PRACTICE EXAM 9: 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 a design development workshop, 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. 56,448.00
B. 84,672.00
C. 70,560.00
D. 105,840.00

2. For a rural highway improvement, 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. 12.91
C. 15.49
D. 19.37

3. During a travel-time reliability study, 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. 431,273.19
B. 345,018.55
C. 517,527.83
D. 646,909.79

4. For a downtown mobility project, 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. 38,272.50
D. 25,515.00

5. During an owner acceptance review, 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. 92,000.00
C. 110,400.00
D. 138,000.00

6. During a design development workshop, a grading operation includes 6,150 cubic yards. At a sustained production rate of 470 cubic yards per day, how many working days are required? Select the nearest listed value.

A. 10.47
B. 15.71
C. 19.63
D. 13.09

7. For a rural highway improvement, a future rehabilitation cost of $680,000 occurs in 4 years. Using an annual discount rate of 7.6%, what is its present worth? Select the nearest listed value.

A. 507,294.12
B. 405,835.30
C. 608,752.94
D. 760,941.18

8. During a travel-time reliability study, a contractor assigns 4 identical crews for 31 days. Each crew installs 335 linear feet per day. What total length can be installed? Select the nearest listed value.

A. 33,232.00
B. 49,848.00
C. 41,540.00
D. 62,310.00

9. For a downtown mobility project, a roadway pay item has an estimated quantity of 2,000 units and a unit price of $58.00 per unit. What is the estimated item cost? Select the nearest listed value.

A. 92,800.00
B. 139,200.00
C. 116,000.00
D. 174,000.00

10. During an owner acceptance review, 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

11. During a design development workshop, 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. 36.50
C. 43.80
D. 54.75

12. For a rural highway improvement, 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. 0.64
B. 0.51
C. 0.77
D. 0.96

13. During a travel-time reliability study, 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. 20,782.63
B. 16,626.10
C. 24,939.16
D. 31,173.94

14. For a downtown mobility project, 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. 0.74
B. 1.12
C. 1.40
D. 0.93

15. During an owner acceptance review, 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. 50.22
C. 41.85
D. 62.78

16. During a design development workshop, 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. 0.62
C. 0.74
D. 0.93

17. For a rural highway improvement, 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. 17,857.07
B. 22,321.34
C. 26,785.61
D. 33,482.01

18. During a travel-time reliability study, 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. 0.94
D. 1.41

19. For a downtown mobility project, 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. 40.50
B. 32.40
C. 48.60
D. 60.75

20. During an owner acceptance review, a segment experienced 40 crashes during 66 million vehicle-miles of travel. What is the crash rate in crashes per million vehicle-miles? Select the nearest listed value.

A. 0.49
B. 0.73
C. 0.92
D. 0.61

21. During a design development workshop, current daily traffic is 14,300 vehicles. With compound annual growth of 4.8% for 11 years, what is the forecast daily traffic? Select the nearest listed value.

A. 19,160.21
B. 23,950.26
C. 28,740.31
D. 35,925.39

22. For a rural highway improvement, during the peak hour, 1280 vehicles are counted, and the highest 15-minute volume is 340 vehicles. What is the peak-hour factor? Select the nearest listed value.

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

23. During a travel-time reliability study, a freeway lane carries 2125 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. 46.20
B. 36.96
C. 55.44
D. 69.30

24. For a downtown mobility project, 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. 0.24
C. 0.29
D. 0.36

25. During an owner acceptance review, 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. 43.20
B. 64.80
C. 81.00
D. 54.00

26. During a design development workshop, 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. 14.50
D. 21.75

27. For a rural highway improvement, a sidewalk segment is 290 feet long and 5 feet wide. What plan area must be constructed? Select the nearest listed value.

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

28. During a travel-time reliability study, 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. 0.45
D. 0.30

29. For a downtown mobility project, 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. 81.60
C. 68.00
D. 102.00

30. During an owner acceptance review, a recoverable roadside slope descends 2 foot vertically over 66 feet horizontally. What is its horizontal-to-vertical ratio? Select the nearest listed value.

A. 33.00
B. 26.40
C. 39.60
D. 49.50

31. During a design development workshop, a sidewalk segment is 330 feet long and 6 feet wide. What plan area must be constructed? Select the nearest listed value.

A. 1,584.00
B. 2,376.00
C. 2,970.00
D. 1,980.00

32. For a rural highway 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

33. During a travel-time reliability study, 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

34. For a downtown mobility project, 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

35. During an owner acceptance review, a simple circular curve has radius 1155 feet and intersection angle 46 degrees. What is the tangent length? Select the nearest listed value.

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

36. During a design development workshop, 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. 123.46
C. 102.88
D. 154.32

37. For a rural highway improvement, 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. 1,242.49
C. 1,553.12
D. 1,035.41

38. During a travel-time reliability study, a simple circular curve has radius 1260 feet and central angle 52 degrees. What is its arc length? Select the nearest listed value.

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

39. For a downtown mobility project, a simple circular curve has radius 1295 feet and intersection angle 54 degrees. What is the tangent length? Select the nearest listed value.

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

40. During an owner acceptance review, 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. 155.68
D. 233.52

41. During a design development workshop, for a circular curve with radius 1365 feet and central angle 58 degrees, what is the long chord? Select the nearest listed value.

A. 1,058.82
B. 1,323.53
C. 1,588.24
D. 1,985.30

42. For a rural highway improvement, a simple circular curve has radius 1400 feet and central angle 60 degrees. What is its arc length? Select the nearest listed value.

A. 1,466.08
B. 1,172.86
C. 1,759.30
D. 2,199.12

43. During a travel-time reliability study, a simple circular curve has radius 1435 feet and intersection angle 62 degrees. What is the tangent length? Select the nearest listed value.

A. 689.78
B. 1,034.68
C. 1,293.35
D. 862.23

44. For a downtown mobility project, for a circular curve with radius 1470 feet and central angle 64 degrees, what is the middle ordinate? Select the nearest listed value.

A. 178.70
B. 268.04
C. 223.37
D. 335.06

45. During an owner acceptance review, 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. 6.90
D. 4.60

46. During a design development workshop, 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. 105.71
B. 158.57
C. 132.14
D. 198.21

47. For a rural highway improvement, 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. 556.96
B. 445.57
C. 668.35
D. 835.44

48. During a travel-time reliability study, 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. 13.50
C. 16.20
D. 20.25

49. For a downtown mobility project, a vertical curve connects grades of 0.10% and +4.90%. What is the algebraic grade difference A? Select the nearest listed value.

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

50. During an owner acceptance review, 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. 136.66
B. 205.00
C. 170.83
D. 256.25

51. During a design development workshop, 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

52. For a rural highway improvement, an overhead structure has a low-chord elevation of 18.40 feet above a datum. The roadway surface is at elevation 5.50 feet. What is the vertical clearance? Select the nearest listed value.

A. 10.32
B. 12.90
C. 15.48
D. 19.35

53. During a travel-time reliability study, a vertical curve connects grades of 0.50% and +5.50%. What is the algebraic grade difference A? Select the nearest listed value.

A. 5.00
B. 4.00
C. 6.00
D. 7.50

54. For a downtown mobility project, a vertical curve is 1125 feet long and has an algebraic grade difference of 5%. What is its K value? Select the nearest listed value.

A. 180.00
B. 270.00
C. 225.00
D. 337.50

55. During an owner acceptance review, a tangent begins at elevation 566.00 feet and rises at 4.20% for 520 feet. What is the ending elevation? Select the nearest listed value.

A. 470.27
B. 587.84
C. 705.41
D. 881.76

56. During a design development workshop, 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

57. For a rural highway improvement, 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

58. During a travel-time reliability study, 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. 107.02
B. 85.62
C. 128.42
D. 160.53

59. For a downtown mobility project, 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. 63.20
B. 79.00
C. 94.80
D. 118.50

60. During an owner acceptance review, 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. 654.72
C. 818.40
D. 545.60

61. During a design development workshop, 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

62. For a rural highway improvement, a channelized intersection uses a circular curb return with radius 81 feet through 88 degrees. What is the curb-return arc length? Select the nearest listed value.

A. 124.41
B. 99.53
C. 149.29
D. 186.62

63. During a travel-time reliability study, an arterial intersection has 3 through lanes in each direction, 12-foot lanes, and a 35-foot median. What is the curb-to-curb crossing width, excluding shoulders? Select the nearest listed value.

A. 85.60
B. 128.40
C. 107.00
D. 160.50

64. For a downtown mobility project, a vehicle approaches an intersection at 70 miles per hour. If the design gap is 6 seconds, what distance does it travel during the gap? Select the nearest listed value.

A. 492.80
B. 616.00
C. 739.20
D. 924.00

65. During an owner acceptance review, a left-turn bay must store 29 passenger vehicles. Using 25 feet of storage per vehicle, what storage length is required? Select the nearest listed value.

A. 580.00
B. 870.00
C. 725.00
D. 1,087.50

66. During a design development workshop, 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. 0.41
D. 0.27

67. For a rural highway improvement, 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. 1,159.00
C. 1,390.80
D. 1,738.50

68. During a travel-time reliability study, 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

69. For a downtown mobility project, a four-phase signal has 5.00 seconds of lost time per phase. What is the total lost time per cycle? Select the nearest listed value.

A. 16.00
B. 24.00
C. 20.00
D. 30.00

70. During an owner acceptance review, a signal has a 170-second cycle, 48 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. 0.21
B. 0.31
C. 0.39
D. 0.26

71. During a design development workshop, a lane group has saturation flow of 1900 vehicles per hour of green and an effective-green ratio of 0.69. What is its capacity? Select the nearest listed value.

A. 1,048.80
B. 1,311.00
C. 1,573.20
D. 1,966.50

72. For a rural highway improvement, a pedestrian must cross 96 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. 27.54
B. 41.32
C. 51.64
D. 34.43

73. During a travel-time reliability study, 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. 405.00
B. 324.00
C. 486.00
D. 607.50

74. For a downtown mobility project, a channelizing line contains 22 devices at 210-foot spacing. What distance separates the first and last device? Select the nearest listed value.

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

75. During an owner acceptance review, 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. 47.50

B. 38.00

C. 57.00

D. 71.25

76. During a design development workshop, a temporary warning sequence should provide 8 seconds of preview at 60 mph. What advance distance corresponds to that travel time? Select the nearest listed value.

A. 563.20

B. 704.00

C. 844.80

D. 1,056.00

77. For a rural highway improvement, for a work-zone taper on a roadway operating at 40 mph, use L = WS^2/60 with offset W = 12 feet. What taper length results? Select the nearest listed value.

A. 320.00

B. 256.00

C. 384.00

D. 480.00

78. During a travel-time reliability study, a channelizing line contains 26 devices at 250-foot spacing. What distance separates the first and last device? Select the nearest listed value.

A. 5,000.00
B. 7,500.00
C. 9,375.00
D. 6,250.00

79. For a downtown mobility project, a broken lane line extends 2100 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. 42.00
B. 63.00
C. 52.50
D. 78.75

80. During an owner acceptance review, 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. 104.56
B. 130.70
C. 156.84
D. 196.05

81. During a design development workshop, 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. 115.20
C. 144.00
D. 96.00

82. For a rural highway improvement, 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. 0.97
B. 0.78
C. 1.16
D. 1.46

83. During a travel-time reliability study, 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. 3,060.00
C. 3,672.00
D. 4,590.00

84. For a downtown mobility project, 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. 108.27
B. 162.41
C. 135.34
D. 203.01

85. During an owner acceptance review, a field dry unit weight is 152.00 pcf and laboratory maximum dry unit weight is 158.00 pcf. What is relative compaction? Select the nearest listed value.

A. 76.96
B. 96.20
C. 115.44
D. 144.30

86. During a design development workshop, a soil element contains 0.78 cubic foot of voids and 0.76 cubic foot of solids. What is the void ratio? Select the nearest listed value.

A. 1.03
B. 0.82
C. 1.24
D. 1.54

87. For a rural highway improvement, a design lane carries 1280 trucks per day, and the adopted equivalency factor is 2.75 ESAL per truck. What is the daily ESAL loading? Select the nearest listed value.

A. 2,816.00
B. 4,224.00
C. 3,520.00
D. 5,280.00

88. During a travel-time reliability study, compacted soil has moist unit weight 165.00 pcf and water content 18.0%. What is its dry unit weight? Select the nearest listed value.

A. 111.86
B. 167.80
C. 209.75
D. 139.83

89. For a downtown mobility project, 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

90. During an owner acceptance review, a circular storm drain has inside diameter 3.80 feet. What is its full cross-sectional flow area? Select the nearest listed value.

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

91. During a design development workshop, 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. 8.64
B. 6.91
C. 10.37
D. 12.96

92. For a rural highway improvement, 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

93. During a travel-time reliability study, 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. 132.19
D. 198.28

94. For a downtown mobility project, 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

95. During an owner acceptance review, 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. 7.00
B. 10.50
C. 13.12
D. 8.75

96. During a design development workshop, 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. 91.80
B. 73.44
C. 110.16
D. 137.70

97. For a rural highway improvement, using Q = CiA, find peak runoff for C = 0.85, rainfall intensity i = 5.20 inches per hour, and drainage area A = 38 acres. Select the nearest listed value.

A. 167.96
B. 134.37
C. 201.55
D. 251.94

98. During a travel-time reliability study, a circular storm drain has inside diameter 4.60 feet. What is its full cross-sectional flow area? Select the nearest listed value.

A. 13.30
B. 19.94
C. 16.62
D. 24.93

99. For a downtown mobility project, a culvert conveys 92.00 cubic feet per second through a flow area of 10.40 square feet. What is mean velocity? Select the nearest listed value.

A. 7.08
B. 8.85
C. 10.62
D. 13.27

100. During an owner acceptance review, a rectangular roadside channel carries water 3.80 feet deep across a bottom width of 31 feet. What is the flow area, neglecting side-slope contribution? Select the nearest listed value.

A. 94.24
B. 141.36
C. 176.70
D. 117.80

Practice Exam 9: Answer Key and Explanations

1. C — Using the stated data, the cost is quantity times unit price: 1,680 x $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.

2. B — 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.

3. A — 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.

4. D — Using the stated data, total output is 3 x 27 x 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.

5. B — Using the stated data, the cost is quantity times unit price: 1,840 x $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.

6. D — Using the stated data, duration equals work divided by production, or 6,150/470 = 13.09 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. A — Using the stated data, discounting gives $680,000/(1+0.076)^4 = $507,294.12. 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 4 x 31 x 335 = 41,540.00 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: 2,000 x $58.00 = $116,000.00. 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 = 1040/(4 x 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.

11. B — 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.

12. A — 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.

13. A — 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.

14. D — Using the stated data, PHF = 1120/(4 x 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.

15. C — 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.

16. B — 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.

17. B — 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.

18. C — Using the stated data, PHF = 1200/(4 x 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.

19. A — 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.

20. D — Using the stated data, the normalized crash rate is 40/66 = 0.61 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. B — Using the stated data, compound growth gives 14,300(1+0.048)^11 = 23,950.26 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. C — Using the stated data, PHF = 1280/(4 x 340) = 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. A — Using the stated data, density is flow divided by speed: 2125/46 = 46.20 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 x 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.

25. D — Using the stated data, paved width is 3 x 12 + 2 x 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.

26. C — 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.

27. A — Using the stated data, rectangular area is 290 x 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.

28. D — Using the stated data, drop equals width times decimal slope: 12 x 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.

29. C — Using the stated data, paved width is 4 x 12 + 2 x 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.

30. A — Using the stated data, the H:V ratio is 66/2 = 33.00 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. D — Using the stated data, rectangular area is 330 x 6 = 1,980.00 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. B — Using the stated data, drop equals width times decimal slope: 12 x 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.

33. B — Using the stated data, paved width is 2 x 12 + 2 x 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.

34. 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.

35. A — 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.

36. C — 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.

37. D — 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.

38. B — 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.

39. A — 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.

40. C — 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.

41. B — Using the stated data, LC = 2R sin(delta/2) = 1323.53 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(1400)(60)/180 = 1466.08 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. D — Using the stated data, T = R tan(delta/2) = 1435 tan(62/2) = 862.23 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. C — Using the stated data, M = R[1-cos(delta/2)] = 223.37 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. D — 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.

46. C — 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.

47. A — Using the stated data, elevation change is 0.034 x 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.

48. B — 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.

49. A — 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.

50. C — 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.

51. D — Using the stated data, elevation change is 0.038 x 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.

52. B — Using the stated data, clearance is the elevation difference: 18.40-5.50 = 12.90 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. A — Using the stated data, A is the absolute grade difference: |5.50-(0.50)| = 5.00%. 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. C — Using the stated data, K equals length divided by algebraic grade difference: 1125/5 = 225.00 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. B — Using the stated data, elevation change is 0.042 x 520 = 21.84 feet, yielding 587.84 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. D — Using the stated data, distance is 54 x 1.4667 x 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.

57. C — Using the stated data, storage length is 21 x 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.

58. A — 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.

59. B — Using the stated data, width is 2 x 2 x 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.

60. D — Using the stated data, distance is 62 x 1.4667 x 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.

61. D — Using the stated data, storage length is 25 x 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.

62. A — Using the stated data, arc length is pi(81)(88)/180 = 124.41 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. C — Using the stated data, width is 2 x 3 x 12 + 35 = 107.00 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 70 x 1.4667 x 6 = 616.00 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. C — Using the stated data, storage length is 29 x 25 = 725.00 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. D — 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.

67. B — Using the stated data, capacity is saturation flow times green ratio: 1900 x 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,.

68. 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.

69. C — Using the stated data, cycle lost time is 4 x 5.00 = 20.00 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. D — Using the stated data, effective green ratio is (48-4)/170 = 0.26. 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. B — Using the stated data, capacity is saturation flow times green ratio: 1900 x 0.69 = 1311.00 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. D — Using the stated data, timing is 7 + 96/3.5 = 34.43 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(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.

74. C — Using the stated data, there are 21 spaces, so distance is 21 x 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.

75. A — 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.

76. B — Using the stated data, distance is 60 x 1.4667 x 8 = 704.00 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. A — Using the stated data, L = 12(40)^2/60 = 320.00 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. D — Using the stated data, there are 25 spaces, so distance is 25 x 250 = 6250.00 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. C — Using the stated data, cycle length is 10+30 = 40 feet, so count is 2100/40 = 52.50. 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. B — 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.

81. D — 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.

82. A — 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.

83. B — Using the stated data, daily loading is 1200 x 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.

84. C — 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.

85. B — Using the stated data, relative compaction is 100(152.00/158.00) = 96.20%. 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. A — Using the stated data, void ratio is void volume divided by solids volume: 0.78/0.76 = 1.03. 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. C — Using the stated data, daily loading is 1280 x 2.75 = 3520.00 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. D — Using the stated data, dry unit weight is 165.00/(1+0.180) = 139.83 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. D — Using the stated data, Q = 0.77 x 4.40 x 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.

90. B — 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.

91. A — 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.

92. C — Using the stated data, rectangular flow area is 23 x 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.

93. C — Using the stated data, Q = 0.81 x 4.80 x 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.

94. 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.

95. D — 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.

96. A — Using the stated data, rectangular flow area is 27 x 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.

97. A — Using the stated data, Q = 0.85 x 5.20 x 38 = 167.96 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. C — Using the stated data, area is pi(4.60)^2/4 = 16.62 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. B — Using the stated data, continuity gives velocity Q/A = 92.00/10.40 = 8.85 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. D — Using the stated data, rectangular flow area is 31 x 3.80 = 117.80 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.