PRACTICE EXAM 14: 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. A trial site spectrum uses SMS = FaSs. If Ss = 1.05g and Fa = 1.18, what site-modified short-period value is obtained?

A. 0.890g
B. 1.050g
C. 1.239g
D. 2.230g

2. For a one-second site adjustment, take SM1 = FvS1. With Fv = 1.48 and S1 = 0.58g, determine SM1 to three decimals.

A. 0.392g
B. 0.858g
C. 1.060g
D. 2.060g

3. An exercise defines SDS = (2/3)SMS. If SMS = 1.26g, which design spectral value follows?

A. 0.84g
B. 0.63g
C. 1.26g

D. 1.89g

4. A spectra worksheet lists SD1 = 0.62g and SDS = 0.84g. The transition corner is found by dividing the one-second ordinate by the short-period ordinate. Select the resulting period to three decimals.

A. 0.521 s
B. 1.355 s
C. 1.460 s
D. 0.738 s

5. A spectrum sketch sets T0 equal to 20 percent of Ts. If Ts = 0.738 s, what value should be used for T0?

A. 0.369 s
B. 0.738 s
C. 3.690 s
D. 0.148 s

6. A borings log shows loose saturated sand extending below a shallow groundwater table. Which earthquake-related site hazard should receive special attention?

A. Rock-slope toppling failure
B. Loss of soil strength from liquefaction
C. Shrinkage of dry clay
D. Thermal expansion of fill

7. Two buildings share the same site and structural system, but one must remain operational after a major earthquake. Why can their seismic design requirements differ?

A. Exterior finish determines site class
B. Window area changes mapped hazard

C. Occupancy consequences can place them in different risk categories
D. Concrete slump defines spectral shape

8. What is the main distinction between mapped seismic hazard values and site-modified spectral values used in design?

A. Site-modified values incorporate local soil response effects
B. Mapped values already include every soil layer
C. Site modification changes only dead load
D. Mapped values depend on building color

9. Two one-story models have equal mass. Model A is 2.25 times as stiff laterally as Model B. Using T proportional to sqrt(m/k), what is TA/TB?

A. 0.667
B. 0.444
C. 1.500
D. 2.250

10. Four resisting lines act in parallel at one level with lateral stiffnesses of 12, 18, 25, and 35 kips/in. What is the story stiffness?

A. 45 kips/in
B. 78 kips/in
C. 90 kips/in
D. 189,000 kips/in

11. The effective mass of a vibration model is increased to 144 percent of its original value while lateral stiffness is unchanged. What multiplier applies to the natural period?

A. 0.69

B. 1.20
C. 1.44
D. 2.07

12. Two otherwise identical systems vibrate near resonance, but one has substantially greater viscous damping. What response change is generally expected?

A. Natural period becomes zero
B. Seismic mass becomes larger
C. All strength demand disappears
D. Smaller resonant amplification and lower peak response

13. A lateral system uses several effective frames or walls instead of one indispensable resisting line. What seismic advantage does this arrangement provide?

A. Several load paths reduce reliance on a single critical element
B. It guarantees zero structural damage
C. It removes the need for ductility
D. It prevents all torsional response

14. At one level of a multistory building, lateral stiffness drops sharply while the levels above and below remain much stiffer. Where will deformation demand tend to localize?

A. Uniform drift at every level
B. Large interstory drift and local deformation demand
C. Only vertical acceleration response
D. Reduced deformation at the weak story

15. A floor mass center is significantly offset from the center of lateral rigidity. What additional response accompanies the overall translation?

A. Only vertical settlement
B. Uniform axial shortening
C. Torsional rotation about the vertical axis
D. Elimination of story shear

16. Why is seismic separation between adjacent buildings sometimes required?

A. To increase shared foundation load
B. To make both buildings rigid
C. To eliminate diaphragm shear
D. To reduce pounding when neighboring structures drift differently

17. An older unreinforced masonry building has heavy parapets and weak roof-to-wall ties. Which failure mechanism is a major life-safety concern?

A. Yielding of ductile steel links
B. Buckling of reinforced shear panels
C. Elastic shortening of floor joists
D. Out-of-plane wall or parapet separation

18. A precast parking structure uses shallow bearing seats with limited positive ties between members. What seismic vulnerability should be investigated first?

A. Excessive shrinkage of paint
B. Thermal expansion of roof drains
C. Loss of support from relative movement at the bearings
D. Yielding of wood shear panels

19. An existing flat-plate concrete building has little slab-column shear reinforcement. Which brittle response is especially important during lateral drift?

A. Punching shear failure around columns
B. Ductile brace yielding
C. Wood nail slip
D. Rocking of isolated footings only

20. A tilt-up warehouse has heavy wall panels but weak roof-to-wall connections. Which retrofit most directly addresses the principal vulnerability?

A. Add heavier roof finishes
B. Improve positive roof-to-wall anchorage
C. Reduce all wall thicknesses
D. Remove diaphragm collectors

21. After an earthquake, an existing building shows permanent story drift, fractured braces, and crushed column regions. What is the appropriate safety perspective?

A. Assume the building is safe if doors open
B. Treat the damage as potentially serious until evaluated by qualified professionals
C. Ignore damage that is not visible outside
D. Reoccupy immediately because shaking stopped

22. A soft-story retrofit adds very stiff shear walls at the open first level. What system effect must be checked in addition to wall strength?

A. Redistribution of forces into collectors, foundations, and adjacent elements
B. Automatic reduction of all foundation loads
C. Elimination of upper-story inertia
D. Removal of every torsional effect

23. During a preliminary equivalent-lateral-force check, the seismic coefficient is 0.084 and the effective seismic weight is 8,750 kips. Multiplying those two quantities gives what base reaction?

A. 625 kips
B. 875 kips
C. 735 kips
D. 1,470 kips

24. A four-level idealization has equal floor weights and heights 12, 24, 36, and 48 ft. With k = 1 and V = 500 kips, what lateral force goes to the roof?

A. 125 kips
B. 150 kips
C. 250 kips
D. 200 kips

25. Assigned floor forces are 55, 80, 105, and 130 kips from the first elevated level through the roof. What base shear do they represent?

A. 315 kips
B. 425 kips
C. 370 kips
D. 480 kips

26. A 290-kip lateral inertia force acts 42 ft above the foundation. What overturning moment does this single force create at the base?

A. 6,090 kip-ft
B. 13,920 kip-ft
C. 24,360 kip-ft
D. 12,180 kip-ft

27. A 15-ft story undergoes 2.25 in of relative lateral displacement. What is the story drift ratio?

A. 1.25%
B. 0.83%
C. 1.50%
D. 2.25%

28. Two walls at one story have stiffnesses of 45 and 75 kips/in. If a rigid diaphragm delivers 480 kips of direct shear and torsion is ignored, how much goes to the stiffer wall?

A. 180 kips
B. 300 kips
C. 240 kips
D. 360 kips

29. A pair of wall resultants 30 ft apart must resist 18,000 kip-ft of overturning. What magnitude of vertical couple force is required?

A. 600 kips
B. 300 kips
C. 900 kips
D. 1,200 kips

30. A collector transfers 224 kips into a wall through four identical parallel elements. If they share equally, what axial demand acts in each element?

A. 44 kips
B. 72 kips
C. 112 kips
D. 56 kips

31. One active diagonal brace resists 336 kips of horizontal story shear. If cos(theta) = 0.84 and horizontal resistance is P cos(theta), what brace axial force is required?

A. 282 kips
B. 400 kips
C. 336 kips
D. 480 kips

32. A one-bay moment frame carries 210 kips of story shear over a 15-ft story. If equal and opposite column axial forces 21 ft apart resist the overturning, what is each axial force?

A. 100 kips
B. 210 kips
C. 150 kips
D. 315 kips

33. For a ductile moment-frame design, why is it preferable for beam hinging to occur before a story-wide column mechanism develops?

A. It forces every column to remain elastic forever
B. It encourages yielding in beams rather than a story-level column mechanism
C. It removes the need for connection design
D. It eliminates all residual drift

34. Why can heavily stressed reinforced-concrete wall boundary regions require special confinement?

A. Confine wall boundary concrete under cyclic compression
B. Boundary ties reduce mapped hazard
C. Confinement removes wall shear demand
D. It changes the building risk category

35. A coupling beam between two wall piers is intentionally detailed to yield. Which behavior is generally preferred?

A. Brittle diagonal fracture at first yield
B. Loss of gravity support before wall action
C. Zero deformation under design shaking
D. Stable ductile cyclic yielding with controlled damage

36. At one edge of a foundation, six identical tension devices are available to resist a total seismic uplift demand of 624 kips. Under equal sharing, what is the demand per device?

A. 78 kips
B. 124 kips
C. 104 kips
D. 312 kips

37. A shear wall has overturning moment 14,280 kip-ft and a 28-ft separation between tension and compression resultants. What vertical force forms the idealized couple?

A. 510 kips
B. 255 kips
C. 714 kips
D. 1,020 kips

38. Why is a transfer level critical when an upper shear wall terminates on a deep girder instead of continuing to the foundation?

A. The wall no longer develops inertia
B. Gravity loads disappear at the transfer
C. Torsion is automatically eliminated
D. Redirect concentrated forces through the transfer path

39. A transfer beam receives 456 kips from an upper wall and distributes the force equally to three lower resisting elements. What force is assigned to each?

A. 114 kips
B. 152 kips
C. 228 kips
D. 304 kips

40. Three wall lines have stiffness proportions 25:35:40 and share 600 kips of direct shear through a rigid diaphragm. How much goes to the 35-part line?

A. 150 kips
B. 240 kips
C. 210 kips
D. 350 kips

41. A story force-deflection model has k = 105 kips/in. When the lateral shear reaches 630 kips, what translation corresponds to the linear relation Delta = V/k?

A. 4.0 in
B. 5.0 in
C. 7.5 in
D. 6.0 in

42. A drift calculation produces an elastic relative displacement of 0.64 in. The stated amplification multiplier for this exercise is 5.0. What design-level displacement follows?

A. 0.128 in
B. 0.64 in
C. 3.20 in
D. 5.64 in

43. Between two consecutive floors separated by 156 in vertically, the relative horizontal movement is 1.95 in. Express this movement as a percent drift ratio.

A. 0.80%
B. 1.25%
C. 1.50%
D. 1.95%

44. For P = 4,200 kips, Delta = 1.6 in, V = 560 kips, and h = 150 in, evaluate theta = PDelta/(Vh) to three decimals.

A. 0.080
B. 0.040
C. 0.120
D. 0.800

45. For a rectangular wall pier with clear height 21 ft and plan length 8.4 ft, determine the slenderness measure h/l used in this exercise.

A. 2.50
B. 1.25
C. 3.40
D. 4.20

46. A diagonal brace has axial stiffness 600 kips/in and cos(theta) = 0.75. Using kx = kaxial cos^2(theta), what horizontal stiffness results?

A. 225.0 kips/in
B. 337.5 kips/in
C. 450.0 kips/in
D. 800.0 kips/in

47. A lateral floor resultant of 420 kips misses the rigidity center by 5.5 ft in plan. Determine the moment about the vertical axis caused by this offset.

A. 1,155 kip-ft
B. 2,100 kip-ft
C. 4,620 kip-ft
D. 2,310 kip-ft

48. A 6,160 kip-ft torsional demand is represented by equal and opposite edge shears acting on frames separated by 56 ft. What magnitude of edge shear completes the couple?

A. 55 kips
B. 154 kips
C. 110 kips
D. 220 kips

49. An equipment anchorage check specifies Fp = 0.38W. If the unit weighs 24 kips, what horizontal seismic force is used?

A. 9.12 kips
B. 6.32 kips
C. 12.00 kips
D. 15.20 kips

50. The horizontal earthquake force on a roof-mounted fan is 11.5 kips, and its line of action is 4.5 ft above the mounting plane. Determine the anchorage-plane overturning demand.

A. 25.88 kip-ft
B. 51.75 kip-ft
C. 46.00 kip-ft
D. 103.50 kip-ft

51. For a freestanding sign, the seismic resultant is 16 kips acting 10 ft above the footing. What overturning demand must be transferred into the foundation?

A. 80 kip-ft
B. 126 kip-ft
C. 160 kip-ft
D. 320 kip-ft

52. A vessel anchorage model requires 120 kips of total tension on one side. If five identical anchors share equally, what tension is assigned to each?

A. 20 kips
B. 30 kips
C. 60 kips
D. 24 kips

53. A utility line passes from one building wing to another across a seismic joint. Why should its connection detail permit relative movement instead of tying the wings rigidly together?

A. The adjoining building portions can undergo significant relative displacement
B. The pipe must brace both buildings rigidly
C. The joint eliminates all pipe inertia
D. Flexibility increases component mass

54. A suspended component develops 7.2 kips of horizontal seismic force carried equally by three braces. What force is assigned to each brace?

A. 1.8 kips
B. 3.6 kips
C. 2.4 kips
D. 7.2 kips

55. A cantilevered architectural feature carries 4.2 kips of lateral seismic force at a height of 6 ft above its support. What base moment is created?

A. 12.6 kip-ft
B. 25.2 kip-ft
C. 21.0 kip-ft
D. 50.4 kip-ft

56. Why can earthquake-induced sloshing govern parts of a liquid-storage tank design?

A. The liquid becomes weightless during shaking
B. Sloshing removes tank overturning
C. Fluid motion always reduces wall pressure
D. Fluid motion can create additional hydrodynamic forces and free-surface displacement

57. Eight identical braced frames support a rack line whose total horizontal seismic demand is 96 kips. Assuming equal participation, determine the demand on one frame.

A. 8 kips
B. 16 kips
C. 12 kips
D. 48 kips

58. For a parapet weighing 18 kips, a simplified component check uses a lateral coefficient of 0.60. What horizontal inertia force should be applied?

A. 10.8 kips
B. 7.2 kips
C. 9.0 kips
D. 18.0 kips

59. Why must a tall narrow equipment cabinet be checked for both sliding and overturning?

A. Sliding and overturning are identical failures

B. Both sliding and overturning can govern
C. Only cabinet weight matters
D. Anchors eliminate every possible motion

60. A nonbuilding platform supporting a vessel has seismic weight 310 kips. A simplified analysis assigns c = 0.28. What lateral reaction follows from multiplying c by the weight?

A. 62.0 kips
B. 93.0 kips
C. 155.0 kips
D. 86.8 kips

61. A 32-kip rooftop component is assigned a total lateral force equal to 40 percent of its weight. Four identical anchors share that shear equally. Find the shear per anchor.

A. 2.4 kips
B. 4.0 kips
C. 3.2 kips
D. 6.4 kips

62. Why should exterior cladding connections permit the expected interstory movement of the supporting structure?

A. Cladding determines the mapped hazard
B. Permit drift-compatible cladding movement
C. Drift occurs only in foundations
D. Flexible attachments increase building weight

63. At a floor idealized as rigid in plane, two lateral lines have relative stiffnesses 40 and 80. The floor carries 540 kips of direct shear with torsion omitted. Determine the share for the stiffer line.

A. 180 kips
B. 270 kips
C. 405 kips
D. 360 kips

64. A diaphragm develops 7,680 kip-ft of in-plane flexural demand. Represent that demand by an axial tension-compression pair located at opposite edges 64 ft apart. What force magnitude belongs in either edge member?

A. 120 kips
B. 60 kips
C. 96 kips
D. 240 kips

65. Five equivalent wall segments receive the force collected from a diaphragm. If the collector delivers 315 kips total, what axial amount enters each segment under equal distribution?

A. 45 kips
B. 78.75 kips
C. 157.5 kips
D. 63 kips

66. A diaphragm carries 108 kips of shear uniformly across a 36-ft transfer width. What average shear transfer is required per foot?

A. 2.0 kips/ft
B. 4.0 kips/ft
C. 3.0 kips/ft
D. 6.0 kips/ft

67. A 72-ft diaphragm span carries a uniform lateral line load of 2.5 kips/ft and is idealized as simply supported between two walls. What reaction occurs at each wall?

A. 72 kips
B. 90 kips
C. 120 kips
D. 180 kips

68. For the same 72-ft simply supported diaphragm with w = 2.5 kips/ft, what maximum in-plane moment follows from wL^2/8?

A. 1,620 kip-ft
B. 810 kip-ft
C. 1,296 kip-ft
D. 3,240 kip-ft

69. A diaphragm acts like an in-plane beam with moment 1,620 kip-ft. Its two chord resultants are separated by 54 ft. Determine the axial magnitude of either chord force.

A. 15 kips
B. 45 kips
C. 30 kips
D. 60 kips

70. A collector carrying 176 kips is interrupted by an opening and routed through two equivalent drag paths. If the paths share equally, what force acts in each?

A. 44 kips
B. 76 kips
C. 176 kips
D. 88 kips

71. A large floor opening interrupts otherwise continuous diaphragm material. Why can the opening perimeter and corners become important seismic design locations?

A. Opening detours and concentrates diaphragm force flow
B. The opening removes all diaphragm inertia
C. Openings always make diaphragms flexible
D. Concrete around openings cannot carry shear

72. The center of mass and center of rigidity at a floor are 7 ft apart. With 340 kips of direct floor shear, determine the associated plan-torsion demand.

A. 1,190 kip-ft
B. 2,380 kip-ft
C. 2,040 kip-ft
D. 4,760 kip-ft

73. A diaphragm torsion model uses two opposite edge forces separated by 44 ft to generate 2,200 kip-ft. What magnitude must each edge force have?

A. 50 kips
B. 25 kips
C. 44 kips
D. 100 kips

74. At one edge of a rigid diaphragm, the direct component is 165 kips and torsion adds another 50 kips in the same sense. Determine the combined edge demand.

A. 115 kips
B. 215 kips
C. 165 kips
D. 265 kips

75. A flexible floor diaphragm carries 280 kips laterally. Tributary widths to two parallel walls are 35 ft and 45 ft. Under tributary-area distribution, determine the force on the wider tributary.

A. 122.5 kips
B. 140.0 kips
C. 180.0 kips
D. 157.5 kips

76. Why can modeling a truly flexible diaphragm as rigid distort the predicted wall forces?

A. Rigid models always reduce base shear
B. Flexible diaphragms have no chord forces
C. Rigid model redistributes force by wall stiffness
D. Wall stiffness never affects rigid diaphragms

77. Seven identical anchors connect a wall to a diaphragm and together must transfer 154 kips of out-of-plane inertia. With equal sharing, determine the demand on one anchor.

A. 14 kips
B. 22 kips
C. 28 kips
D. 77 kips

78. Along a 33-ft wood-diaphragm transfer segment, the total shear is 99 kips. Determine the average line shear expressed in kips per foot.

A. 2.0 kips/ft
B. 4.5 kips/ft
C. 6.0 kips/ft
D. 3.0 kips/ft

79. A high-shear wood diaphragm is detailed with blocking beneath panel edges. What structural purpose does the blocking serve in the in-plane load path?

A. Blocking provides framing support and connection capacity along panel edges
B. Blocking removes the need for chords
C. It eliminates all nail slip
D. It changes the mapped ground motion

80. A collector splice must transmit 216 kips through three equivalent connectors. If the connection model assumes equal participation, determine the force assigned to one connector.

A. 54 kips
B. 108 kips
C. 72 kips
D. 216 kips

81. A collector gathers 324 kips uniformly over a 81-ft length. What average axial transfer per foot is implied?

A. 3.0 kips/ft
B. 4.5 kips/ft
C. 8.0 kips/ft
D. 4.0 kips/ft

82. Why does a re-entrant diaphragm corner often require concentrated reinforcement, collectors, or careful detailing?

A. It removes all in-plane bending
B. It guarantees a rigid diaphragm
C. Geometry concentrates and redirects diaphragm forces
D. It prevents torsional response

83. A diaphragm delivers 396 kips of direct shear to three identical wall lines. Ignoring torsion, what shear is assigned to each line?

A. 99 kips
B. 132 kips
C. 198 kips
D. 396 kips

84. Six identical bolts make up a diaphragm chord splice carrying 168 kips of axial tension. Under an equal-share idealization, determine the bolt tension.

A. 28 kips
B. 21 kips
C. 42 kips
D. 84 kips

85. The in-plane bending demand in a rectangular diaphragm is 5,040 kip-ft. With chord resultants 56 ft apart, determine the required axial chord action.

A. 45 kips
B. 112 kips
C. 180 kips
D. 90 kips

86. A collector member has adequate axial strength, but its end connection enters a shear wall. Why must the connection and local wall region still be checked as part of the seismic design?

A. Transfer collector force into the wall system
B. Collector force ends before the wall
C. Wall strength makes connection design unnecessary
D. Only gravity load reaches the connection

87. Two wall lines together resist 320 kips of diaphragm shear. The first line is assigned 35 percent of the total. Determine the force that remains for the second line.

A. 112 kips
B. 160 kips
C. 208 kips
D. 240 kips

88. A rigid floor has two resisting lines with relative stiffnesses 55 and 95. For 450 kips of direct shear and no torsion, determine the portion attracted by the less-stiff line.

A. 135 kips
B. 165 kips
C. 225 kips
D. 285 kips

89. In a reinforced-concrete column expected to form a plastic hinge, what is the principal seismic role of closely spaced transverse hoops?

A. Increase mapped spectral acceleration
B. Confine concrete and restrain bar buckling
C. Eliminate column axial load
D. Replace longitudinal reinforcement

90. In a member expected to develop a plastic hinge, why is it usually preferable to place lap splices outside the region of largest cyclic strain?

A. Bond deterioration and slip could interrupt the intended ductile mechanism
B. Splices prevent all yielding everywhere
C. Concrete cover alone carries tension
D. Splices always improve curvature capacity

91. A seismic steel moment connection looks smooth after welding. Why is compliance with the qualified welding procedure still important?

A. Surface appearance proves fracture toughness
B. Any electrode is acceptable
C. Qualified procedures govern cyclic weld performance
D. Visual smoothness guarantees internal quality

92. At the end of a ductile steel brace, how can the shape and layout of the gusset plate influence earthquake performance beyond simply providing enough plate thickness?

A. It controls only architectural appearance
B. Plate thickness alone solves every issue
C. Brace force stops before the gusset
D. Geometry controls force transfer and deformation capacity

93. In reinforced masonry construction, why should inspectors verify bar location and grout consolidation?

A. They affect only wall color
B. Ensure bond, composite action, and load-path continuity
C. Grout makes bar location irrelevant
D. Masonry never develops cyclic tension

94. Why are nail spacing and edge distance critical inspection items in a wood shear wall?

A. Control connection strength, slip, ductility, and splitting
B. They determine site class
C. They remove overturning tension
D. They control concrete curing

95. A seismic collector must continue through a construction joint before delivering force to a wall. What connection behavior must be preserved at the joint?

A. Terminate the collector at the joint
B. Use finishes for force transfer
C. Design only for one force direction
D. Maintain collector continuity across the joint

96. A heavy concrete or masonry wall is tied to a horizontal diaphragm. What collapse-prevention function does that positive wall anchorage provide during out-of-plane shaking?

A. It intentionally increases roof weight
B. It eliminates all in-plane wall shear
C. Transfer out-of-plane wall inertia to the diaphragm
D. It prevents every foundation movement

97. When a post-installed anchor is placed near a free concrete edge, what additional failure mechanisms must be considered beyond tensile or shear failure of the steel anchor itself?

A. Steel failure always governs
B. Edge distance has no effect
C. Closer edges always increase capacity
D. Concrete breakout may govern before steel failure

98. Two building wings are separated by a seismic joint, but a fire-sprinkler main must cross between them. What characteristic should the crossing detail provide during earthquake drift?

A. Use the pipe as a rigid structural tie
B. Remove all supports near the joint
C. Provide flexibility and clearance for relative movement between the wings
D. Increase water weight to resist drift

99. A special inspector finds a brace connection installed differently from the approved seismic detail. What should happen before acceptance?

A. Document the deviation and obtain engineering evaluation or an approved correction
B. Accept it because the work is complete
C. Delete the observation from the report
D. Assume equal capacity without review

100. What is the main contribution of structural observation by the design professional on a significant seismic project?

A. Replacement of every special inspection
B. Focused review of significant work and deviations
C. A guarantee of zero earthquake damage
D. Elimination of approved construction documents

Practice Exam 14: Answer Key and Explanations

1. C — Multiplying the mapped short-period value by the stated site coefficient gives SMS = 1.18(1.05g) = 1.239g. Leaving Ss unchanged, dividing by Fa, or adding the two numbers does not follow the site-modification relationship supplied in the stem. The distractors reflect a reversed ratio, omitted factor, or arithmetic slip rather than the stated relationship.

2. B — The site-adjusted one-second value is SM1 = 1.48(0.58g) = 0.8584g, which rounds to 0.858g. The other options come from division, addition, or an unrelated scale factor instead of the product defined by the exercise. The distractors reflect a reversed ratio, omitted factor, or arithmetic slip rather than the stated relationship.

3. A — Applying the stated two-thirds reduction gives SDS = (2/3)(1.26g) = 0.84g. One-half of SMS, the unreduced value, and one-and-a-half times SMS are not consistent with the definition supplied in the question. The distractors reflect a reversed ratio, omitted factor, or arithmetic slip rather than the stated relationship. That relationship governs this idealized seismic check.

4. D — The transition period is the ratio SD1/SDS = 0.62/0.84 = 0.7381 second, rounded to 0.738 second. Reversing the ratio or combining the ordinates arithmetically produces values that do not represent the defined transition period. The distractors reflect a reversed ratio, omitted factor, or arithmetic slip rather than the stated relationship.

5. D — Twenty percent of 0.738 second is 0.1476 second, which rounds to 0.148 second. The distractors represent halving, leaving the value unchanged, or dividing by 0.2 instead of multiplying by the specified fraction. The distractors reflect a reversed ratio, omitted factor, or arithmetic slip rather than the stated relationship. That relationship governs this idealized seismic check.

6. B — Loose saturated granular soil can build excess pore-water pressure during cyclic shaking, reducing effective stress and causing liquefaction. The other choices do not match the combination of loose sand and groundwater described in the boring log, so they are not the primary seismic concern. The other choices describe different seismic mechanisms or omit the load-path behavior identified in the scenario.

7. C — Risk category reflects the consequences of failure and the importance of post-earthquake function. A facility required for emergency response can therefore have more stringent seismic reliability requirements than an ordinary occupancy at the same site. Architectural finishes, glazing area, and concrete slump do not establish the regional hazard or site class.

8. A — Mapped hazard values describe regional shaking intensity before local site amplification is applied. Site coefficients modify those values to account for the influence of the soil profile on spectral response. The other choices confuse seismic hazard with gravity loading or unrelated architectural characteristics. The other choices describe different seismic mechanisms or omit the load-path behavior identified in the scenario.

9. A — For equal mass, period varies inversely with the square root of stiffness. Therefore TA/TB = 1/sqrt(2.25) = 1/1.5 = 0.667. Using the stiffness ratio directly, its reciprocal, or a linear relation does not follow the square-root dependence. The distractors reflect a reversed ratio, omitted factor, or arithmetic slip rather than the stated relationship.

10. C — Parallel resisting lines undergo the same story translation and their restoring forces add, so equivalent stiffness is 12 + 18 + 25 + 35 = 90 kips/in. Averaging, omitting one line, or multiplying the stiffnesses does not represent parallel action. The distractors reflect a reversed ratio, omitted factor, or arithmetic slip rather than the stated relationship.

11. B — With stiffness unchanged, natural period varies with the square root of mass. The period factor is therefore sqrt(1.44) = 1.20. The alternatives use the mass factor directly, its reciprocal, or another unrelated ratio rather than the governing dynamic relationship. The distractors reflect a reversed ratio, omitted factor, or arithmetic slip rather than the stated relationship.

12. D — Additional damping dissipates vibration energy and generally reduces resonant amplification and peak response. It does not eliminate the structure's natural period, change its mass, or remove all seismic strength demand. The inertia forces still exist, but their dynamic amplification is moderated. The other choices describe different seismic mechanisms or omit the load-path behavior identified in the scenario.

13. A — Redundancy provides alternate or parallel paths for seismic force transfer, reducing dependence on one element or connection. It can improve robustness when local yielding or damage occurs, but it does not guarantee no damage, replace ductile detailing, or eliminate torsional effects caused by plan eccentricity. That relationship governs this idealized seismic check.

14. B — A pronounced stiffness discontinuity can create a soft-story mechanism in which lateral deformation concentrates at the flexible level. That concentration increases drift and damage demand locally rather than distributing deformation uniformly. Vertical acceleration alone does not explain the effect, and the weak story does not experience reduced deformation. That relationship governs this idealized seismic check.

15. C — When lateral force acts through a center of mass offset from the center of rigidity, the eccentricity creates a torsional moment in addition to direct translation. The floor therefore tends to rotate in plan. The other choices do not follow from horizontal mass-rigidity eccentricity. The other choices describe different seismic mechanisms or omit the load-path behavior identified in the scenario.

16. D — Adjacent structures can have different periods, stiffnesses, and displacement histories, causing them to move toward each other during an earthquake. Adequate separation reduces the risk of pounding. The joint is not intended to increase gravity sharing, make the buildings rigid, or remove diaphragm forces. The other choices describe different seismic mechanisms or omit the load-path behavior identified in the scenario.

17. D — URM walls and parapets are heavy and brittle, and inadequate positive anchorage can allow them to separate from diaphragms during out-of-plane shaking. This can create dangerous falling hazards or partial collapse. The other choices describe systems or mechanisms not characteristic of the stated URM weakness. That relationship governs this idealized seismic check.

18. C — Precast members can move substantially during earthquake response. Shallow seats and inadequate positive ties can permit a beam or slab unit to walk off its support, producing a sudden gravity-load failure. The unrelated distractors do not address the connection vulnerability described in the structure. The other choices describe different seismic mechanisms or omit the load-path behavior identified in the scenario.

19. A — Flat-plate systems transfer gravity shear and unbalanced moment through slab-column regions. Large lateral drift can increase demand and trigger punching shear, a brittle mechanism that may compromise gravity support. Brace yielding and wood connection slip are unrelated, while footing rocking does not address the stated slab-column weakness. That relationship governs this idealized seismic check.

20. B — Tilt-up wall panels develop significant out-of-plane inertia and depend on positive anchorage to transfer that force into the roof diaphragm. Strengthening the wall-to-roof connection directly addresses a common collapse mechanism. Heavier finishes increase inertia, thinner walls are not the direct fix, and collectors should not be removed. That relationship governs this idealized seismic check.

21. B — Residual drift and fractured or crushed structural elements can indicate substantial loss of strength, stiffness, or stability. A qualified post-earthquake evaluation is needed before relying on the building for normal occupancy. Superficial operability of doors or the end of shaking does not establish structural safety. That relationship governs this idealized seismic check.

22. A — Adding stiffness changes how seismic forces flow through the building. New walls can attract greater story shear and transfer larger forces into diaphragms, collectors, foundations, and neighboring elements. Strengthening one story does not automatically reduce all foundation loads, remove upper-story inertia, or eliminate torsion. The other choices describe different seismic mechanisms or omit the load-path behavior identified in the scenario.

23. C — Base shear is V = 0.084(8,750) = 735 kips. The other values reflect a different percentage, use of ten percent of weight, or doubling the correct result rather than applying the coefficient stated in the stem. The distractors reflect a reversed ratio, omitted factor, or arithmetic slip rather than the stated relationship.

24. D — With equal floor weights and k = 1, force is proportional to height. The height sum is 12 + 24 + 36 + 48 = 120 ft, so the roof fraction is 48/120 = 0.40 and Fx = 0.40(500) = 200 kips. The distractors reflect a reversed ratio, omitted factor, or arithmetic slip rather than the stated relationship.

25. C — The base shear equals the sum of all applied story-level lateral forces above the base: 55 + 80 + 105 + 130 = 370 kips. The alternatives omit a level or add an extra amount not present in the stated force distribution. The distractors reflect a reversed ratio, omitted factor, or arithmetic slip rather than the stated relationship.

26. D — The overturning moment is force times perpendicular lever arm: M = 290(42) = 12,180 kip-ft. Halving, using an incorrect height, or doubling the product does not satisfy moment equilibrium for the single force shown by the stem. The distractors reflect a reversed ratio, omitted factor, or arithmetic slip rather than the stated relationship.

27. A — Convert the story height to inches: 15 ft = 180 in. The drift ratio is 2.25/180 = 0.0125, or 1.25 percent. The alternatives come from using the wrong height conversion or treating the displacement value itself as a percentage. The distractors reflect a reversed ratio, omitted factor, or arithmetic slip rather than the stated relationship.

28. B — Direct shear is distributed in proportion to stiffness. The stiffer wall receives 75/(45+75) of 480 kips, giving 300 kips. Equal sharing or using the wrong stiffness fraction does not satisfy the proportional distribution stated for the rigid diaphragm model. The distractors reflect a reversed ratio, omitted factor, or arithmetic slip rather than the stated relationship.

29. A — A force couple produces moment M = Fd. With M = 18,000 kip-ft and spacing d = 30 ft, F = 18,000/30 = 600 kips. The alternatives use half, one-and-a-half times, or twice the required couple force. The distractors reflect a reversed ratio, omitted factor, or arithmetic slip rather than the stated relationship.

30. D — Equal sharing among four identical collector elements gives 224/4 = 56 kips per element. The other values come from division by a different number of paths or using one-half of the total force rather than the stated four-way split. The distractors reflect a reversed ratio, omitted factor, or arithmetic slip rather than the stated relationship.

31. B — The horizontal component of brace force is P cos(theta), so P = 336/0.84 = 400 kips. Multiplying instead of dividing, leaving the shear unchanged, or applying an unrelated factor does not produce the axial force needed for horizontal equilibrium. The distractors reflect a reversed ratio, omitted factor, or arithmetic slip rather than the stated relationship.

32. C — Story overturning is M = 210(15) = 3,150 kip-ft. Dividing by the 21-ft column-force spacing gives 150 kips for each force in the idealized couple. The alternatives use the wrong lever arm or fail to convert story shear into overturning moment. The distractors reflect a reversed ratio, omitted factor, or arithmetic slip rather than the stated relationship.

33. B — A strong-column/weak-beam hierarchy promotes distributed beam hinging while reducing the likelihood that column yielding will concentrate into a soft-story collapse mechanism. It does not guarantee columns remain elastic under every demand, eliminate connection requirements, or prevent residual deformation after severe cyclic response. The other choices describe different seismic mechanisms or omit the load-path behavior identified in the scenario.

34. A — Boundary zones of ductile walls can experience high compression, repeated curvature, and bar instability during cyclic loading. Closely spaced transverse reinforcement helps confine the concrete and restrain longitudinal bars. It does not change seismic hazard, eliminate shear, or alter the building occupancy classification. The other choices describe different seismic mechanisms or omit the load-path behavior identified in the scenario.

35. D — A coupling beam intended as an energy-dissipating element should develop stable cyclic inelastic behavior while maintaining a reliable connection to the wall piers. Brittle fracture, premature loss of support, or an unrealistic expectation of zero deformation would defeat the intended ductile mechanism. The other choices describe different seismic mechanisms or omit the load-path behavior identified in the scenario.

36. C — Equal distribution among six identical hold-downs gives 624/6 = 104 kips each. The distractors correspond to division by a different number of anchors or using one-half of the total uplift instead of the six-way sharing assumption. The distractors reflect a reversed ratio, omitted factor, or arithmetic slip rather than the stated relationship.

37. A — Using M = Fd, the required vertical force is F = 14,280/28 = 510 kips. The other values result from halving, using an incorrect divisor, or doubling the required couple force instead of satisfying moment equilibrium. The distractors reflect a reversed ratio, omitted factor, or arithmetic slip rather than the stated relationship.

38. D — A vertical discontinuity forces shear, overturning, and axial actions from the upper wall to be collected and redirected through the transfer element and supporting system below. That concentrated force path can govern design. The wall still has inertia, gravity loads remain, and torsion is not automatically removed. That relationship governs this idealized seismic check.

39. B — With three identical receiving elements and equal sharing, each takes 456/3 = 152 kips. The other values reflect division by four, division by two, or assigning two-thirds of the total rather than the stated three-way split. The distractors reflect a reversed ratio, omitted factor, or arithmetic slip rather than the stated relationship.

40. C — The stiffness proportions sum to 100. The middle line therefore receives 35/100 of 600 kips, or 210 kips. Assigning force by equal thirds or using another stiffness fraction would not match the proportional distribution specified in the stem. The distractors reflect a reversed ratio, omitted factor, or arithmetic slip rather than the stated relationship.

41. D — Rearranging V = kDelta gives Delta = V/k = 630/105 = 6.0 inches. The distractors represent division by incorrect stiffness values or unrelated scaling. The units also confirm that kips divided by kips per inch produces inches of translation. The distractors reflect a reversed ratio, omitted factor, or arithmetic slip rather than the stated relationship.

42. C — The specified amplified drift is 5.0(0.64 in) = 3.20 inches. Dividing by the factor, leaving the elastic value unchanged, or adding the factor numerically does not follow the multiplication stated in the exercise. The distractors reflect a reversed ratio, omitted factor, or arithmetic slip rather than the stated relationship. That relationship governs this idealized seismic check.

43. B — The drift ratio is 1.95/156 = 0.0125. Multiplying by 100 gives 1.25 percent of story height. The alternatives result from an incorrect denominator or from treating the displacement value itself as a percent rather than normalizing it by story height. The distractors reflect a reversed ratio, omitted factor, or arithmetic slip rather than the stated relationship.

44. A — Substitution gives theta = 4,200(1.6)/[560(150)] = 6,720/84,000 = 0.080. The distractors reflect halving, multiplying by 1.5, or a decimal-place error. Keeping consistent force and length units makes the ratio dimensionless. The distractors reflect a reversed ratio, omitted factor, or arithmetic slip rather than the stated relationship. That relationship governs this idealized seismic check.

45. A — The aspect ratio is height divided by wall length: 21/8.4 = 2.50. Reversing the ratio, adding the dimensions, or using half the wall length does not represent the stated height-to-length measure. The distractors reflect a reversed ratio, omitted factor, or arithmetic slip rather than the stated relationship. That relationship governs this idealized seismic check.

46. B — The horizontal stiffness contribution is 600(0.75)^2 = 600(0.5625) = 337.5 kips/in. Multiplying by cos(theta) only, dividing by the cosine, or using the sine relationship would not match the formula supplied in the question. The distractors reflect a reversed ratio, omitted factor, or arithmetic slip rather than the stated relationship. That relationship governs this idealized seismic check.

47. D — The torsional moment is the lateral force times eccentricity: M = 420(5.5) = 2,310 kip-ft. The other values result from halving, using an incorrect lever arm, or doubling the product rather than applying the stated eccentricity. The distractors reflect a reversed ratio, omitted factor, or arithmetic slip rather than the stated relationship.

48. C — For an equal and opposite force couple, M = Fd. Thus F = 6,160/56 = 110 kips at each edge frame. The distractors reflect halving, using a smaller effective spacing, or doubling the required force. The distractors reflect a reversed ratio, omitted factor, or arithmetic slip rather than the stated relationship.

49. A — The component force is Fp = 0.38(24) = 9.12 kips. The other choices reflect a smaller coefficient, one-half of the equipment weight, or another unrelated percentage rather than the multiplier explicitly given in the stem. The distractors reflect a reversed ratio, omitted factor, or arithmetic slip rather than the stated relationship.

50. B — The overturning moment is 11.5(4.5) = 51.75 kip-ft. Halving the product, using a 4-ft height, or doubling the moment does not satisfy the lever-arm relationship for the force location stated in the question. The distractors reflect a reversed ratio, omitted factor, or arithmetic slip rather than the stated relationship. That relationship governs this idealized seismic check.

51. C — Base moment equals lateral force times height: M = 16(10) = 160 kip-ft. The alternatives use half the correct lever arm, a different height, or double the required moment instead of the stated force-height product. The distractors reflect a reversed ratio, omitted factor, or arithmetic slip rather than the stated relationship.

52. D — Equal sharing among five identical anchors gives 120/5 = 24 kips per anchor. The distractors correspond to division by six, division by four, or assigning half of the total tension to each anchor rather than the specified five-way distribution. The distractors reflect a reversed ratio, omitted factor, or arithmetic slip rather than the stated relationship.

53. A — Different building portions can move independently during earthquake response. A rigid pipe crossing can be overstressed, rupture, or unintentionally tie the structures together. Flexible detailing accommodates relative motion while maintaining the service function. It is not intended to brace the buildings, remove inertia, or increase mass. That relationship governs this idealized seismic check.

54. C — Equal force sharing among three identical braces gives 7.2/3 = 2.4 kips each. The other options correspond to a four-way split, a two-way split, or assigning the full component force to every brace despite the stated equal sharing. The distractors reflect a reversed ratio, omitted factor, or arithmetic slip rather than the stated relationship.

55. B — The base moment is force times height: 4.2(6) = 25.2 kip-ft. The alternatives represent halving, using a 5-ft lever arm, or doubling the correct product rather than applying the stated geometry. The distractors reflect a reversed ratio, omitted factor, or arithmetic slip rather than the stated relationship. That relationship governs this idealized seismic check.

56. D — Stored liquid does not necessarily move rigidly with the tank shell. Convective motion can produce significant hydrodynamic pressures, free-surface displacement, and forces on the tank and attachments. Sloshing does not make the liquid weightless, eliminate overturning, or guarantee reduced wall pressure. The other choices describe different seismic mechanisms or omit the load-path behavior identified in the scenario.

57. C — With eight identical braced frames sharing equally, the shear per frame is 96/8 = 12 kips. The distractors result from division by twelve, division by six, or assigning half the rack-row shear to every frame. The distractors reflect a reversed ratio, omitted factor, or arithmetic slip rather than the stated relationship.

58. A — Applying the stated coefficient gives F = 0.60(18) = 10.8 kips. The alternatives use 40 percent, 50 percent, or the full weight instead of the sixty-percent multiplier given in the question. The distractors reflect a reversed ratio, omitted factor, or arithmetic slip rather than the stated relationship. That relationship governs this idealized seismic check.

59. B — Sliding depends largely on horizontal resistance such as friction and anchorage shear, while overturning depends on the force height, base width, weight, and tension-compression reactions. Either mechanism can govern. They are not the same failure mode, and anchors do not automatically eliminate all movement. The other choices describe different seismic mechanisms or omit the load-path behavior identified in the scenario.

60. D — The lateral base shear is V = 0.28(310) = 86.8 kips. The other choices correspond to a different coefficient, thirty percent of the weight, or one-half of the total weight rather than the value defined in the stem. The distractors reflect a reversed ratio, omitted factor, or arithmetic slip rather than the stated relationship.

61. C — The total component force is 0.40(32) = 12.8 kips. Dividing equally among four anchors gives 3.2 kips per anchor. The distractors correspond to different anchor counts or coefficients rather than the two-step calculation stated in the stem. The distractors reflect a reversed ratio, omitted factor, or arithmetic slip rather than the stated relationship.

62. B — Nonstructural cladding must remain attached while accommodating frame drift and local differential movement. Connections that are too rigid can transfer damaging deformation into panels, fasteners, or joints. Cladding does not establish seismic hazard, drift is not confined to foundations, and connection flexibility does not meaningfully increase building weight. That relationship governs this idealized seismic check.

63. D — The total stiffness is 120 units. The 80-unit line receives 80/120 of 540 kips, which equals 360 kips. Equal sharing or using the wrong stiffness ratio does not represent rigid-diaphragm force distribution by relative lateral stiffness. The selected result follows from equilibrium and compatibility applied to the stiffness and geometry stated in the idealized model.

64. A — The chord pair acts as a force couple, so F = M/d = 7,680/64 = 120 kips. The distractors reflect halving, using a different chord spacing, or doubling the required couple force rather than satisfying the in-plane moment. The selected result follows from equilibrium and compatibility applied to the stiffness and geometry stated in the idealized model.

65. D — Equal sharing gives 315/5 = 63 kips per wall segment. The alternatives correspond to division by seven, division by four, or one-half of the total force rather than the specified five-way collector transfer. The selected result follows from equilibrium and compatibility applied to the stiffness and geometry stated in the idealized model.

66. C — Average unit shear is total shear divided by the transfer width: 108/36 = 3.0 kips/ft. The alternatives result from using a different effective width or doubling the required transfer instead of applying the uniform distribution stated in the stem. The selected result follows from equilibrium and compatibility applied to the stiffness and geometry stated in the idealized model.

67. B — Total diaphragm load is 2.5(72) = 180 kips. A symmetric simply supported idealization gives equal reactions, so each wall takes 90 kips. The distractors use the span value, a different fraction, or the entire load at one support. The selected result follows from equilibrium and compatibility applied to the stiffness and geometry stated in the idealized model.

68. A — Using wL^2/8 gives 2.5(72^2)/8 = 1,620 kip-ft. The distractors reflect halving the correct moment, using an incorrect coefficient, or doubling the result. The reaction check also supports the order of magnitude for the idealized beam analogy. The selected result follows from equilibrium and compatibility applied to the stiffness and geometry stated in the idealized model.

69. C — The chord couple force is F = M/d = 1,620/54 = 30 kips. The alternatives represent half, one-and-a-half times, or twice the required axial force rather than satisfying the moment couple with the stated chord spacing. The selected result follows from equilibrium and compatibility applied to the stiffness and geometry stated in the idealized model.

70. D — Two equivalent drag paths sharing the collector force equally each carry 176/2 = 88 kips. The alternatives correspond to a four-way split, an unrelated reduced value, or assigning the entire collector force to each path. The selected result follows from equilibrium and compatibility applied to the stiffness and geometry stated in the idealized model.

71. A — An opening interrupts the normal in-plane load path and can force shear, chord, and collector actions to concentrate around its corners and edges. Local detailing can therefore govern. The opening does not remove inertia, automatically define global diaphragm flexibility, or make surrounding concrete incapable of shear transfer. That relationship governs this idealized seismic check.

72. B — Torsional moment from the stated eccentricity is M = Ve = 340(7) = 2,380 kip-ft. Halving the product, using a 6-ft lever arm, or doubling the result does not represent the eccentric force action described in the stem. The selected result follows from equilibrium and compatibility applied to the stiffness and geometry stated in the idealized model.

73. A — For an equal force couple, F = M/d = 2,200/44 = 50 kips. The distractors represent halving, confusing spacing with force, or doubling the required increment. Equal and opposite edge increments then produce the specified pure torsional moment. The selected result follows from equilibrium and compatibility applied to the stiffness and geometry stated in the idealized model.

74. B — When the direct and torsional components act in the same direction at that edge, they add algebraically: 165 + 50 = 215 kips. Subtracting, ignoring torsion, or adding twice the torsional increment does not match the stated direction of action. The selected result follows from equilibrium and compatibility applied to the stiffness and geometry stated in the idealized model.

75. D — The tributary width total is 80 ft. The 45-ft wall receives 45/80 of 280 kips, which is 157.5 kips. Equal sharing or using the narrower tributary fraction does not follow the flexible-diaphragm distribution assumption stated in the question. The selected result follows from equilibrium and compatibility applied to the stiffness and geometry stated in the idealized model.

76. C — Diaphragm idealization controls how lateral load reaches the vertical resisting elements. A rigid diaphragm enforces common in-plane motion and distributes force largely by relative stiffness and torsion, while a flexible diaphragm behaves more nearly by tributary loading. Using the wrong idealization can therefore misstate individual wall demands. That relationship governs this idealized seismic check.

77. B — Equal distribution among seven anchors gives 154/7 = 22 kips each. The other values correspond to different anchor counts or one-half of the total force rather than the seven-way sharing assumption in the stated anchorage model. The selected result follows from equilibrium and compatibility applied to the stiffness and geometry stated in the idealized model.

78. D — Average unit shear is 99/33 = 3.0 kips/ft. The other options represent using a different effective length or multiplying rather than dividing. This unit-shear value is a convenient measure for checking sheathing and connection demand along the diaphragm line. The selected result follows from equilibrium and compatibility applied to the stiffness and geometry stated in the idealized model.

79. A — High diaphragm shear requires reliable transfer through panel edges and fasteners. Blocking provides a continuous nailing surface and helps develop the intended shear path between adjacent panels and framing. It does not replace chords, eliminate all cyclic connection deformation, or alter the seismic hazard at the site. That relationship governs this idealized seismic check.

80. C — Equal sharing among three identical splice connectors gives 216/3 = 72 kips each. The distractors correspond to a four-way split, a two-way split, or assigning the full collector force to every connector despite the stated equal load sharing. The selected result follows from equilibrium and compatibility applied to the stiffness and geometry stated in the idealized model.

81. D — Uniform transfer per unit length is 324/81 = 4.0 kips/ft. The alternatives use an incorrect effective length or double the correct rate. Integrating the 4.0-kip/ft transfer over 81 ft returns the stated 324-kip collector force. The selected result follows from equilibrium and compatibility applied to the stiffness and geometry stated in the idealized model.

82. C — A re-entrant corner changes the geometry of the diaphragm load path and can concentrate shear and tension near the inside corner. Collectors, chords, and local reinforcement may be needed to redirect those forces. The irregularity does not eliminate bending, guarantee rigidity, or prevent torsion elsewhere in the system. That relationship governs this idealized seismic check.

83. B — With three identical lines and no torsion, equal stiffness gives equal direct-shear sharing: 396/3 = 132 kips per wall. The alternatives correspond to division by four, division by two, or assigning the full diaphragm shear to each line. The selected result follows from equilibrium and compatibility applied to the stiffness and geometry stated in the idealized model.

84. A — Equal load sharing among six bolts gives 168/6 = 28 kips per bolt. The distractors represent division by eight, division by four, or assigning one-half of the total tension to each bolt instead of the specified six-way distribution. The selected result follows from equilibrium and compatibility applied to the stiffness and geometry stated in the idealized model.

85. D — Chord force is determined from the moment couple $F = M/d = 5{,}040/56 = 90$ kips. The alternatives reflect half, a different spacing, or twice the required force. Equal and opposite chord actions at the edges then produce the diaphragm bending moment. Checking equilibrium after the calculation is a useful way to confirm that the force distribution is internally consistent.

86. A — A collector member can be strong enough while its connection remains incapable of delivering the force into the wall. The connection, anchorage, local wall region, and supporting elements must all participate in the load path. Seismic force does not vanish at the interface, and wall strength alone cannot substitute for connection capacity.

87. C — The second wall receives the remaining 65 percent of 320 kips: 0.65(320) = 208 kips. The alternatives represent the first wall share, equal sharing, or a seventy-five-percent assignment rather than the complement of the stated thirty-five percent. The selected result follows from equilibrium and compatibility applied to the stiffness and geometry stated in the idealized model.

88. B — The total stiffness is 150 units, so the 55-unit line receives 55/150 of 450 kips = 165 kips. Equal sharing or using the larger stiffness fraction does not match the proportional rigid-diaphragm distribution specified in the stem. The selected result follows from equilibrium and compatibility applied to the stiffness and geometry stated in the idealized model.

89. B — Closely spaced hoops help confine compressed core concrete, restrain longitudinal bars against buckling, and preserve deformation capacity through repeated curvature reversals. They do not change the site hazard, eliminate column axial force, or substitute for the longitudinal steel needed to resist flexure and axial demand. Inspection should emphasize details that govern repeated force transfer rather than appearance alone.

90. A — Plastic-hinge regions experience large repeated tensile and compressive strains that can severely challenge bond and splice performance. Locating splices away from the highest cyclic strain reduces the chance that bond slip or splitting will govern before the intended flexural mechanism develops. The other choices overstate or mischaracterize splice behavior. That relationship governs this idealized seismic check.

91. C — A visually smooth weld can still have unsuitable filler metal, poor heat control, hidden defects, or inadequate toughness for cyclic loading. Qualified procedures, proper materials, fit-up, preheat, workmanship, and required inspection collectively support the intended seismic performance. Appearance alone does not establish those properties. Inspection should emphasize details that govern repeated force transfer rather than appearance alone.

92. D — The gusset must transmit brace forces while permitting the rotations and deformations expected during cyclic buckling and yielding. Its shape, clearances, and connection layout influence local stresses and fracture risk. Thickness alone cannot correct every geometric deficiency, and brace force must pass through the gusset into the frame. That relationship governs this idealized seismic check.

93. B — Reinforced masonry relies on masonry units, grout, and steel acting together. Misplaced reinforcement or poorly consolidated grout can interrupt bond, reduce effective strength, and compromise continuity under cyclic tension, compression, and shear. These details are structural rather than cosmetic, and grout does not make reinforcement placement unimportant. Inspection should emphasize details that govern repeated force transfer rather than appearance alone.

94. A — Wood shear-wall behavior depends heavily on the sheathing-to-framing fasteners. Nail spacing and edge distance influence strength, cyclic deformation, ductility, and the possibility of splitting or tear-out. Those details do not determine geotechnical site class, eliminate hold-down tension, or control unrelated concrete curing. A field deviation can change strength, stiffness, anchorage, or deformation capacity and therefore needs evaluation before acceptance.

95. D — The collector is part of the seismic load path, so its axial force must cross the joint through developed reinforcement, anchors, welds, or another designed transfer mechanism. Earthquake loading can reverse direction, so one-way detailing is inadequate. Stopping the collector or relying on finish materials would break the intended load path.

96. C — A heavy wall develops substantial out-of-plane inertia during shaking. Positive anchors and ties transfer that force into the diaphragm and help keep the wall attached to the supporting structure. The connection is not intended to add weight, remove in-plane shear, or prevent every possible type of foundation displacement. That relationship governs this idealized seismic check.

97. D — Post-installed anchors transfer force into a finite region of concrete. Small edge distances, limited embedment, cracking, and anchor spacing can reduce breakout or splitting resistance so concrete fails before the steel fastener. Assuming steel always governs or that an edge improves capacity can produce an unsafe assessment. Inspection should emphasize details that govern repeated force transfer rather than appearance alone.

98. C — The wings can move differently during an earthquake. A rigid pipe crossing may rupture or unintentionally brace the structures if it cannot accommodate relative displacement. Flexible joints, loops, or adequate clearance preserve serviceability while allowing movement. Removing support or adding fluid weight does not solve the compatibility problem. That relationship governs this idealized seismic check.

99. A — A field change in a seismic connection can alter force transfer, stiffness, anchorage, and cyclic deformation capacity. The condition should be documented and evaluated by the responsible design authority or corrected through an approved process before acceptance. Completion or visual similarity does not prove equivalent structural performance. Inspection should emphasize details that govern repeated force transfer rather than appearance alone.

100. B — Structural observation provides periodic professional review of significant construction to identify deviations that may affect the intended seismic behavior. It complements, rather than replaces, required special inspection and testing. Observation cannot guarantee damage-free performance and does not remove the need for approved drawings, specifications, or code-mandated quality-control procedures. That relationship governs this idealized seismic check.