistent with the governing relationship. Moist unit weight includes water mass, so dividing by one plus decimal water content isolates dry solids. The distractors result from reversing density ratios, confusing void ratio with porosity, treating percent as decimal, or dividing.

89. B — Using the stated data, $Q = 0.73 \times 4.00 \times 26 = 75.92$ cubic feet per second. Therefore, the keyed value is the only option consistent with the governing relationship. With the customary rational-method convention, the product yields the design peak discharge for the contributing area. The distractors reflect radius-diameter confusion, inverted continuity, omitted runoff factors, or use of perimeter.

90. C — Using the stated data, area is $\pi(3.40)^2/4 = 9.08$ square feet. Therefore, the keyed value is the only option consistent with the governing relationship. Circular area depends on the square of diameter, with the four arising from conversion between radius and diameter. The distractors reflect radius-diameter confusion, inverted continuity, omitted runoff factors, or use of perimeter instead of cross-sectional area.

91. A — Using the stated data, continuity gives velocity $Q/A = 68.00/8.00 = 8.50$ feet per second. Therefore, the keyed value is the only option consistent with the governing relationship. Mean velocity follows directly from discharge divided by the wetted flow area. The distractors reflect radius-diameter confusion, inverted continuity, omitted runoff factors, or use of perimeter instead of cross-sectional area.

92. D — Using the stated data, rectangular flow area is $19 \times 2.60 = 49.40$ square feet. Therefore, the keyed value is the only option consistent with the governing relationship. Under the stated simplification, flow area is the product of bottom width and water depth. The distractors reflect radius-diameter confusion, inverted continuity, omitted runoff factors, or use of perimeter instead of cross-sectional.

93. D — Using the stated data, $Q = 0.77 \times 4.40 \times 30 = 101.64$ cubic feet per second. Therefore, the keyed value is the only option consistent with the governing relationship. With the customary rational-method convention, the product yields the design peak discharge for the contributing area. The distractors reflect radius-diameter confusion, inverted continuity, omitted runoff factors, or use of perimeter.

94. A — Using the stated data, area is $\pi(3.80)^2/4 = 11.34$ square feet. Therefore, the keyed value is the only option consistent with the governing relationship. Circular area depends on the square of diameter, with the four arising from conversion between radius and diameter. The distractors reflect radius-diameter confusion, inverted continuity, omitted runoff factors, or use of perimeter instead of cross-sectional area.

95. B — Using the stated data, continuity gives velocity $Q/A = 76.00/8.80 = 8.64$ feet per second. Therefore, the keyed value is the only option consistent with the governing relationship. Mean velocity follows directly from discharge divided by the wetted flow area. The distractors reflect radius-diameter confusion, inverted continuity, omitted runoff factors, or use of perimeter instead of cross-sectional area.

96. C — Using the stated data, rectangular flow area is $23 \times 3.00 = 69.00$ square feet. Therefore, the keyed value is the only option consistent with the governing relationship. Under the stated simplification, flow area is the product of bottom width and water depth. The distractors reflect radius-diameter confusion, inverted continuity, omitted runoff factors, or use of perimeter instead of cross-sectional.

97. D — Using the stated data, $Q = 0.81 \times 4.80 \times 34 = 132.19$ cubic feet per second. Therefore, the keyed value is the only option consistent with the governing relationship. With the customary rational-method convention, the product yields the design peak discharge for the contributing area. The distractors reflect radius-diameter confusion, inverted continuity, omitted runoff factors, or use of perimeter.

98. B — Using the stated data, area is $\pi(4.20)^2/4 = 13.85$ square feet. Therefore, the keyed value is the only option consistent with the governing relationship. Circular area depends on the square of diameter, with the four arising from conversion between radius and diameter. The distractors reflect radius-diameter confusion, inverted continuity, omitted runoff factors, or use of perimeter instead of cross-sectional area.

99. A — Using the stated data, continuity gives velocity $Q/A = 84.00/9.60 = 8.75$ feet per second. Therefore, the keyed value is the only option consistent with the governing relationship. Mean velocity follows directly from discharge divided by the wetted flow area. The distractors reflect radius-diameter confusion, inverted continuity, omitted runoff factors, or use of perimeter instead of cross-sectional area.

100. C — Using the stated data, rectangular flow area is $27 \times 3.40 = 91.80$ square feet. Therefore, the keyed value is the only option consistent with the governing relationship. Under the stated simplification, flow area is the product of bottom width and water depth. The distractors reflect radius-diameter confusion, inverted continuity, omitted runoff factors, or use of perimeter instead of cross-sectional.