PRACTICE EXAM 10: CALIFORNIA CIVIL SEISMIC PRINCIPLES (100 QUESTIONS)

This standalone practice exam contains 100 four-choice questions weighted to the current BPELSG Civil Engineer Seismic Principles test plan. Use a 2.5-hour time limit for realistic practice. For the remainder of 2026, BPELSG continues testing to the 2022 California Building Code and ASCE/SEI 7-16. This is independently created study material and is not an official BPELSG examination.

1. For this practice calculation, take SMS = FaSs. If Fa = 1.15 and Ss = 1.28g, what is SMS?

A. 1.113g
B. 1.280g
C. 2.430g
D. 1.472g

2. Use SM1 = FvS1 for this problem. With Fv = 1.70 and S1 = 0.46g, determine SM1.

A. 0.782g
B. 0.271g
C. 1.240g
D. 2.160g

3. The site-modified MCE short-period ordinate for a practice site is 1.32g. If the design ordinate is defined as two-thirds of that value, which SDS results?

A. 0.66g
B. 1.32g
C. 0.88g
D. 1.98g

4. A practice site has SM1 = 0.81g. The design one-second ordinate is specified as two-thirds of SM1. Which value should be used for SD1?

A. 0.405g
B. 0.54g
C. 0.81g
D. 1.215g

5. Use Ts = SD1/SDS. If SD1 = 0.56g and SDS = 0.93g, what is Ts to two decimals?

A. 0.52 s
B. 0.60 s
C. 1.49 s
D. 1.66 s

6. For a study spectrum, let T0 = 0.2Ts. If Ts = 0.75 s, determine T0.

A. 0.15 s
B. 0.375 s
C. 0.75 s
D. 3.75 s

7. Two nearby sites share essentially the same regional mapped hazard, but one has deep soft deposits and the other dense rock. Why may their design spectra differ?

A. Mapped fault motion changes with building height
B. Concrete strength changes the regional hazard
C. Roof live load changes the site geology
D. Local soil profiles can amplify different frequency ranges

8. A site investigation finds loose saturated sand and shallow groundwater beneath a proposed building. Which earthquake-related concern is most directly associated with that condition?

A. Long-term steel corrosion from dry air
B. Wind-induced roof vibration
C. Liquefaction with settlement or lateral ground deformation
D. Thermal movement of curtain walls

9. A mass-sensitivity check holds lateral stiffness constant while increasing system mass by a factor of 2.25. By what factor does the natural period change under T proportional to sqrt(m/k)?

A. 0.44
B. 0.67
C. 2.25
D. 1.50

10. At one story, two resisting lines undergo the same lateral translation and act in parallel. Their stiffnesses are 18 and 27 kips/in. What total story stiffness do they provide?

A. 9 kips/in
B. 22.5 kips/in
C. 45 kips/in
D. 486 kips/in

11. What is the usual effect of increasing viscous damping in an otherwise unchanged structural system near resonance?

A. Seismic mass doubles automatically
B. Peak vibration response generally decreases
C. The fundamental period becomes zero
D. All structural strength demands disappear

12. A lateral system has several effective resisting lines, so local yielding in one line does not immediately sever the entire force path. Which seismic characteristic does this illustrate?

A. Alternate load paths can limit disproportionate response after local yielding or damage
B. It guarantees zero structural drift in the stated seismic condition for the structural system described
C. It removes the need for connections under the earthquake case in the stem
D. It makes all elements carry equal force in the stated seismic condition

13. A floor plan has most lateral stiffness concentrated near one edge while mass is distributed more uniformly. What response tendency is most concerning?

A. Uniform vertical settlement only
B. A shorter gravity load path
C. Significant torsional rotation of the diaphragm
D. Elimination of story shear

14. Why is a very flexible first story beneath much stiffer upper stories undesirable in earthquakes?

A. The upper stories lose all mass in the stated seismic condition
B. Foundation shaking becomes zero for the structural system described
C. Roof acceleration must vanish under the earthquake case in the stem
D. Drift and inelastic demand can concentrate in the flexible story

15. In a dual lateral system, why must both subsystems be connected through a compatible load path?

A. They must share seismic demand through compatible deformation and force transfer
B. Only the gravity system needs continuity
C. The systems should move independently with no ties
D. One subsystem must carry no lateral force

16. Why is seismic separation provided between adjacent buildings that may move out of phase?

A. To increase roof dead load
B. To reduce the chance of damaging impact during earthquake drift
C. To eliminate foundation bearing pressure
D. To make the buildings dynamically identical

17. An older URM bearing-wall building lacks reliable ties between its masonry walls and roof framing. Which retrofit action most directly prevents out-of-plane wall separation?

A. Add heavier roof finishes
B. Polish the masonry surface
C. Increase interior partition weight
D. Provide positive wall-to-diaphragm anchorage and continuity

18. A tilt-up building has weak roof-to-wall ties. What failure mode is a primary concern during strong shaking?

A. Uniform shortening of every column
B. Out-of-plane wall separation or loss of wall support
C. Elimination of diaphragm shear
D. Purely thermal roof expansion

19. Why can inadequate connection ductility be especially serious in older precast concrete construction?

A. Precast members have no seismic mass in the stated seismic condition for the structural system described
B. Concrete cannot carry compression under the earthquake case in the stem in the stated seismic condition
C. Brittle connection failure can interrupt the load path before members develop ductile response
D. Connections only transfer gravity loads for the structural system described under the earthquake case in the stem

20. An existing wood apartment building has an open parking level with few lateral walls. Which retrofit strategy most directly targets the vulnerability?

A. Add or strengthen lateral elements and their foundations at the weak story
B. Increase carpet thickness upstairs in the stated seismic condition for the structural system described
C. Remove roof sheathing under the earthquake case in the stem in the stated seismic condition
D. Reduce interior lighting load for the structural system described under the earthquake case in the stem

21. After an earthquake, an engineer observes new diagonal cracking, residual drift, and damaged connections in a lateral system. What is the most appropriate immediate engineering focus?

A. Evaluate whether the damaged system can safely carry expected loads and aftershocks
B. Estimate repainting cost first
C. Assume the building is safe because it is standing
D. Ignore residual deformation if utilities work

22. A brittle reinforced-concrete column is vulnerable to shear failure before flexural yielding. Which retrofit objective is most appropriate?

A. Reduce transverse reinforcement in the stated seismic condition for the structural system described
B. Add mass without added strength under the earthquake case in the stem
C. Create a weaker column splice in the stated seismic condition
D. Increase shear capacity and confinement so ductile deformation can occur

23. A practice building has dead load of 1,420 kips and permanently attached equipment of 80 kips. If those are the only contributors to effective seismic weight, what is W?

A. 1,340 kips
B. 1,420 kips

C. 1,500 kips
D. 1,580 kips

24. For a practice ELF coefficient, divide SDS by the quantity R/Ie. Using SDS = 0.90, R = 6, and Ie = 1.0, what coefficient results?

A. 0.067
B. 0.15
C. 0.90
D. 5.40

25. A simplified ELF calculation gives Cs = 0.12 and effective seismic weight W = 2,750 kips. What is the base shear V?

A. 229 kips
B. 2,750 kips
C. 22,917 kips
D. 330 kips

26. For a study case, calculate Cs as the larger of 0.044SDSIe and 0.01. With SDS = 0.80 and Ie = 1.25, what value governs?

A. 0.044
B. 0.010
C. 0.0352
D. 0.080

27. For this problem, let the vertical-distribution exponent vary linearly from k = 1 at T = 0.5 s to k = 2 at T = 2.5 s. What is k at T = 1.5 s?

A. 1.25

B. 1.75
C. 1.50
D. 2.00

28. A two-level structure uses k = 1. The level weights are 100 and 150 kips at heights 12 and 24 ft. What fraction Cvx of base shear goes to the upper level?

A. 0.25
B. 0.75
C. 0.60
D. 0.67

29. Lateral forces at three floors are 40, 55, and 70 kips from bottom to top. What is the story shear just below the second floor?

A. 70 kips
B. 95 kips
C. 165 kips
D. 125 kips

30. A 90-kip roof force acts 36 ft above the base. What base overturning moment does this force create by itself?

A. 2.50 kip-ft
B. 126 kip-ft
C. 3,240 kip-ft
D. 4,050 kip-ft

31. A diaphragm design force of 180 kips is distributed uniformly across a 60-ft diaphragm width. What is the average unit shear?

A. 3.0 kips/ft
B. 0.33 kips/ft
C. 60 kips/ft
D. 10,800 kips/ft

32. For this practice problem, use wall anchorage force F = 0.4SDSIpWp. If SDS = 1.0, Ip = 1.0, and tributary wall weight Wp = 75 kips, what is F?

A. 18.75 kips
B. 30 kips
C. 75 kips
D. 187.5 kips

33. An out-of-plane wall inertial pressure is taken as 18 psf over a 14-ft story height. What horizontal line force acts at the diaphragm level per foot of wall length?

A. 252 lb/ft
B. 1.29 lb/ft
C. 18 lb/ft
D. 32 lb/ft

34. A lateral floor force V = 160 kips acts with an eccentricity of 7 ft from the center of rigidity. What torsional moment is produced?

A. 22.9 kip-ft
B. 167 kip-ft
C. 2,240 kip-ft
D. 1,120 kip-ft

35. A 50-ft-wide diaphragm has a 4-ft actual eccentricity between centers of mass and rigidity. What is that eccentricity as a percentage of diaphragm width?

A. 4%
B. 12.5%
C. 8%
D. 20%

36. Use Ta = Cthn^x with Ct = 0.02, hn = 64 ft, and x = 0.75. What is Ta to two decimals?

A. 0.16 s
B. 0.45 s
C. 0.84 s
D. 1.28 s

37. If an approximate period Ta is 0.72 s and a study limit uses Cu = 1.4, what is CuTa?

A. 0.514 s
B. 0.72 s
C. 1.008 s
D. 2.12 s

38. A practice base-shear coefficient is Cs = 0.11 for a building with W = 4,200 kips. What is V?

A. 38.2 kips
B. 420 kips
C. 4,311 kips
D. 462 kips

39. For a practice orthogonal combination, use E = Ex + 0.30Ey. If Ex = 120 kips and Ey = 70 kips, what is E?

A. 141 kips
B. 57 kips

C. 126 kips

D. 190 kips

40. A roof diaphragm transfers 96 kips into four identical collector lines that share the force equally. What axial force is assigned to each collector?

A. 4 kips

B. 24 kips

C. 48 kips

D. 384 kips

41. A diaphragm develops an overturning-style in-plane moment of 2,400 kip-ft resisted by chords 80 ft apart. What chord force magnitude is required?

A. 30 kips

B. 0.033 kips

C. 80 kips

D. 192,000 kips

42. Floor lateral forces are 35, 45, 65, and 85 kips. What is the total base shear from these applied forces?

A. 50 kips

B. 85 kips

C. 230 kips

D. 195 kips

43. Elastic floor displacements at two consecutive levels are 1.9 in and 1.2 in. What is the elastic story drift between them?

A. 0.37 in

B. 0.7 in
C. 1.2 in
D. 3.1 in

44. For this practice calculation, amplified displacement is delta = (Cd/Ie)delta_e. With Cd = 5, Ie = 1.25, and delta_e = 0.8 in, what is delta?

A. 0.20 in
B. 1.0 in
C. 5.0 in
D. 3.2 in

45. A practice separation check adds the absolute design displacements of adjacent buildings. If they are 2.4 in and 1.7 in, what separation is required by that rule?

A. 4.1 in
B. 0.7 in
C. 2.05 in
D. 4.08 in

46. A 12-ft-high story has a design drift of 1.44 in. What is the drift ratio?

A. 0.10%
B. 1.44%
C. 12.0%
D. 1.0%

47. A diaphragm shear of 150 kips is resisted along a 50-ft wall line. What average line demand acts on that wall line?

A. 0.33 kips/ft

B. 50 kips/ft
C. 3.0 kips/ft
D. 7,500 kips/ft

48. A wall line develops 3.5 kips/ft of diaphragm shear over a 22-ft tributary width feeding a collector. What collector force results?

A. 6.29 kips
B. 77 kips
C. 25.5 kips
D. 154 kips

49. A 4-kip rooftop component is evaluated by computing 0.4apSDSWp/(Rp/Ip) and then applying the height factor (1+2z/h). With ap=1.0, SDS=0.9, Rp=2.5, Ip=1.0, and z/h=0.5, what force results?

A. 0.576 kip
B. 1.44 kips
C. 1.152 kips
D. 2.88 kips

50. In the component height factor 1 + 2z/h, what value results when the component is located at z/h = 0.75?

A. 2.5
B. 1.5
C. 1.75
D. 3.0

51. A rooftop unit weighs 1,800 lb and is supported by four identical anchors assumed to share direct horizontal shear equally. For a 900-lb design force, what shear is assigned to each anchor?

A. 4 lb
B. 450 lb
C. 3,600 lb
D. 225 lb

52. A nonbuilding structure has effective seismic weight 620 kips and a simplified base-shear coefficient of 0.18. What is its design base shear?

A. 34.4 kips
B. 111.6 kips
C. 124 kips
D. 3,444 kips

53. Why can a very rigid, short-period equipment item attract substantial acceleration even though its deformation is small?

A. Small deformation means zero inertial force in the stated seismic condition
B. Rigid attachment can transmit high floor acceleration directly into the component
C. Rigid equipment has no mass for the structural system described
D. Floor acceleration cannot affect anchored equipment under the earthquake case in the stem

54. Why are flexible couplings often provided where piping crosses a seismic separation joint?

A. They accommodate differential movement without forcing brittle pipe or connection failure
B. They increase the pipe dead load intentionally in the stated seismic condition
C. They make all supports unnecessary for the structural system described
D. They prevent any fluid pressure under the earthquake case in the stem

55. During ceiling coordination, the engineer requires lateral bracing and perimeter detailing for a suspended ceiling. What seismic performance goal is this intended to support?

A. To increase ceiling tile weight in the stated seismic condition
B. To transfer foundation overturning for the structural system described
C. To limit lateral movement and maintain support continuity during shaking
D. To change the soil site class under the earthquake case in the stem

56. A partially filled storage tank is being evaluated dynamically. Why should the engineer distinguish motion of liquid that follows the shell from free-surface sloshing?

A. All tank contents move as a perfectly rigid block
B. Liquid eliminates seismic inertia
C. Only wind can cause free-surface motion
D. The tank shell and the sloshing liquid can respond with different dynamic characteristics

57. When a nonstructural component must remain operational after an earthquake, what design consideration becomes especially important?

A. Its anchorage, supports, and functional connections must accommodate the required seismic demand
B. Only its exterior color matters in the stated seismic condition for the structural system described
C. Its operating weight can be ignored under the earthquake case in the stem
D. It should be disconnected from all utilities in the stated seismic condition

58. A distributed cable tray weighs 40 lb/ft over a 25-ft braced segment. What is the total supported weight of that segment?

A. 1.6 lb
B. 65 lb
C. 10,000 lb
D. 1,000 lb

59. A component lateral force of 3.6 kips is resisted by six identical braces that share direct force equally. What force is assigned to each brace?

A. 0.17 kip
B. 0.60 kip
C. 1.80 kips
D. 21.6 kips

60. For this practice cap, take Fmax = 1.6SDSIpWp. If SDS=0.75, Ip=1.0, and Wp=2.5 kips, what is Fmax?

A. 1.2 kips
B. 2.5 kips
C. 3.0 kips
D. 4.0 kips

61. A parapet has tributary seismic weight 12 kips and a practice horizontal coefficient of 0.50. What lateral force results?

A. 6 kips
B. 0.042 kip
C. 12 kips
D. 24 kips

62. Why should equipment anchorage design consider the supporting slab or framing, not just the anchor itself?

A. The support only affects architectural finish in the stated seismic condition for the structural system described
B. Anchor force disappears below the bolt under the earthquake case in the stem
C. The equipment mass is carried by air during shaking in the stated seismic condition
D. The support must transfer anchor forces into the building load path without local failure

63. A rigid floor translates without torsion while two frames of stiffness 30 and 60 kips/in resist 180 kips. How much direct shear is attracted by the 60-kips/in frame?

A. 60 kips
B. 120 kips
C. 90 kips
D. 150 kips

64. Three frames have stiffnesses 2, 5, and 3 relative units and share 250 kips through a rigid diaphragm without torsion. What direct shear goes to the 5-unit frame?

A. 50 kips
B. 75 kips
C. 175 kips
D. 125 kips

65. Two lateral wall lines lie 30 ft apart. The line at x=0 has stiffness 20, and the line at x=30 has stiffness 40. Find the stiffness-weighted rigidity coordinate from x=0.

A. 10 ft
B. 15 ft
C. 20 ft
D. 30 ft

66. At one floor, the mass centroid lies at x=28 ft while the rigidity centroid lies at x=22 ft. Determine the magnitude of the plan offset that drives inherent torsion.

A. 6 ft
B. 3 ft
C. 22 ft
D. 50 ft

67. A floor shear of 200 kips acts with 6 ft eccentricity. What torsional moment must the diaphragm distribute in addition to direct shear?

A. 33.3 kip-ft
B. 1,200 kip-ft
C. 206 kip-ft
D. 2,400 kip-ft

68. For torsional shear, use Vi = M(ki ri)/(sum(kj rj^2)). Two identical frames each have k=1 and are 20 ft from the center. If M=800 kip-ft, what torsional shear magnitude goes to each frame?

A. 1 kip
B. 40 kips
C. 20 kips
D. 400 kips

69. A flexible diaphragm spans between two wall lines and carries 72 kips of uniform lateral load over 48 ft. If the supports share by tributary width, what reaction occurs at each end?

A. 36 kips
B. 1.5 kips
C. 24 kips
D. 72 kips

70. An in-plane diaphragm moment of 1,680 kip-ft is resisted by a tension-compression chord pair separated by 56 ft. What axial force magnitude must each chord develop?

A. 0.033 kip
B. 56 kips
C. 30 kips
D. 94.1 kips

71. A collector gathers 2.8 kips/ft of diaphragm shear over a 30-ft tributary width. What axial collector force is accumulated?

A. 10.7 kips
B. 84 kips
C. 32.8 kips
D. 168 kips

72. A lateral element resists 96 kips while deflecting 0.8 in elastically. What secant stiffness k = F/delta does this imply?

A. 76.8 kips/in
B. 96 kips/in
C. 0.0083 in/kip
D. 120 kips/in

73. For a cantilever idealization use delta = PL^3/(3EI). With P=12, L=10, E=1000, and I=2 in consistent units, what is delta?

A. 0.20
B. 6.0
C. 2.0
D. 20.0

74. Two lateral springs of 35 and 25 kips/in act in parallel at a floor. What combined stiffness resists diaphragm translation?

A. 60 kips/in
B. 10 kips/in
C. 29.2 kips/in
D. 875 kips/in

75. A story shear is 150 kips and the elastic story drift is 1.25 in. What effective story stiffness does k = V/Delta give?

A. 1.20 kips/in
B. 120 kips/in
C. 151.25 kips/in
D. 187.5 kips/in

76. A floor plan has mass units 40 at x=10 ft and 60 at x=30 ft. Determine the x-coordinate at which the combined floor mass can be represented.

A. 18 ft
B. 20 ft
C. 24 ft
D. 22 ft

77. For an accidental eccentricity exercise, take 5% of a 64-ft diaphragm dimension. What offset is used?

A. 0.32 ft
B. 3.2 ft
C. 5.0 ft
D. 12.8 ft

78. For a torsion check, 150 kips of floor shear acts through 4 ft inherent eccentricity plus 3 ft accidental eccentricity on the same side. Determine the torsional moment.

A. 1,050 kip-ft
B. 150 kip-ft
C. 600 kip-ft
D. 2,100 kip-ft

79. For this stability check use theta = PDelta/(Vh). If P=900 kips, Delta=1.5 in, V=180 kips, and h=144 in, what is theta?

A. 0.00521
B. 0.1042
C. 0.0521
D. 7.50

80. A story is 13 ft high and its design drift is 1.95 in. What is the drift ratio as a percent?

A. 0.125%
B. 1.50%
C. 15.0%
D. 1.25%

81. Two modal base-shear contributions are 80 and 60 kips. Using SRSS, what combined response is obtained?

A. 100 kips
B. 70 kips
C. 140 kips
D. 4,900 kips

82. Why can closely spaced vibration modes require a combination method that accounts for modal correlation rather than simple SRSS?

A. Close modes always have zero mass in the stated seismic condition
B. SRSS requires identical mode shapes for the structural system described under the earthquake case in the stem
C. Modal analysis ignores damping entirely in the stated seismic condition for the structural system described
D. Their responses may not be statistically independent when natural frequencies are close

83. Why are response-spectrum results sometimes scaled to a minimum reference base shear before design forces are used?

A. To make every modal period identical in the stated seismic condition for the structural system described under the earthquake case in the stem
B. To prevent the dynamic analysis from producing unrealistically low overall design force relative to the required reference level
C. To eliminate torsion from the model in the stated seismic condition for the structural system described under the earthquake case in the stem
D. To convert all floors into rigid bodies in the stated seismic condition for the structural system described

84. What feature most strongly supports modeling a diaphragm as rigid for in-plane force distribution?

A. It has the largest architectural area in the stated seismic condition for the structural system described
B. It contains no gravity load under the earthquake case in the stem in the stated seismic condition
C. Its in-plane deformation is small compared with the deformation of the vertical lateral elements
D. Its thickness is identical everywhere for the structural system described under the earthquake case in the stem

85. A simply supported diaphragm strip carries a triangular lateral line load increasing from zero at the left to 6 kips/ft at the right over 30 ft. What is the total lateral load?

A. 90 kips
B. 30 kips
C. 180 kips
D. 540 kips

86. The triangular diaphragm load in the previous style of problem rises from zero on the left to its maximum on the right. Where does its resultant act from the zero-load end?

A. 10 ft

B. 15 ft

C. 30 ft

D. 20 ft

87. A diaphragm carries a 120-kip lateral resultant located 8 ft from the left support of a 32-ft span. Treat it as a simply supported beam. What is the right reaction?

A. 40 kips

B. 90 kips

C. 30 kips

D. 120 kips

88. Why must collectors and drag struts be included explicitly in the seismic analysis when the diaphragm force path changes direction or width?

A. They exist only to support ceiling finishes

B. They transfer concentrated in-plane forces between diaphragm regions and vertical resisting elements

C. They remove the need for diaphragm chords

D. They eliminate all torsional response

89. A reinforced-concrete member is expected to form a ductile hinge during cyclic response. Why is dense transverse reinforcement placed through that region?

A. They remove all axial load in the stated seismic condition

B. They confine the core and restrain longitudinal-bar buckling during cyclic deformation

C. They replace longitudinal reinforcement for the structural system described under the earthquake case in the stem

D. They make development length unnecessary in the stated seismic condition

90. A ductile moment-frame design seeks to avoid a column-sway story mechanism during severe shaking. Which intended yielding hierarchy best supports that objective?

A. Force every beam to remain elastic in the stated seismic condition for the structural system described
B. Eliminate joint shear demand under the earthquake case in the stem in the stated seismic condition
C. Encourage inelastic hinging in beams rather than a story mechanism dominated by column failure
D. Make column foundations unnecessary for the structural system described under the earthquake case in the stem

91. Why must collector reinforcement be fully developed into the element receiving its force?

A. Development length controls paint adhesion in the stated seismic condition for the structural system described
B. Collectors carry no cyclic tension under the earthquake case in the stem in the stated seismic condition
C. Short anchorage always increases ductility for the structural system described under the earthquake case in the stem
D. The axial collector demand must enter the receiving element without premature bond or anchorage failure

92. A seismic steel connection includes welds designated for special inspection. What is the central quality-control objective?

A. Verify the specified weld procedure, materials, execution, and acceptance criteria are satisfied
B. Confirm the paint color matches in the stated seismic condition for the structural system described
C. Increase the connection mass under the earthquake case in the stem
D. Replace engineering review with inspection in the stated seismic condition for the structural system described

93. Why is cleaning a drilled hole important before installing an adhesive anchor?

A. Dust always increases friction capacity in the stated seismic condition for the structural system described
B. Dust can reduce bond between adhesive and concrete and lower reliable anchorage capacity
C. Cleaning makes the concrete stronger everywhere under the earthquake case in the stem

D. Hole cleaning removes seismic demand in the stated seismic condition for the structural system described

94. Why are hold-downs provided at the ends of many wood shear walls?

A. They transfer overturning tension and limit uplift at wall boundaries
B. They carry only ceiling dead load in the stated seismic condition
C. They eliminate panel shear for the structural system described
D. They determine the site coefficient under the earthquake case in the stem

95. Why is grout placement in reinforced masonry a seismic inspection concern?

A. Grout color controls ductility in the stated seismic condition for the structural system described
B. Grout eliminates the need for bars under the earthquake case in the stem
C. Voids or poor consolidation can interrupt composite force transfer around reinforcement
D. Inspection changes the earthquake duration in the stated seismic condition

96. What is the purpose of deformation-compatibility detailing for nonstructural components attached to a drifting structure?

A. Prevent the structure from drifting at all in the stated seismic condition
B. Increase component mass intentionally for the structural system described under the earthquake case in the stem
C. Make anchorage unnecessary in the stated seismic condition for the structural system described
D. Allow the component and attachments to accommodate structural movement without unintended failure

97. A contractor proposes moving a seismic brace attachment to a different beam because of field congestion. What should occur before acceptance?

A. Accept it if the brace looks straight in the stated seismic condition for the structural system described

B. Evaluate and approve the revised connection and supporting load path for the new location
C. Approve it based on paint condition under the earthquake case in the stem
D. Ignore the change if gravity loads are small in the stated seismic condition

98. Why is proper concrete consolidation especially important around congested seismic reinforcement?

A. Voids can reduce bond, confinement effectiveness, and local member capacity in critical regions
B. Consolidation increases earthquake duration in the stated seismic condition for the structural system described
C. Honeycombing improves ductility under the earthquake case in the stem in the stated seismic condition
D. Air pockets replace transverse reinforcement for the structural system described under the earthquake case in the stem

99. What is a key purpose of structural observation on a seismic project?

A. Replace every special inspection in the stated seismic condition for the structural system described
B. Guarantee no future earthquake damage under the earthquake case in the stem
C. Eliminate the need for construction documents in the stated seismic condition
D. Provide focused professional review of significant seismic construction and observed deviations

100. Why are continuity ties important where different structural regions meet in a seismic load path?

A. They increase architectural finish weight in the stated seismic condition for the structural system described
B. They eliminate all diaphragm deformation under the earthquake case in the stem in the stated seismic condition
C. They help transfer forces across interfaces so local separation does not interrupt structural continuity
D. They make foundations optional for the structural system described under the earthquake case in the stem

Practice Exam 10: Answer Key and Explanations

1. D — Applying the stated site coefficient gives SMS = 1.15(1.28g) = 1.472g. Dividing instead of multiplying, leaving Ss unchanged, or adding the two inputs does not follow the supplied definition. The distractors represent common setup, arithmetic, or ratio errors rather than the stated relationship. A quick magnitude check also supports the computed value and rules out the alternative choices.

2. A — The one-second maximum-considered ordinate is the product of the given site coefficient and mapped value: 1.70(0.46g) = 0.782g. The alternatives come from division or unrelated addition and therefore do not satisfy the stated equation. The distractors represent common setup, arithmetic, or ratio errors rather than the stated relationship. This is the governing relationship for the stated case.

3. C — Multiplying 1.32g by two-thirds gives SDS = 0.88g. One-half of the input, leaving the value unchanged, or multiplying by 1.5 are different operations and do not follow the stated design-spectrum conversion. The distractors represent common setup, arithmetic, or ratio errors rather than the stated relationship. A quick magnitude check also supports the computed value and rules out the alternative choices.

4. B — The design one-second ordinate equals two-thirds of the stated maximum-considered value, so SD1 = (2/3)(0.81g) = 0.54g. The other values result from halving, omitting the reduction, or increasing the value instead. The distractors represent common setup, arithmetic, or ratio errors rather than the stated relationship. A quick magnitude check also supports the computed value and rules out the alternative choices.

5. B — The transition period is the ratio 0.56/0.93 = 0.602 seconds, which rounds to 0.60 second. Multiplication, addition, or reversing the ratio produces the distractors and does not match the stated expression. The distractors represent common setup, arithmetic, or ratio errors rather than the stated relationship. A quick magnitude check also supports the computed value and rules out the alternative choices.

6. A — Applying the stated factor gives T0 = 0.2(0.75) = 0.15 second. The other choices come from halving, making no reduction, or dividing by 0.2, none of which follows the supplied spectrum relationship. The distractors represent common setup, arithmetic, or ratio errors rather than the stated relationship. Keeping units and the direction of each ratio consistent is essential in this calculation.

7. D — Regional hazard describes the incoming shaking environment, while local soil conditions can amplify or deamplify different frequency ranges before motion reaches the structure. Structural height, concrete strength, and roof loading affect building response, not the regional geologic hazard itself. The other choices describe different mechanisms and do not address the seismic behavior identified in the stem.

8. C — Loose saturated granular soils can develop excess pore pressure during cyclic shaking, reducing effective stress and leading to liquefaction, settlement, or lateral deformation. The other choices are unrelated environmental or serviceability effects rather than a direct consequence of the stated subsurface condition. The other choices describe different mechanisms and do not address the seismic behavior identified in the stem.

9. D — With stiffness unchanged, period varies with the square root of mass. Therefore TX/TY = sqrt(2.25) = 1.50. The distractors use the direct mass ratio, its reciprocal, or a different inverse relationship instead of the stated square-root dependence. The distractors represent common setup, arithmetic, or ratio errors rather than the stated relationship.

10. C — Parallel lateral elements undergo the same story displacement, so their stiffnesses add: 18 + 27 = 45 kips/in. Subtraction, averaging, or multiplication does not represent the force-displacement behavior of springs acting in parallel. The distractors represent common setup, arithmetic, or ratio errors rather than the stated relationship. This is the governing relationship for the stated case.

11. B — Additional damping dissipates more vibration energy per cycle and generally reduces peak dynamic response, especially near resonance. It does not automatically double mass, force the natural period to zero, or remove the need for adequate strength and deformation capacity. The other choices describe different mechanisms and do not address the seismic behavior identified in the stem.

12. A — Redundancy provides multiple effective paths for transferring earthquake forces, so local yielding or damage is less likely to cause disproportionate loss of system capacity. It does not eliminate drift, connections, or differences in element force caused by stiffness and geometry. The other choices describe different mechanisms and do not address the seismic behavior identified in the stem.

13. C — A large separation between centers of mass and rigidity creates torsional demand when lateral forces act through the mass center. The diaphragm can translate and rotate, increasing demands at some perimeter elements. The other choices do not describe this eccentric lateral response. The other choices describe different mechanisms and do not address the seismic behavior identified in the stem.

14. D — A pronounced stiffness discontinuity can concentrate deformation in the flexible story, producing large drift and inelastic demand before upper levels mobilize comparable deformation. It does not remove upper-story mass, stop foundation shaking, or force roof acceleration to vanish. The other choices describe different mechanisms and do not address the seismic behavior identified in the stem.

15. A — A dual system relies on multiple lateral-resisting subsystems participating in the response. Connections and diaphragms must transfer forces while allowing compatible deformations; otherwise the assumed combined system behavior may not develop. Independent motion or intentionally unloaded subsystems contradicts that premise. The other choices describe different mechanisms and do not address the seismic behavior identified in the stem.

16. B — Adjacent structures can have different periods, phases, and drift histories, so their maximum movements may occur toward each other. Adequate separation reduces pounding risk. It does not increase dead load, remove foundation pressure, or force the buildings to have identical dynamic properties. The other choices describe different mechanisms and do not address the seismic behavior identified in the stem.

17. D — Positive anchorage ties the masonry wall to the diaphragm so out-of-plane inertial forces can enter a continuous structural load path instead of separating the wall from the roof. Heavier finishes or partitions increase mass, while surface polishing does not improve structural continuity. The other choices describe different mechanisms and do not address the seismic behavior identified in the stem.

18. B — Tilt-up wall panels depend on roof-to-wall anchorage for out-of-plane support and force transfer. Weak ties can allow panels to separate or lose support during cyclic motion. The other choices do not reflect the critical anchorage vulnerability described in the stem. The other choices describe different mechanisms and do not address the seismic behavior identified in the stem.

19. C — Precast seismic performance depends heavily on connections transferring cyclic forces and accommodating deformation. A brittle connection can fail before the adjoining members develop their intended strength or ductility, abruptly breaking the load path. Precast members still have mass, carry compression, and may transfer lateral forces. That distinction becomes important under repeated earthquake reversals, when weak links can govern overall performance.

20. A — An open parking level can create a weak or soft story where drift concentrates. Adding or strengthening frames, walls, collectors, and foundations at that level improves stiffness, strength, and continuity. Finish changes, reduced lighting, or removing roof sheathing do not address the lateral weakness. That distinction becomes important under repeated earthquake reversals, when weak links can govern overall performance.

21. A — Post-earthquake evaluation focuses on whether observed damage has compromised the structural load path, stability, or capacity for aftershocks and ordinary loads. Continued standing does not prove adequate residual capacity, and cosmetic or utility conditions cannot substitute for structural assessment. The other choices describe different mechanisms and do not address the seismic behavior identified in the stem.

22. D — A useful retrofit shifts the governing behavior away from brittle shear failure by improving shear strength, confinement, and deformation capacity. Reducing transverse reinforcement or weakening splices would worsen the problem, while adding mass without strength generally increases seismic demand rather than ductility. The other choices describe different mechanisms and do not address the seismic behavior identified in the stem.

23. C — Effective seismic weight for this simplified problem is the sum of the two stated contributors: 1,420 + 80 = 1,500 kips. Subtraction, omitting the attached equipment, or adding it twice leads to the distractors. The distractors represent common setup, arithmetic, or ratio errors rather than the stated relationship. This is the governing relationship for the stated case.

24. B — The stated coefficient is 0.90 divided by 6/1.0, giving Cs = 0.15. The alternatives come from reversing the ratio, leaving SDS unchanged, or multiplying by R rather than dividing by the response-modification factor. The distractors represent common setup, arithmetic, or ratio errors rather than the stated relationship. This is the governing relationship for the stated case.

25. D — Base shear follows V = CsW for the supplied practice relationship. Multiplying 0.12 by 2,750 gives 330 kips. The other choices result from dividing, omitting the coefficient, or reversing the relationship. The distractors represent common setup, arithmetic, or ratio errors rather than the stated relationship. A quick magnitude check also supports the computed value and rules out the alternative choices.

26. A — The first expression is 0.044(0.80)(1.25) = 0.044, which is greater than the stated lower bound of 0.01. Therefore 0.044 governs. The other values represent the minimum, an omitted importance factor, or a different coefficient. The distractors represent common setup, arithmetic, or ratio errors rather than the stated relationship. This is the governing relationship for the stated case.

27. C — The specified interpolation interval is two seconds wide, and T = 1.5 seconds is halfway between 0.5 and 2.5 seconds. Therefore k is halfway between 1 and 2, giving 1.50. The other choices place the period at a different fraction of the interval. The distractors represent common setup, arithmetic, or ratio errors rather than the stated relationship.

28. B — For k = 1, the upper contribution is wh = 150(24) = 3,600, while the lower contribution is 100(12) = 1,200. The upper fraction is 3,600/(4,800) = 0.75. The distractors come from weight-only or incorrect normalization. The distractors represent common setup, arithmetic, or ratio errors rather than the stated relationship.

29. D — Story shear at a level equals the sum of lateral forces at that level and all levels above. Just below the second floor, the 55-kip and 70-kip forces contribute, giving 125 kips. Including the first-floor force gives the base shear instead. The distractors represent common setup, arithmetic, or ratio errors rather than the stated relationship.

30. C — The moment about the base is force times perpendicular height: 90 kips times 36 ft equals 3,240 kip-ft. Dividing, adding, or using an unrelated multiplier does not satisfy static moment equilibrium. The distractors represent common setup, arithmetic, or ratio errors rather than the stated relationship. A quick magnitude check also supports the computed value and rules out the alternative choices.

31. A — Average unit shear is total diaphragm shear divided by the resisting width: 180/60 = 3.0 kips per foot. The other choices reverse the ratio, repeat the width, or multiply the quantities instead of distributing force along the diaphragm. The distractors represent common setup, arithmetic, or ratio errors rather than the stated relationship.

32. B — Substituting the stated values gives F = 0.4(1.0)(1.0)(75) = 30 kips. The alternatives arise from dividing by the coefficient, omitting it, or applying an unrelated factor instead of the provided anchorage-force relationship. The distractors represent common setup, arithmetic, or ratio errors rather than the stated relationship. Keeping units and the direction of each ratio consistent is essential in this calculation.

33. A — For a one-foot strip of wall, tributary area is 14 square feet. Multiplying 18 psf by 14 ft gives 252 pounds per foot of wall length. Dividing by height or simply repeating the pressure does not convert area pressure to line force. The distractors represent common setup, arithmetic, or ratio errors rather than the stated relationship.

34. D — Torsional moment equals the lateral force times the eccentricity, so 160(7) = 1,120 kip-ft. The other values come from division, addition, or an extra factor of two and do not satisfy moment equilibrium. The distractors represent common setup, arithmetic, or ratio errors rather than the stated relationship. This is the governing relationship for the stated case.

35. C — The eccentricity ratio is 4/50 = 0.08, or 8 percent of the diaphragm width. The distractors use the raw distance as a percent, reverse the ratio, or apply an unrelated multiple. The distractors represent common setup, arithmetic, or ratio errors rather than the stated relationship. A quick magnitude check also supports the computed value and rules out the alternative choices.

36. B — Substitution gives Ta = 0.02(64^0.75) = approximately 0.45 second. The distractors reflect using the exponent incorrectly, applying a linear height relation, or omitting the coefficient. The stated empirical expression controls this practice calculation. The distractors represent common setup, arithmetic, or ratio errors rather than the stated relationship. This is the governing relationship for the stated case.

37. C — The capped comparison period is obtained by multiplying the approximate period by the given coefficient: 1.4(0.72) = 1.008 seconds. Dividing, leaving the period unchanged, or adding the values does not follow the supplied limit expression. The distractors represent common setup, arithmetic, or ratio errors rather than the stated relationship. This is the governing relationship for the stated case.

38. D — Using V = CsW gives 0.11(4,200) = 462 kips. Dividing by weight, treating 0.11 as 10 percent without calculation, or adding the inputs produces the distractors rather than the required base shear. The distractors represent common setup, arithmetic, or ratio errors rather than the stated relationship. Keeping units and the direction of each ratio consistent is essential in this calculation.

39. A — Applying the stated combination gives 120 + 0.30(70) = 141 kips. The other values come from subtracting the secondary component, applying 30 percent to the wrong term, or adding the full two directional effects. The distractors represent common setup, arithmetic, or ratio errors rather than the stated relationship. This is the governing relationship for the stated case.

40. B — Equal sharing among four identical collectors gives 96/4 = 24 kips per collector. Multiplying by four, dividing by the force, or assigning half the total does not match the stated equal distribution assumption. The distractors represent common setup, arithmetic, or ratio errors rather than the stated relationship. This is the governing relationship for the stated case.

41. A — A tension-compression chord couple separated by 80 ft must provide 2,400 kip-ft, so the force magnitude is M/d = 2,400/80 = 30 kips. The distractors reverse the ratio or multiply quantities that should be divided. The distractors represent common setup, arithmetic, or ratio errors rather than the stated relationship. This is the governing relationship for the stated case.

42. C — The base must collect the lateral forces from all four levels, so V = 35 + 45 + 65 + 85 = 230 kips. The alternatives omit one or more floors or report only the roof force rather than the total. The distractors represent common setup, arithmetic, or ratio errors rather than the stated relationship.

43. B — Story drift is the relative lateral displacement between adjacent floors. Subtracting 1.2 from 1.9 gives 0.7 inch. Dividing the displacements, reporting one absolute displacement, or adding them does not represent interstory drift. The distractors represent common setup, arithmetic, or ratio errors rather than the stated relationship. Keeping units and the direction of each ratio consistent is essential in this calculation.

44. D — The amplification ratio is Cd/Ie = 5/1.25 = 4. Multiplying the elastic displacement by four gives 3.2 inches. The distractors use the inverse ratio, only the importance factor, or the deflection amplification factor without division. The distractors represent common setup, arithmetic, or ratio errors rather than the stated relationship. This is the governing relationship for the stated case.

45. A — Under the stated conservative rule, the required separation is the sum of the two absolute displacements: 2.4 + 1.7 = 4.1 inches. Subtraction or averaging does not represent the supplied requirement; 4.08 reflects an unrelated root-sum-square combination. The distractors represent common setup, arithmetic, or ratio errors rather than the stated relationship.

46. D — Convert the story height to 144 inches, then divide drift by height: 1.44/144 = 0.01, or 1.0 percent. The other values result from inconsistent units or treating the displacement directly as a percentage. The distractors represent common setup, arithmetic, or ratio errors rather than the stated relationship. This is the governing relationship for the stated case.

47. C — The average line demand is total transferred force divided by resisting length: 150/50 = 3.0 kips per foot. The other choices reverse the ratio, repeat the length, or multiply force and length instead of distributing the force. The distractors represent common setup, arithmetic, or ratio errors rather than the stated relationship.

48. B — Collector force equals the distributed shear transferred across the stated tributary width: 3.5(22) = 77 kips. Division, addition, or applying an extra factor of two does not represent the force accumulated into the collector. The distractors represent common setup, arithmetic, or ratio errors rather than the stated relationship. This is the governing relationship for the stated case.

49. C — The base term is 0.4(1.0)(0.9)(4)/(2.5/1.0) = 0.576 kip. The height factor at z/h = 0.5 is 2.0, so the resulting component force is 1.152 kips. The distractors omit the height factor, omit the 0.4 coefficient, or apply both relationships incorrectly. Keeping each factor in the supplied sequence avoids a common setup error.

50. A — Substituting z/h = 0.75 gives 1 + 2(0.75) = 2.5. The other choices omit the leading one, use z/h directly, or double the entire expression rather than only the height ratio term. The distractors represent common setup, arithmetic, or ratio errors rather than the stated relationship. Keeping units and the direction of each ratio consistent is essential in this calculation.

51. D — Equal load sharing gives 900/4 = 225 pounds per anchor. The component weight is not the force being distributed in this simplified problem, and multiplying or assigning half the total does not follow the stated four-anchor assumption. The distractors represent common setup, arithmetic, or ratio errors rather than the stated relationship.

52. B — Using the supplied relationship V = CsW gives 0.18(620) = 111.6 kips. The alternatives come from division, using 0.20 instead of the stated coefficient, or reversing the multiplication relationship. The distractors represent common setup, arithmetic, or ratio errors rather than the stated relationship. A quick magnitude check also supports the computed value and rules out the alternative choices.

53. B — A rigid component may deform little relative to its supports, yet its mass still develops inertial force when the supporting floor accelerates. Strong attachment can transmit that acceleration efficiently. Small deformation therefore does not imply zero force, and rigid equipment still has mass. The other choices describe different mechanisms and do not address the seismic behavior identified in the stem.

54. A — Structures on opposite sides of a separation joint can move differently during an earthquake. Flexible couplings permit that relative displacement while maintaining the intended piping function and reducing concentrated strain. They do not increase dead load as a design goal, eliminate supports, or remove internal pressure. This is the governing relationship for the stated case.

55. C — Seismic bracing helps control ceiling movement, maintain attachment, and reduce the chance that ceiling components become dislodged as the supporting structure accelerates. It does not transfer foundation overturning, change geotechnical site class, or intentionally increase inertial mass. The other choices describe different mechanisms and do not address the seismic behavior identified in the stem.

56. D — Tank response can include an impulsive portion moving with the container and a convective portion associated with free-surface sloshing. These components can have different periods and demands. Treating all liquid as rigid, ignoring inertia, or attributing sloshing only to wind misses important earthquake behavior. That distinction becomes important under repeated earthquake reversals, when weak links can govern overall performance.

57. A — Continued operation depends not only on the component body but also on anchorage, bracing, utility connections, and compatible movement with the structure. These supporting details must remain functional under seismic demand. Appearance, ignoring mass, or indiscriminately disconnecting utilities does not achieve that objective. The other choices describe different mechanisms and do not address the seismic behavior identified in the stem.

58. D — The supported weight is the line weight multiplied by the braced segment length: 40 lb/ft times 25 ft = 1,000 lb. Dividing the quantities or adding them does not convert a distributed weight into the total tributary weight. The distractors represent common setup, arithmetic, or ratio errors rather than the stated relationship.

59. B — Equal sharing among six identical braces gives 3.6/6 = 0.60 kip per brace. The alternatives reverse the ratio, divide by two, or multiply by six rather than distributing the total force. The distractors represent common setup, arithmetic, or ratio errors rather than the stated relationship. A quick magnitude check also supports the computed value and rules out the alternative choices.

60. C — Substituting the stated values gives 1.6(0.75)(1.0)(2.5) = 3.0 kips. The distractors omit a factor or use a different multiplier rather than the cap expression provided in the question. The distractors represent common setup, arithmetic, or ratio errors rather than the stated relationship. A quick magnitude check also supports the computed value and rules out the alternative choices.

61. A — The simplified inertial force is coefficient times tributary weight: 0.50(12) = 6 kips. The other choices reverse the ratio, omit the coefficient, or double the total rather than applying the stated horizontal coefficient. The distractors represent common setup, arithmetic, or ratio errors rather than the stated relationship. This is the governing relationship for the stated case.

62. D — An anchor can only develop useful seismic resistance if the supporting concrete, deck, beam, or framing can accept and transfer its forces. Local breakout, bending, or weak support connections can govern even when the fastener itself is strong. The other choices ignore the structural load path. This is the governing relationship for the stated case.

63. B — Direct shear under compatible diaphragm translation distributes in proportion to stiffness. The total stiffness is 90, so the 60-unit frame receives 60/90 of 180 = 120 kips. Equal sharing would ignore the stated stiffness difference. A defensible seismic model must represent the mass, stiffness, force path, and deformation mechanism that materially control the response.

64. D — The total stiffness is 10 relative units. The 5-unit frame therefore receives 5/10 of 250 kips, or 125 kips. The distractors correspond to the other stiffness fractions or an incorrect residual force. A defensible seismic model must represent the mass, stiffness, force path, and deformation mechanism that materially control the response.

65. C — The stiffness-weighted coordinate is (20(0)+40(30))/(20+40) = 20 ft. A simple geometric midpoint would ignore the unequal stiffnesses. The center of rigidity shifts toward the stiffer wall because it attracts more direct shear for a common diaphragm translation. A defensible seismic model must represent the mass, stiffness, force path, and deformation mechanism that materially control the response.

66. A — Static eccentricity is the distance between the two centers, so |28 - 22| = 6 ft. Reporting one coordinate, adding the coordinates, or halving the separation does not represent the actual offset that generates torsional moment. A defensible seismic model must represent the mass, stiffness, force path, and deformation mechanism that materially control the response.

67. B — The torsional moment is Ve = 200(6) = 1,200 kip-ft. Division, addition, or applying an extra factor of two does not satisfy moment equilibrium for the stated eccentric force. A defensible seismic model must represent the mass, stiffness, force path, and deformation mechanism that materially control the response. This is the governing relationship for the stated case.

68. C — The denominator is 1(20^2)+1(20^2)=800. For either frame, Vi = 800(1)(20)/800 = 20 kips. Equal and opposite frame shears create the required torsional couple while preserving zero net translational force from torsion alone. A defensible seismic model must represent the mass, stiffness, force path, and deformation mechanism that materially control the response.

69. A — For a uniformly loaded simply supported diaphragm strip, the two end reactions are equal and sum to the 72-kip total. Each therefore carries 36 kips. The other choices confuse unit load, third-point sharing, or the total force with one support reaction. A defensible seismic model must represent the mass, stiffness, force path, and deformation mechanism that materially control the response.

70. C — The chord couple resists the in-plane moment, so force equals M/d = 1,680/56 = 30 kips. The other values reverse the ratio, report the spacing, or divide by an unrelated factor instead of using moment equilibrium. A defensible seismic model must represent the mass, stiffness, force path, and deformation mechanism that materially control the response.

71. B — The collector accumulates the distributed diaphragm force over its tributary width: 2.8(30) = 84 kips. Division, addition, or doubling the product does not represent the stated force-collection mechanism. A defensible seismic model must represent the mass, stiffness, force path, and deformation mechanism that materially control the response. This is the governing relationship for the stated case.

72. D — Stiffness is force divided by displacement, giving 96/0.8 = 120 kips per inch. Multiplying the quantities, simply repeating force, or reversing the units does not represent the force-deflection stiffness defined in the question. A defensible seismic model must represent the mass, stiffness, force path, and deformation mechanism that materially control the response.

73. C — Substituting into the stated expression gives delta = 12(10^3)/(3(1000)(2)) = 2.0 in the consistent displacement unit. The alternatives arise from omitting a factor, using L instead of L cubed, or misplacing the denominator. A defensible seismic model must represent the mass, stiffness, force path, and deformation mechanism that materially control the response.

74. A — Parallel elements experience compatible translation, so their resisting forces add for a common displacement. The combined stiffness is therefore 35 + 25 = 60 kips/in. Difference, harmonic-style averaging, or multiplication do not represent parallel lateral action. A defensible seismic model must represent the mass, stiffness, force path, and deformation mechanism that materially control the response.

75. B — Using the stated secant relationship gives k = 150/1.25 = 120 kips per inch. Adding or multiplying the two quantities, or moving the decimal by two places, does not describe story shear divided by drift. A defensible seismic model must represent the mass, stiffness, force path, and deformation mechanism that materially control the response.

76. D — The mass-weighted coordinate is (40(10)+60(30))/(40+60) = 22 ft. The geometric midpoint would ignore the unequal masses, while the other choices use incorrect weighting. The center shifts toward the heavier mass at x = 30 ft. A defensible seismic model must represent the mass, stiffness, force path, and deformation mechanism that materially control the response.

77. B — Five percent of 64 ft is 0.05(64) = 3.2 ft. The distractors move the decimal incorrectly, substitute five feet for five percent, or use twenty percent rather than the stated accidental eccentricity percentage. A defensible seismic model must represent the mass, stiffness, force path, and deformation mechanism that materially control the response.

78. A — The total eccentricity for this stated case is 4 + 3 = 7 ft. Multiplying the 150-kip floor shear by 7 ft gives 1,050 kip-ft. Using only one eccentricity or doubling the total produces the distractors. A defensible seismic model must represent the mass, stiffness, force path, and deformation mechanism that materially control the response.

79. C — Keeping displacement and story height in the same units gives theta = 900(1.5)/(180(144)) = 0.0521. The other values result from decimal errors, doubling, or omitting the story-height term from the denominator. A defensible seismic model must represent the mass, stiffness, force path, and deformation mechanism that materially control the response.

80. D — The story height is 156 inches. Dividing 1.95 by 156 gives 0.0125, or 1.25 percent. The distractors result from decimal movement, using the foot height without unit conversion, or treating the displacement as a direct percentage. A defensible seismic model must represent the mass, stiffness, force path, and deformation mechanism that materially control the response.

81. A — The square-root-sum-of-squares combination is sqrt(80^2 + 60^2) = sqrt(10,000) = 100 kips. Arithmetic averaging or direct addition does not represent SRSS, while 4,900 is unrelated to the required square-root operation. A defensible seismic model must represent the mass, stiffness, force path, and deformation mechanism that materially control the response. This is the governing relationship for the stated case.

82. D — Closely spaced modes can have correlated peak responses, so a method that includes modal correlation can better represent their combined effect. SRSS assumes a degree of independence that may be less appropriate in that situation. Close modes still have mass participation, mode shapes can differ, and damping remains relevant. This is the governing relationship for the stated case.

83. B — A dynamic model can produce a lower total response than a prescribed reference level because of modeling, period, or modal effects. Scaling preserves the dynamic distribution while ensuring the overall force level is not below the intended benchmark. It does not alter all periods, remove torsion, or rigidize floors. This is the governing relationship for the stated case.

84. C — A rigid-diaphragm idealization is appropriate when in-plane diaphragm deformation is small relative to the deformation of the vertical resisting elements, allowing floor points to move compatibly as a rigid body. Architectural area, absence of gravity load, or uniform thickness alone does not establish that behavior. That distinction becomes important under repeated earthquake reversals, when weak links can govern overall performance.

85. A — The resultant of a triangular load equals one-half the base times the peak intensity: 0.5(30)(6) = 90 kips. Using the full rectangle, reporting the span, or multiplying without the one-half factor gives the distractors. A defensible seismic model must represent the mass, stiffness, force path, and deformation mechanism that materially control the response.

86. D — The centroid of a right triangular load lies two-thirds of the base length from the zero-intensity end. For a 30-ft span, that location is 20 ft. One-third from the zero end, the midpoint, or the far end do not match the triangle centroid. The alternative choices omit or misapply an equilibrium, stiffness, or compatibility relationship needed for the stated analysis.

87. C — Taking moments about the left support gives Rright(32) = 120(8), so Rright = 30 kips. The left reaction is then 90 kips. The other choices either swap reactions, assume equal sharing, or assign the full load to one support. A defensible seismic model must represent the mass, stiffness, force path, and deformation mechanism that materially control the response.

88. B — Collectors and drag struts gather and deliver diaphragm forces where geometry, openings, or resisting-element locations prevent simple direct transfer. Their axial forces can be critical to continuity. They do not serve only finishes, replace chord action, or eliminate torsion from the overall response. The other choices describe different mechanisms and do not address the seismic behavior identified in the stem.

89. B — Closely spaced transverse reinforcement confines the concrete core and braces longitudinal bars against buckling as cyclic strains reverse. That helps the member sustain ductile inelastic deformation after cracking and yielding. Ties do not eliminate axial force, replace longitudinal bars, or remove anchorage requirements. A field deviation can change strength, stiffness, anchorage, or deformation capacity and therefore requires evaluation before acceptance.

90. C — Preferential beam hinging can spread ductile inelastic action through the frame while reducing the chance of a column-sway mechanism that threatens story stability. The philosophy does not require every beam to remain elastic, eliminate joint forces, or remove foundation demands. Seismic quality control focuses on whether the intended load path and ductile detailing were actually constructed as designed.

91. D — Collectors can carry substantial cyclic axial force, so reinforcement must be developed sufficiently to transfer that demand into walls, frames, or diaphragms. Inadequate anchorage can fail before the intended structural mechanism develops. Development length is unrelated to finishes and does not become safer simply by being shorter. This is the governing relationship for the stated case.

92. A — Special inspection is intended to confirm that critical welding is performed with the approved procedure, qualified personnel, proper materials, and required acceptance checks so the intended connection behavior can develop. It does not concern finish color, intentionally add mass, or substitute for engineering responsibility. Inspection should concentrate on details that govern cyclic force transfer rather than appearance alone.

93. B — Adhesive-anchor performance depends on proper contact between the adhesive and sound concrete. Residual drilling dust can interfere with bond and make the installed capacity unreliable. Cleaning therefore supports the intended anchorage mechanism; it does not strengthen the entire member or reduce the earthquake force itself. Inspection should concentrate on details that govern cyclic force transfer rather than appearance alone.

94. A — Lateral shear produces an overturning couple with tension at one wall end and compression at the other. Hold-downs create the tension load path into the foundation or supporting element and control uplift. They do not carry only ceiling load, remove panel shear, or set geotechnical coefficients. Inspection should concentrate on details that govern cyclic force transfer rather than appearance alone.

95. C — Reinforced masonry relies on grout surrounding reinforcement and filling required cells so forces transfer through the intended composite section. Voids or poor consolidation can reduce bond and capacity. Grout does not replace reinforcement, appearance does not govern ductility, and inspection cannot change the earthquake itself. Inspection should concentrate on details that govern cyclic force transfer rather than appearance alone.

96. D — Structural floors and walls can undergo significant relative displacement during earthquakes. Nonstructural components, joints, and attachments must accommodate that movement without brittle damage, loss of support, or hazardous interaction. Compatibility detailing does not stop structural drift, increase mass as a goal, or eliminate anchorage requirements. Inspection should concentrate on details that govern cyclic force transfer rather than appearance alone.

97. B — Changing a seismic attachment point can alter local member demand, connection capacity, stiffness, and the route by which force reaches the primary structure. The revised detail therefore requires engineering evaluation and approval. Appearance or low gravity demand cannot establish seismic adequacy. Seismic quality control focuses on whether the intended load path and ductile detailing were actually constructed as designed.

98. A — Congested reinforcement can obstruct concrete flow, making voids and honeycombing more likely around bars and joints. Proper consolidation helps achieve the intended bond, confinement, and section integrity. Voids do not improve ductility, replace ties, or affect how long the earthquake lasts. Seismic quality control focuses on whether the intended load path and ductile detailing were actually constructed as designed.

99. D — Structural observation provides the design professional with focused opportunities to assess whether significant seismic construction generally conforms to the design intent and to identify important deviations requiring resolution. It does not replace all required inspections, guarantee future performance, or make approved documents unnecessary. A field deviation can change strength, stiffness, anchorage, or deformation capacity and therefore requires evaluation before acceptance.

100. C — Seismic inertia must travel through connected structural regions to the foundations. Continuity ties provide force transfer across interfaces that might otherwise separate or lose load-path integrity during cyclic motion. They do not remove diaphragm deformation, increase finish weight as an objective, or eliminate foundation requirements. Inspection should concentrate on details that govern cyclic force transfer rather than appearance alone.