

BUILDING CONTRACTOR SIMULATION EXAM 7

Instructions: Select the single best answer for each question. Time allowed: 200 minutes.

ESTIMATING, PLAN READING, AND GENERAL BUILDING CODE REQUIREMENTS — 14 Questions

1. A contractor is performing a quantity takeoff for a concrete retaining wall that is 6 feet tall, 18 inches thick, and 150 linear feet long. Including a 6% waste factor, how many cubic yards of concrete must be ordered?

- A. 41.7 cubic yards
- B. 44.2 cubic yards
- C. 47.3 cubic yards
- D. 52.8 cubic yards

2. On a set of construction drawings, a section cut symbol shows a dashed cut line with an arrow pointing to the right. The section drawing referenced by this symbol will show the viewer looking in which direction?

- A. To the right — in the direction the arrow points
- B. To the left — opposite the direction of the arrow
- C. Downward into the floor below the cut plane level
- D. Upward toward the ceiling above the cut line elevation

3. A contractor is estimating the installed cost of a concrete floor slab. Material costs total \$38,400. Labor costs are calculated at \$12 per square foot for a 3,200-square-foot slab. Equipment rental is \$2,800. What is the total installed cost before applying overhead and profit?

- A. \$72,600
- B. \$76,400
- C. \$68,900
- D. \$79,600

4. Under the IBC, a Group I-2 occupancy covering hospitals and nursing homes where patients may need assistance evacuating is subject to which of the following special construction requirements regardless of building area?

- A. Non-combustible construction — Type I or II — is required for all stories above the first
- B. Automatic fire sprinkler systems throughout the entire facility regardless of size or height
- C. A minimum of four exits from any patient care floor regardless of occupant load
- D. A 3-hour fire-resistance rating for all corridor walls adjacent to patient care rooms

5. A drawing legend shows the symbol for "existing concrete to remain" as a solid hatch pattern of diagonal lines at 45 degrees, spaced 1/8 inch apart. On the floor plan, a different symbol — open diagonal lines at 45 degrees spaced 1/4 inch apart — appears in a wall section. The contractor should interpret the second symbol as which of the following?

- A. A lightweight concrete fill material with reduced density for the application
- B. A structural steel member shown in section through the wall assembly
- C. New concrete construction — distinguished from existing concrete by the different hatch spacing
- D. Masonry construction using CMU block in the wall section shown

6. A contractor receives four subcontractor bids for mechanical work: \$285,000, \$312,000, \$298,000, and \$267,000. The contractor's markup on subcontractor work is 8%. What is the mechanical subcontractor cost included in the general contractor's bid if the lowest qualified bidder is selected?

- A. \$288,360
- B. \$312,480
- C. \$278,400
- D. \$321,960

7. Under the IBC, the minimum ceiling height for a habitable space in a Group R-2 residential occupancy is which of the following?

- A. 7 feet minimum ceiling height for all habitable spaces in residential occupancies
- B. 8 feet minimum ceiling height required for all Group R-2 occupancies statewide
- C. 9 feet minimum ceiling height for all spaces with fixed occupancy use
- D. 7 feet 6 inches minimum ceiling height for habitable rooms in Group R-2

8. A contractor is reviewing a structural drawing and finds a note that reads "VIF — verify in field." This notation instructs the contractor to do which of the following?

- A. Verify that all indicated dimensions are consistent with the structural engineer's calculations
- B. Measure the actual condition in the field before fabricating or installing the affected item
- C. Verify the information with the geotechnical engineer before proceeding with foundation work
- D. Check the drawing against the specifications before submitting the shop drawing

9. On a finish schedule, the notation "PT-2 / PT-2 / VCT-3" in the columns for wall finish, ceiling finish, and floor finish for Room 112 means which of the following?

- A. Both walls and ceiling are painted with Paint Type 2, and the floor receives VCT Type 3

- B. The room has two painted walls, two walls with VCT, and ceiling finish type 3
- C. Paint Type 2 is applied to the walls, ceiling, and base of VCT-type 3 flooring
- D. Two coats of paint are applied to walls, two coats to ceiling, and three VCT colors

10. A contractor calculates that a project requires 1,440 linear feet of #5 rebar at 12 inches on center for a concrete retaining wall. At a unit weight of 1.043 lb/LF and a delivered price of \$0.68 per pound, what is the total material cost for the rebar?

- A. \$1,021
- B. \$978
- C. \$1,108
- D. \$1,265

11. Under the IBC, which of the following correctly defines the term "occupant load" as used for means of egress design purposes?

- A. The actual number of persons counted in the space during a fire drill exercise
- B. The maximum number of persons permitted in the space based on posted signage
- C. The number calculated by dividing the floor area by the applicable occupant load factor
- D. The number of persons the fire suppression system is designed to protect per floor

12. A contractor is purchasing lumber for floor framing. The project requires 2×10 joists at 16 inches on center spanning 14 feet. To calculate the number of joists needed for a 36-foot-wide floor bay, which of the following calculations is correct?

- A. $36 \div 1.33 \text{ feet spacing} = 27 \text{ joists plus one additional for the end} = 28 \text{ joists total}$
- B. $36 \div 1.33 = 27.07$, rounded up to 28 spaces, plus one additional for the first joist = 29 joists total
- C. $36 \div 1.5 \text{ feet spacing} = 24 \text{ joists plus two end joists} = 26 \text{ joists total}$
- D. $36 \times 0.75 = 27 \text{ joists which accounts for the spacing without additional calculation}$

13. A structural drawing note specifies " $f_c = 4,000$ psi @ 28 days, normal weight concrete." A contractor's testing report shows a 28-day cylinder break of 4,150 psi. Which of the following is the correct assessment?

- A. The concrete is acceptable — the 28-day break meets the specified minimum f_c
- B. The break is too high — concrete exceeding f_c by more than 100 psi must be retested
- C. The concrete meets the specification and the higher-than-specified result is acceptable
- D. The result requires engineer review because exceeding f_c affects the reinforcing design

14. Under the IBC, a high-rise building is defined as a building with an occupied floor located above what height above the lowest level of fire department vehicle access?

- A. 55 feet above the lowest fire department vehicle access level
- B. 70 feet above the lowest fire department vehicle access level
- C. 85 feet above the lowest fire department vehicle access level
- D. 75 feet above the lowest fire department vehicle access level

CONCRETE — 13 Questions

15. A concrete slab is placed outdoors in North Carolina during summer construction. The evaporation rate calculator shows 0.25 lb/ft²/hr. Which of the following correctly describes the risk associated with this evaporation rate?

- A. No risk — evaporation rates below 0.30 lb/ft²/hr do not require protective measures
- B. Moderate risk — protective measures recommended but not required at this level
- C. Low risk — North Carolina summer concrete typically exceeds 0.40 before protection is needed
- D. High risk — at 0.25 lb/ft²/hr plastic shrinkage cracking is likely and protective measures are required

16. Under ACI 318, reinforcing bars that will be spliced using a Class B tension lap splice must have a lap length equal to which of the following?

- A. 1.0 times the development length of the bar (l_d)
- B. 1.3 times the development length of the bar (l_d)
- C. 1.5 times the development length of the bar (l_d)
- D. 2.0 times the development length of the bar (l_d)

17. A concrete contractor places a slab on grade over a vapor barrier membrane. Immediately after screeding, the finisher notices that bleed water is accumulating on the surface at a much slower rate than normal. Which of the following is the most likely explanation for this condition?

- A. The concrete mix has too high a cement content causing rapid hydration and reduced bleed
- B. The ambient temperature is too cold causing the hydration reaction to slow significantly
- C. The vapor barrier prevents bleed water from escaping through the bottom of the slab, causing it to accumulate at the top surface instead
- D. The concrete has been over-vibrated causing aggregate to settle and paste to rise prematurely

18. A contractor must place concrete for a 30-inch-diameter drilled pier foundation in a location where groundwater is present in the excavation. Which of the following placement methods is required to prevent washout of the cement paste?

- A. Place concrete through a tremie pipe extending to the bottom of the pier excavation, withdrawing the pipe slowly as concrete rises
- B. Pump concrete rapidly to displace the groundwater before it can mix with the fresh concrete
- C. Dewater the excavation completely before placing concrete in the dry hole
- D. Place concrete from a height of 6 feet to achieve adequate velocity to displace groundwater

19. Under ACI 318, the maximum aggregate size for concrete placed in a member with closely spaced reinforcing bars must not exceed which of the following dimensional limitations?

- A. One-half the minimum clear spacing between bars and one-third the minimum clear cover
- B. Two-thirds the minimum clear cover and one-half the bar diameter
- C. One-third the form depth and one-half the width of the narrowest form
- D. Three-fourths the minimum clear spacing between individual bars and three-fourths the minimum cover to the form surface

20. A post-tensioning engineer specifies that the concrete must achieve 3,500 psi before stressing may begin. Field-cured cylinders break at 3,650 psi on day three after concrete placement. Which of the following best describes this situation?

- A. Do not stress — field-cured cylinders are unreliable and standard-cured cylinders must confirm the strength
- B. Stressing may proceed — field-cured cylinders exceeding the specified minimum authorize stressing operations
- C. The engineer must be notified of the early strength gain before any stressing begins
- D. The cylinders must be retested at day seven before stressing authorization is valid

21. A concrete batch ticket shows 7.5 gallons of water were added at the job site. The truck contains 8 cubic yards of concrete. If the original mix design water content was 270 lb/CY and the cement content was 600 lb/CY, what is the new water-cement ratio after the job-site addition?

- A. 0.452 — still within the 0.45 maximum for moderate exposure
- B. 0.534 — the job-site water addition has caused a significant w/c ratio increase
- C. 0.496 — slightly above the 0.45 maximum for moderate freeze-thaw exposure
- D. 0.468 — marginally above the 0.45 maximum for severe exposure conditions

22. A reinforced concrete column under combined axial load and bending moment is failing in which of the following modes if the failure initiates by crushing of the concrete in the compression zone before the tension steel yields?

- A. Compression-controlled failure — occurs when the concrete crushes before the steel yields, indicating a brittle failure mode
- B. Balanced failure — occurring when concrete crushing and steel yielding happen simultaneously
- C. Tension-controlled failure — occurring when steel yields well before concrete crushes
- D. Shear failure — occurring when diagonal tension cracks form before flexural capacity is reached

23. A concrete contractor is estimating the number of form ties required for a 20-foot-long, 10-foot-tall wall form. The form ties are spaced at 2 feet on center horizontally and 2 feet on center vertically. How many form ties are needed for one side of this wall section?

- A. 40 ties
- B. 45 ties
- C. 50 ties
- D. 55 ties

24. Which of the following correctly describes the "modulus of rupture" of concrete and how it differs from compressive strength?

- A. The modulus of rupture measures tensile strength in direct tension; compressive strength measures resistance to crushing
- B. The modulus of rupture measures flexural tensile strength in bending; it is approximately $7.5\sqrt{f'_c}$ for normal weight concrete
- C. The modulus of rupture equals 0.45 times the compressive strength and is used for long-term deflection
- D. The modulus of rupture measures shear strength across diagonal crack planes in beams

25. ACI 318 Table 19.2.1.1 establishes the minimum specified compressive strength for structural concrete. For normal weight concrete used in structures not subject to special exposure classes, the minimum f_c is which of the following?

- A. 2,000 psi minimum for all structural concrete regardless of application
- B. 3,500 psi minimum for all cast-in-place structural concrete per ACI 318
- C. 2,500 psi minimum for structural concrete under ACI 318 for normal weight concrete
- D. 3,000 psi minimum for all structural concrete regardless of exposure classification

26. A concrete mix design requires that entrained air be tested and confirmed within the specified range before each placement. The test method used for measuring air content in fresh concrete is which of the following?

- A. ASTM C231 — the pressure method for determining air content of freshly mixed concrete
- B. ASTM C143 — the standard slump test method for workability measurement
- C. ASTM C39 — the standard test for compressive strength of cylindrical concrete specimens
- D. ASTM C78 — the flexural strength test for concrete modulus of rupture

27. A contractor pours a concrete slab on grade during a period of light rain. The rain falls on the fresh concrete surface before finishing is complete. What is the primary structural concern with rain falling on unfinished concrete?

- A. Rain causes the concrete to set too rapidly by adding calcium to the hydration reaction
- B. Rain cools the surface too quickly, causing differential thermal cracking between surface and core
- C. Rain on fresh concrete surface is acceptable — it is equivalent to wet curing
- D. Rain dilutes the surface paste, increases the w/c ratio at the surface, and weakens the surface layer — reducing hardness and durability

METALS — 12 Questions

28. A contractor receives a delivery of structural steel and finds that several W-shape beams have minor surface rust on the flanges. The project specifications state "ASTM A992 structural steel — paint per SSPC-SP3 power tool cleaning." Which of the following is the most appropriate action?

- A. Reject the steel — surface rust is a structural deficiency that voids the ASTM certification
- B. Accept the steel — minor surface rust on structural steel is acceptable per ASTM A992 and does not affect structural capacity; cleaning and painting per SSPC-SP3 will address the surface condition
- C. Require the steel to be hot-dip galvanized before erection to prevent further corrosion
- D. Accept only beams that will be concealed in the final construction — reject exposed beams

29. A steel fabricator submits a request for information asking whether ASTM A572 Grade 50 steel can be substituted for the specified ASTM A992 steel for wide flange columns. The structural engineer's response should be based on which of the following technical considerations?

- A. Both grades have the same 50 ksi yield strength — substitution is always acceptable
- B. ASTM A572 Grade 50 does not include the yield-to-tensile ratio cap required by ASTM A992
- C. ASTM A572 has a higher carbon content making field welding more difficult
- D. ASTM A572 is not available in W-shape profiles making the substitution impractical

30. Under SJI specifications, which of the following is the correct procedure when a K-series steel joist is found to have a damaged connector plate (knuckle) at a web-to-chord joint during a site inspection?

- A. The joist may be loaded to 50% of its design capacity until the repair is made
- B. The damaged joist must be replaced or repaired under the supervision of a structural engineer before any construction loads are applied
- C. Minor connector plate damage is acceptable if the affected web member is in compression
- D. The joist may be used if the damaged chord is the bottom chord in a standard simple span

31. A crane is lifting a 35,000-pound structural steel assembly at a 40-foot radius. The crane load chart shows a rated capacity of 55,000 pounds at this radius. The lift represents what percentage of rated capacity, and which of the following describes the operational status?

- A. 75% of rated capacity — requires a formal lift plan and pre-lift safety meeting
- B. 64% of rated capacity — acceptable but requires a second rigger to assist with positioning
- C. 82% of rated capacity — classified as a critical lift requiring engineer oversight
- D. 64% of rated capacity — well within standard operating parameters; proceed with normal rigging procedures

32. Under AISC Chapter J, when determining the shear capacity of a bolted connection, which of the following correctly describes the difference between a bearing-type connection and a slip-critical connection?

- A. Bearing connections rely on bolt shear and plate bearing; slip-critical connections rely on friction between faying surfaces
- B. Bearing connections are used only in seismic regions; slip-critical connections are used in standard gravity applications
- C. Bearing connections require A490 bolts; slip-critical connections use A325 bolts exclusively
- D. Bearing connections transfer force through plate bending; slip-critical connections transfer through bolt tension

33. A steel erection crew completes a structural bay and moves to the next bay. Before leaving the completed bay, they must verify that which of the following has been accomplished per OSHA Subpart R?

- A. All deck panels in the completed bay have been welded at every flute per SDI requirements
- B. All shear studs in the completed bay have been installed and hammer-tested for acceptance
- C. All final permanent connections have been made and the bay is structurally stable before the crew moves to the next erection area
- D. The bay has been inspected by a special inspector and approved before erection can continue

34. Structural steel hollow structural sections (HSS) used as columns in a parking structure require corrosion protection. The most critical location for corrosion protection on closed HSS columns is which of the following?

- A. All exposed surfaces including the exterior of the HSS column throughout its height
- B. The base of the column where moisture and deicing chemicals are most concentrated
- C. The top of the column where rainwater collects in the open end of the section
- D. The connection plates welded to the HSS column where weld heat affects the surface finish

35. Under OSHA Subpart R, the specific requirement for protecting workers from the hazard of falling objects during steel erection operations includes which of the following measures?

- A. Installing a debris net below all steel erection operations at a maximum of 6 feet below work
- B. Requiring all workers in steel erection areas to wear impact-resistant safety glasses
- C. Requiring a safety observer to be positioned below all erection activities at all times
- D. Establishing a controlled access zone below the erection area and securing all tools and materials against displacement

36. A structural drawing shows a steel beam with the note "camber 3/4-inch." This means the beam should be fabricated with which of the following geometric condition?

- A. A 3/4-inch sweep (lateral bow) in the horizontal plane to accommodate thermal expansion
- B. A 3/4-inch upward bow (precamber) at midspan to offset anticipated dead load deflection
- C. A 3/4-inch taper in flange width from one end to the other for architectural purposes
- D. A 3/4-inch vertical offset at the splice connection to accommodate beam alignment

37. Which of the following correctly describes the function of diagonal brace members in an X-brace configuration under lateral loads?

- A. Both diagonal members act in compression simultaneously when lateral loads are applied
- B. Both diagonal members act in tension simultaneously regardless of lateral load direction
- C. One diagonal member acts in tension and the other acts in compression depending on the direction of the lateral load
- D. Both diagonal members carry equal loads in bending regardless of lateral load direction

38. A steel detailer prepares connection details showing 3/8-inch fillet welds at beam web connections. The structural specification requires a minimum 5/16-inch fillet weld for the base metal thickness involved. Which of the following describes this condition?

- A. The 3/8-inch weld is acceptable — it exceeds the specified minimum weld size
- B. The 3/8-inch weld must be rejected — it exceeds the maximum weld size permitted
- C. The details must be resubmitted with the exact specified minimum size of 5/16 inch
- D. The larger weld size requires additional quality control testing per AWS D1.1

39. Under OSHA construction standards, a crane operator must hold which of the following qualifications before operating a crane on a construction site?

- A. Completion of a 40-hour safety course and a written examination from any OSHA-approved provider
- B. A state-issued crane operator license obtained through the NC Department of Labor
- C. Certification from an accredited crane operator testing organization or a qualification from the employer meeting specified criteria
- D. At least five years of documented crane operating experience verified by previous employers

CARPENTRY — 7 Questions

40. A contractor is framing a wood-framed gable wall at the end of a building that will be exposed to 130-mph design wind speeds in a coastal NC county. Under the IRC and WFCM (Wood Frame Construction Manual), which of the following additional framing requirements applies to gable end walls in high-wind areas compared to standard framing?

- A. The gable end wall must be framed with 2×8 studs rather than 2×6 studs
- B. Continuous lateral bracing must be installed at mid-height of all gable end wall studs
- C. Rafter connections must use only fully threaded structural screws rather than nails
- D. The gable end stud spacing must be reduced to 12 inches on center from the standard 16 inches

41. A wood-framed exterior bearing wall is interrupted by a 12-foot-wide garage door opening. The structural engineer specifies a built-up LVL header for this opening. Which of the following describes the correct installation orientation for an LVL header?

- A. LVL headers are installed with the laminations horizontal — parallel to the floor
- B. LVL headers must be installed with the laminations in the vertical plane — on edge — to maximize bending strength in the correct direction
- C. LVL headers may be installed in any orientation as long as the correct number of plies is used
- D. LVL headers are installed flat with the widest face horizontal to maximize bearing area

42. Under BCSI, the minimum number of top chord lateral bracing members that must be installed before the crane is released from a newly erected truss is which of the following?

- A. At least three lateral braces connecting the new truss to the previously erected trusses before crane release
- B. The crane may be released without bracing if the truss is properly nailed to the top plate below
- C. The crane must remain connected until the full permanent bracing system is installed

D. At least two lateral braces connecting the new truss to the adjacent previously set truss before crane release

43. A platform-framed residential structure has a crawlspace foundation. The wood floor framing bears on a wood sill plate that is anchored to the top of the masonry foundation wall. Under IRC Section R317, which type of lumber is required for this sill plate application?

A. Grade No. 1 Douglas Fir-Larch — the minimum structural grade for bearing applications

B. Select Structural southern pine — required for all foundation bearing applications

C. Naturally decay-resistant species such as redwood or cedar, or equivalent

D. Pressure-treated lumber or naturally decay-resistant species — required because the sill contacts concrete or masonry

44. A carpenter is installing hardwood strip flooring over a concrete slab that tested at a moisture vapor emission rate (MVER) of 6.2 lb/1,000 SF/24 hours. The hardwood flooring manufacturer specifies a maximum MVER of 3.0 lb/1,000 SF/24 hours for direct nail installation. Which of the following is the correct action?

A. Proceed with installation using a thicker vapor barrier under the flooring

B. Install a moisture mitigation system — epoxy coating or polyurethane membrane — to reduce the vapor emission to within the manufacturer's limits before installation

C. Allow additional time for the slab to dry and retest after 30 days before making a decision

D. Install the hardwood over a sleeper system to provide air space between the slab and flooring

45. Which of the following correctly describes the structural role of a ridge board in conventional stick-framed roof construction?

A. The ridge board is a structural member that carries the vertical loads from the rafter tops as a beam

B. The ridge board transfers wind uplift forces from the roof to the exterior wall top plates

C. The ridge board provides a nailing surface for opposing rafters but carries no structural load when properly framed with ceiling joists or collar ties

D. The ridge board acts as a compression strut between the two opposing gable end walls

46. A wood-framed floor system meets the live load deflection limit of $L/360$ but occupants report a springy, bouncy feeling when walking. The floor uses 2×10 joists at 16 inches OC spanning 16 feet. The engineer confirms deflection compliance but notes that the natural frequency of the floor system may be causing vibration perception. The most effective intervention to address floor vibration without adding structure below is which of the following?

A. Installing blocking panels between joists at mid-span to increase the floor system's natural frequency and stiffness against vibration

B. Replacing the OSB subfloor with $3/4$ -inch solid hardwood planking to add mass

C. Installing resilient channels between the subfloor and joists to dampen vibration transmission

D. Adding a second layer of $1/2$ -inch gypsum board to the ceiling below to increase system mass

BUSINESS AND LAW — 7 Questions

47. After a general contractor discovers that the owner has stopped payments, the contractor's most critical first action to preserve lien rights while managing project risks is which of the following?

A. File a complaint with the NCLBGC against the owner for non-payment

B. Immediately terminate all subcontracts to limit the general contractor's financial exposure

C. Negotiate a payment plan with the owner before taking any legal action

D. Stop work and track the last date of furnishing labor or materials carefully — this date starts the 120-day lien filing clock

48. A subcontractor submits a pay application to the general contractor showing \$85,000 in completed work. The general contractor disputes \$15,000 of the application claiming the work is defective. Under NC Prompt Pay Act principles, which of the following best describes the general contractor's payment obligation?

- A. The general contractor may withhold the full \$85,000 pending resolution of the defect claim
- B. The general contractor must pay the undisputed \$70,000 within seven days of receiving owner payment while retaining the \$15,000 pending resolution
- C. The general contractor may delay payment of the entire application until the defect dispute is resolved
- D. The general contractor must pay the full \$85,000 and pursue the defect as a back-charge

49. A licensed NC Building Contractor is awarded a design-build contract that includes architectural design services and construction of a commercial building. The contractor plans to hire a licensed architect as a consultant to provide the design. Which of the following correctly describes the contractor's authority under their Building Contractor license?

- A. Building Contractor licenses automatically include design authority for all building types
- B. Design authority requires a separate engineering license from the NC Board of Examiners
- C. The contractor may manage the construction scope but must ensure that design services are provided by and under the responsible charge of a licensed architect or engineer
- D. Design-build contracts are exempt from professional licensing requirements in North Carolina

50. Under North Carolina law, a contractor who submits a false certification of lien waivers to induce an owner to release payment may face which of the following legal consequences beyond a civil breach of contract claim?

- A. Mandatory mediation followed by binding arbitration under the NC Construction Arbitration Act
- B. License revocation by the NCLBGC and potential criminal prosecution for fraud or obtaining property by false pretenses
- C. A civil fine assessed by the NC Department of Commerce for deceptive trade practices
- D. Automatic forfeiture of all retained contract rights and a suspension of bidding privileges

51. A general contractor's company overhead rate is 12% of total project cost. The contractor wins a project at a total bid price of \$4,200,000. If direct project costs total \$3,600,000 and company overhead is \$504,000 (12% of direct costs plus general conditions), what is the contractor's net profit on this project?

- A. \$96,000 — approximately 2.3% net profit margin on total contract revenue
- B. \$126,000 — approximately 3.0% net profit margin on total contract revenue
- C. \$168,000 — approximately 4.0% net profit margin on total contract revenue
- D. \$96,000 — calculated as revenue minus direct costs minus overhead

52. An owner discovers construction defects in a newly completed building and files a lawsuit against the general contractor two years after project completion. The general contractor's commercial general liability policy was a claims-made policy that expired one year after project completion without tail coverage being purchased. Which of the following describes the insurance coverage situation?

- A. The GC's current CGL policy covers the claim because the building was constructed during its policy period
- B. There is no CGL coverage for this claim — the claims-made policy expired before the claim was filed and no tail coverage was purchased
- C. The claim is covered under the completed operations portion of the expired policy
- D. The owner's property insurance provides coverage for construction defect claims after occupancy

53. Under the NC Contractors Licensing law, which of the following actions by a licensed contractor constitutes "aiding and abetting" unlicensed contracting and is subject to Board disciplinary action?

- A. Hiring an unlicensed laborer to perform unskilled work on a licensed project
- B. Subcontracting specialty trade work to a licensed trade contractor under the GC's supervision
- C. Allowing an unlicensed person or entity to use the contractor's license to bid or perform work they could not otherwise obtain
- D. Using a licensed subcontractor from another state that does not hold a current NC license

54. A construction company is transitioning from a sole proprietorship to an LLC. The owner wants to transfer the existing NC general contractors license to the new LLC. Under NCLBGC rules, which of the following is required?

- A. Submit a transfer application to the Board with a \$50 administrative fee within 30 days
- B. The existing license may be transferred to the LLC because the same qualifier and owner are involved
- C. Obtain letters of reference from three clients confirming the transition has been communicated
- D. The LLC must apply for a new license as a separate legal entity — licenses are not transferable between entities

SITE WORK — 6 Questions

55. A contractor discovers an existing culvert not shown on any drawings during site grading. The culvert appears to be at the same elevation as the proposed building pad requiring grading through this area. After notifying the engineer and owner, the most important next step for the contractor is which of the following?

- A. Immediately backfill over the culvert and continue grading to the design elevation
- B. Demolish the culvert and install a new culvert at the required depth per the grading plan
- C. Continue work around the culvert while the RFI is being resolved to maintain schedule
- D. Stop all work in the affected area and await written direction from the engineer before proceeding

56. The NC Administrative Code requires that a copy of the approved Erosion and Sedimentation Control Plan be kept on site at all times during land-disturbing activities. An inspector visits a 1.5-acre commercial construction site and the superintendent cannot locate the plan. The inspector observes that all installed BMPs appear to be functional and properly maintained. Which of the following describes the compliance status?

- A. The site is in full compliance — BMP performance is the only criterion that matters
- B. The site is in violation — failure to maintain the approved plan on site is a specific regulatory requirement regardless of BMP performance

- C. The inspector may not issue a violation if all BMPs are functioning correctly
- D. The contractor has 48 hours to produce the plan before a violation may be issued

57. A sewer line runs 400 feet from Manhole A at elevation 228.40 to Manhole B. The minimum required slope is 0.7% to maintain self-cleansing velocity for a 10-inch pipe carrying industrial wastewater. What is the minimum required invert elevation at Manhole B?

- A. 226.40 — calculated using a 0.5% slope over 400 feet
- B. 227.60 — calculated using a 0.3% slope over 400 feet
- C. 225.60 — calculated using the required 0.7% slope over 400 feet
- D. 224.80 — calculated using a 0.9% slope over 400 feet

58. A site grading plan shows a finish grade elevation of 312.5 feet at a building corner. The existing grade at the same location is 308.7 feet. This location requires which of the following earthwork operations?

- A. Fill — placing and compacting soil to raise the existing grade 3.8 feet to the design elevation
- B. Cut — excavating soil to lower the existing grade to the design elevation
- C. No earthwork — the difference is within normal surveying tolerance
- D. Both cut and fill — the existing grade must be cut and re-compacted to achieve stability

59. A contractor is installing underground conduit for a telecommunications system using directional boring under an existing roadway. Before beginning the boring operation, which of the following is the most critical pre-boring requirement?

- A. Obtaining a road closure permit from the local municipality for the crossing location
- B. Completing a soil investigation to verify the boring path is free of obstructions
- C. Notifying NCDOT of the intent to bore under the state road right-of-way
- D. Calling NC 811 to have all utilities in the boring path located and marked before drilling

60. An erosion control inspector visits a site and observes that a temporary sediment basin is overflowing over the emergency spillway during a moderate rainfall event. The basin was sized per the approved plan. Which of the following is the most likely explanation for the overflow?

- A. The basin was constructed at the correct size but the design storm has been exceeded
- B. The outlet riser pipe perforations are partially blocked by sediment accumulation
- C. The basin sediment has accumulated beyond 50% of capacity, significantly reducing storage volume and causing premature overflow
- D. The basin's emergency spillway elevation is lower than the principal spillway outlet elevation

MASONRY — 6 Questions

61. A masonry contractor is constructing a brick veneer wall system. The brick veneer is attached to a steel stud backup framing system. Which of the following correctly describes the structural role of the brick veneer in this assembly?

- A. The brick veneer shares gravity load-carrying capacity with the steel stud backup
- B. The brick veneer provides the primary lateral resistance against wind loads for the building
- C. The brick veneer carries only its own self-weight — it is a non-structural cladding element
- D. The brick veneer and steel stud system act compositely to resist both gravity and lateral loads

62. A masonry contractor discovers that 60 standard modular bricks have been inadvertently laid in a stack bond pattern in a section of an exterior wall that is specified to be in running bond. The mortar has hardened. Which of the following is the correct action?

- A. Remove and reinstall all 60 bricks in the correct running bond pattern before the wall construction proceeds above this point
- B. Install horizontal joint reinforcement at 16-inch vertical spacing throughout the affected section and continue construction

C. Document the deviation and obtain a formal engineering review before deciding whether correction is necessary

D. Install a pilaster on each side of the affected section to provide additional lateral support

63. Under ACI 530, the maximum grout pour height for coarse grout in a reinforced masonry assembly with a grout space of 3 inches by 3 inches — the largest standard space — is which of the following?

A. 12 feet maximum pour height for the largest standard coarse grout space

B. 18 feet maximum pour height for the largest standard coarse grout space

C. 5 feet maximum pour height for all coarse grout applications regardless of space size

D. 24 feet maximum pour height for coarse grout in a 3×3-inch minimum space

64. A mason is constructing an exterior CMU wall and notices that the CMU units received have visible surface crazing (fine surface cracks on the face shell). Under ASTM C90, surface crazing of CMU units is which of the following?

A. Cause for rejection — crazing indicates inadequate curing and reduces compressive strength

B. Acceptable — ASTM C90 permits surface crazing that does not reduce the unit below minimum strength requirements

C. Cause for rejection only if the crazing extends through the full face shell thickness

D. Acceptable only in non-load-bearing interior applications where strength is not critical

65. A masonry contractor proposes using retempering to restore the workability of mortar that has been in the mortar board for 90 minutes and has begun to stiffen. The ambient temperature is 85°F and the mortar appears to have partially set. Under ASTM C270 and industry standards, which of the following applies?

A. Retempering is acceptable because mortar workability must be maintained for productivity

B. The mortar may be retempered one time only with no more than 1 pint of water per batch

C. The mortar has likely begun initial set and must be discarded — retempering partially set mortar produces severely weakened bond strength

D. Retempering is acceptable if the mortar is remixed for a minimum of 5 minutes after water addition

66. Under ACI 530, pilasters in masonry walls serve which of the following structural purposes?

A. Providing a bearing surface for steel beam and joist connections to the masonry wall

B. Interrupting the plane of the wall to control crack propagation at regular intervals

C. Creating architectural texture and shadow patterns on the building exterior

D. Increasing the wall's resistance to lateral loads by acting as stiffening ribs that reduce the effective span of the wall between lateral supports

ROOFING — 6 Questions

67. A roofing membrane on a commercial low-slope roof is being inspected before application of a roof coating. The inspector finds areas where the EPDM membrane has lifted from the insulation substrate but the seams are intact. This condition — called membrane tenting or bridging — is most likely caused by which of the following?

A. UV degradation of the membrane surface causing the rubber to shrink away from the substrate

B. Foot traffic during maintenance operations pressing down on the membrane between seams

C. Moisture or temperature differential causing membrane expansion while seam restraint prevents uniform expansion

D. Inadequate adhesive coverage during the original membrane installation in these areas

68. A roofing contractor is installing metal flashing at the base of a parapet wall on a commercial low-slope roof. The base flashing extends up the vertical face of the parapet. The minimum height that base flashing must extend up the vertical face of the parapet wall is which of the following?

A. 4 inches minimum above the finished roof surface for all parapet base flashing

B. 8 inches minimum above the finished roof surface for parapet base flashing

- C. 6 inches minimum above the finished roof surface for parapet base flashing
- D. 12 inches minimum above the finished roof surface for parapet base flashing

69. A commercial building owner wants to install a new TPO membrane over an existing single-ply EPDM membrane. The EPDM is intact and well-adhered. Before proceeding, which of the following conditions must be verified?

- A. The EPDM must be removed — different membrane systems cannot be layered
- B. A test section must be installed and monitored for 30 days before full application
- C. The existing EPDM is compatible with the new TPO adhesive, the deck can support the additional load, and local code permits the overlay
- D. The TPO manufacturer's warranty requires minimum 30°F temperature for adhesive application

70. A standing seam metal roof panel develops a loud popping or clicking sound during temperature changes. This noise is caused by which of the following?

- A. The panel clips are binding rather than allowing free thermal movement of the panels
- B. The ridge cap is loose and vibrating in wind before thermal expansion occurs
- C. The panel sidelap seams are unlocked and shifting under temperature-induced movement
- D. The structural purlins are deflecting under thermal loads causing panel stress

71. Under the NC Building Code, roofing materials and assemblies must be tested and rated for wind uplift resistance. In coastal counties with ASCE 7 design wind speeds exceeding 130 mph, which of the following additional requirements typically applies to asphalt shingle installations?

- A. Only Class F (110 mph) rated shingles are required for all NC coastal installations
- B. Enhanced fastening with ring-shank nails and six nails per shingle is typically required
- C. Metal roofing must be substituted for asphalt shingles in all coastal county applications
- D. Double underlayment is the only additional requirement for high-wind coastal installations

72. A roofing contractor is installing a two-ply modified bitumen system using a torch-applied APP cap sheet over a self-adhering SBS base sheet. The base sheet must be fully adhered to the insulation before the cap sheet is applied. Which of the following correctly describes the application sequence?

- A. Install the base sheet first without adhesive, torch the cap sheet over it, then torch the base sheet edges to adhere
- B. Torch the cap sheet first to create a finished surface, then self-adhere the base sheet beneath it
- C. Self-adhere the base sheet to the insulation first, allow it to cure per the manufacturer's requirements, then torch-apply the cap sheet over the base sheet
- D. Apply both sheets simultaneously using a two-man crew with one rolling base sheet and one torching cap sheet

73. A roofing system's R-value is primarily provided by the insulation layer, not the membrane. For a commercial low-slope roof requiring R-30 total insulation value using polyisocyanurate (polyiso) insulation at R-6 per inch, which of the following installation configurations meets the requirement?

- A. One layer of 4-inch polyiso providing R-24 — slightly below the R-30 requirement
- B. One 5-inch thick single layer of polyiso — providing R-30 in the most economical configuration
- C. Two layers of 2-1/2 inch polyiso totaling 5 inches — providing R-30 with staggered joints
- D. Three layers of 1-1/2 inch polyiso — providing R-27, slightly below the requirement

SPORTS FIELDS — 5 Questions

74. A natural turf soccer field is being constructed with a sand-based USGA root zone. The specification requires the root zone to be installed at a depth of 12 inches. After compaction and fine grading, the installed depth measures 10-1/2 inches in multiple locations. Which of the following actions is required?

- A. Accept the field if the average of all measurements meets 12 inches minimum depth
- B. Apply a 2-inch topdressing of the root zone mix to all deficient areas after the turf is established

C. Install the turf immediately and rely on annual core aeration and topdressing to build up the root zone depth over time

D. Remove deficient areas down to the gravel drainage blanket and reinstall the root zone mix to the full 12-inch specified depth before proceeding

75. Under ASTM F1936 (Standard Specification for Shock-Absorbing Properties of North American Football Field Playing Systems), the maximum Gmax value for a playing surface is which of the following?

A. 100 Gmax maximum for all artificial turf playing surfaces

B. 150 Gmax maximum for certified competition artificial turf surfaces

C. 250 Gmax maximum for recreational use artificial turf and natural turf systems

D. 200 Gmax maximum for all football field playing surfaces per ASTM F1936

76. A track and field facility is being designed with a combined running track and spectator seating area. Under ANSI A117.1 and ADA requirements, the accessible route from accessible parking to the accessible spectator seating must have a maximum running slope of which of the following?

A. 1:20 (5%) maximum running slope for the accessible route to spectator seating

B. 1:12 (8.33%) maximum running slope for outdoor accessible routes at athletic facilities

C. 1:16 (6.25%) maximum for outdoor accessible routes in new construction only

D. 1:10 (10%) maximum for routes with intermediate landings every 30 feet

77. A baseball field is being constructed with an infield skin area using a calcined clay material mixed with native soil. The primary purpose of the calcined clay addition is which of the following?

A. Providing a consistent reddish-brown color that distinguishes the infield from the outfield grass

B. Improving the drainage capacity and footing stability of the infield skin under wet conditions

C. Reducing the maintenance requirement for the infield surface during the playing season

D. Hardening the infield surface to produce consistent ball hop characteristics for play

SAFETY (OSHA) — 4 Questions

78. A contractor discovers that workers have been using a suspended scaffold over a public sidewalk without required toeboards or overhead protection for the public below. Under OSHA standards, what type of overhead protection must be provided when workers on a scaffold could drop materials onto passersby below?

- A. A covered walkway providing protection equivalent to that provided by a 2-inch plank floor system
- B. Warning cones placed on the sidewalk to redirect pedestrian traffic around the scaffold
- C. A safety net installed below the scaffold platform level to catch dropped objects
- D. A flagperson stationed at each end of the scaffold to warn pedestrians of the hazard

79. Under OSHA construction standards, which of the following correctly describes when a safety data sheet (SDS) must be accessible to workers?

- A. Only during the worker's initial training on each hazardous chemical used at the site
- B. At the end of each work day when workers may need to reference exposure information
- C. Only when a worker specifically requests access to the SDS for a chemical they are using
- D. During all work shifts while the hazardous chemicals covered by the SDS are present at the site

80. An excavation cave-in on a construction site buries two workers to their waists in soil. Emergency responders begin rescue operations. Under OSHA requirements, which of the following describes the contractor's primary obligation during and after this event?

- A. The contractor must perform the rescue using company employees before calling 911
- B. The contractor must immediately call 911, stop all work in the excavation, protect the victims from further cave-in using shields, and report the incident to NC OSHA within required timeframes

- C. The contractor must complete an internal investigation before notifying NC OSHA of the event
- D. The contractor must notify NC OSHA within 72 hours if any worker requires hospitalization

81. Under OSHA 1926.416, which of the following is the required practice before an employee works on or near electrical equipment that is not de-energized?

- A. The employee must wear rubber-soled footwear and stand on a dry surface
- B. The employee must complete a lockout/tagout procedure on all circuits within 10 feet
- C. All energized parts to which the employee might be exposed must be guarded by insulation or other effective means
- D. The employee must hold a valid OSHA electrical safety certification for the voltage level

ASSOCIATED TRADES — 3 Questions

82. A commercial building's HVAC system specifies R-6 duct insulation on all supply ducts in unconditioned spaces. The contractor proposes substituting R-4 insulation to reduce costs. Which of the following is the correct response?

- A. Accept the substitution — the difference in energy performance is minimal for supply ducts
- B. Reject the substitution — the NC Energy Code and the project specifications establish minimum duct insulation requirements that may not be reduced without documented equivalency review
- C. Accept the substitution only for ducts longer than 20 feet where heat gain is significant
- D. Allow the substitution if the supply air temperature differential is less than 20°F from ambient

83. A resilient flooring installer is preparing to install sheet vinyl over an existing terrazzo floor. The terrazzo has small surface cracks and grout joint lines that are visible through the existing surface. Which of the following preparatory steps is most critical before sheet vinyl installation?

- A. Grinding down the terrazzo surface to eliminate all existing grout lines and surface texture

- B. Installing a self-leveling underlayment over the terrazzo to create a smooth, flat substrate free of surface irregularities
- C. Applying a chemical adhesion primer to the terrazzo to improve adhesive bond strength
- D. Installing a 1/4-inch plywood underlayment over the terrazzo as the bonding substrate

84. A contractor is coordinating the installation of an acoustical ceiling system in a server room where both standard opaque panels and lay-in HVAC supply grilles are required. The most critical coordination step before ceiling grid layout begins is which of the following?

- A. Verifying that the ceiling tile manufacturer's color matches the client's approved sample
- B. Confirming the exact locations of all HVAC supply and return grilles with the mechanical drawings to ensure the grid layout aligns with duct connections above
- C. Scheduling the tile installation after all mechanical equipment has been started and balanced
- D. Verifying that the hanger wire spacing meets seismic bracing requirements for the room

ONE CALL — 2 Questions

85. A property owner wants to plant a tree in their backyard and hires a landscaping contractor to dig a 24-inch-deep hole for the root ball. The landscaping contractor does not submit a locate request to NC 811 because the hole is only 24 inches deep and on private residential property. This situation represents which of the following?

- A. A compliant situation — residential property owners are exempt from NC 811 requirements
- B. A compliant situation — excavations less than 36 inches deep are exempt from notification
- C. A violation of NC 811 law — all excavation regardless of depth or property type requires notification
- D. A minor violation that carries no penalty because no utility was actually damaged

86. A utility locator responds to a NC 811 locate request and marks a gas line with yellow paint flags across a contractor's excavation area. During excavation, the contractor discovers that the actual gas line is 18 inches to the right of the paint mark. The contractor is working within the tolerance zone and is using a backhoe. Which of the following is required?

- A. Stop mechanical excavation and hand dig to expose and verify the exact location of the gas line before resuming mechanical excavation
- B. Continue the backhoe excavation using slow movements — the mark is within the tolerance zone so extra care is sufficient
- C. Contact NC 811 to report the marking discrepancy but continue work with the backhoe at reduced depth
- D. Reject the locate and call a private utility locating service to re-mark the area before continuing

EROSION AND SEDIMENTATION CONTROL — 2 Questions

87. A contractor is beginning a 1.2-acre commercial site grading project. The project is located in a county with a delegated local erosion control program that has adopted a one-half-acre threshold for plan approval. The contractor has not submitted an Erosion and Sedimentation Control Plan to the local program before beginning grading. Which of the following describes the compliance status?

- A. The contractor is in compliance — the state SPCA threshold of one acre has not been exceeded
- B. The contractor is in compliance — the county threshold applies only to residential projects
- C. The contractor is in violation only if sediment has actually left the site and entered a waterway
- D. The contractor is in violation — the local program threshold of one-half acre has been exceeded and plan approval was required before disturbance began

88. An Erosion and Sedimentation Control Plan specifies that a vegetated buffer zone of 30 feet must be maintained along the north boundary of the project, adjacent to an intermittent stream. During construction, a subcontractor's operator clears trees and grades within 10 feet of the stream in the buffer zone area. Which of the following is the most appropriate immediate response?

- A. Document the violation and include it in the weekly site safety report to the owner

- B. Stop the grading work immediately in the buffer zone area, report the violation to DEMLR, and take corrective action to restore the buffer to the extent possible
- C. Notify the subcontractor's supervisor and allow 48 hours to correct the condition before escalating
- D. Continue work and add additional silt fence along the stream edge to compensate for the buffer disturbance

LICENSING — 2 Questions

89. Under NC General Statutes Chapter 87, a complaint against a licensed general contractor alleging abandonment of a project is received by the NCLBGC. Which of the following correctly describes the Board's investigative authority?

- A. The Board may only act after a civil judgment has been obtained against the contractor
- B. The Board has no jurisdiction over contract disputes between private parties
- C. The Board may investigate the complaint, hold a hearing, and impose disciplinary action including license suspension or revocation if the abandonment is substantiated
- D. The Board may assess civil penalties but may not suspend or revoke a license without a court order

LIENS — 1 Question

90. A material supplier delivers roofing materials to a project site. The materials are off-loaded from the truck and stacked in a laydown area on the construction site but have not yet been incorporated into the building. The supplier has not been paid. Which of the following correctly describes the supplier's lien rights under NC Chapter 44A?

- A. The supplier has full lien rights because the materials were delivered to the project site regardless of whether they were incorporated into the improvement
- B. The supplier has lien rights only if the materials are ultimately incorporated into the improvement — stored materials not yet incorporated are generally not lienable until installed
- C. The supplier has no lien rights because they are a material supplier rather than a subcontractor

D. The supplier's lien rights depend on whether the materials were ordered from the general contractor or the owner directly

BUILDING CONTRACTOR

SIMULATION EXAM 7 — ANSWER

KEY

1. C — Volume = $6 \text{ ft} \times 1.5 \text{ ft} \times 150 \text{ ft} = 1,350 \text{ CF} \div 27 = 50 \text{ CY} \times 1.06 = 53 \text{ CY}$. C at 47.3 would require: $47.3 \div 1.06 = 44.6 \text{ CY}$ base. For exam purposes: always convert all dimensions to feet before calculating volume, divide by 27 to get cubic yards, then apply the waste factor — never apply the waste factor before dividing by 27.
2. A — Section cut arrows indicate the direction of view — the observer stands at the cut line and looks in the direction the arrows point. If the arrow points right, the viewer is looking to the right, seeing everything to the right of the cut plane. This convention is universal across all construction disciplines. Reversing the viewing direction produces a mirror image of the intended section and leads to incorrect spatial understanding of the building assembly.
3. D — Material cost = \$38,400. Labor = $3,200 \text{ SF} \times \$12 = \$38,400$. Equipment = \$2,800. Total = $\$38,400 + \$38,400 + \$2,800 = \$79,600$. Always sum all cost components — material, labor, and equipment — before applying markup. Omitting any component from the direct cost total understates the base for overhead and profit calculations, compressing margin on the final bid.
4. B — Group I-2 occupancies are required by the IBC to have automatic fire sprinkler systems installed throughout the entire facility regardless of building size, area, or height. This mandatory sprinkler requirement reflects the critical vulnerability of I-2 occupants — patients, residents, and prisoners — who cannot self-evacuate in an emergency. No size threshold exists for I-2 sprinkler requirements as it does for other occupancy groups.
5. C — Different hatch patterns on the same drawing distinguish between different materials or conditions. When the drawing legend defines a specific pattern for existing concrete, a visually similar but distinctly different pattern — different line weight, spacing, or angle — represents a different material. On renovation drawings, new concrete is consistently distinguished from existing concrete using different hatch conventions. Always refer to the drawing legend before interpreting any hatch or fill pattern.
6. A — Lowest bid = $\$267,000 \times 1.08 \text{ markup} = \$288,360$. The general contractor applies markup to the subcontractor's bid price to cover their overhead and profit on managing the subcontract scope. The 8% markup on \$267,000 produces \$21,360 in additional cost, bringing the total mechanical

line item in the GC's bid to \$288,360. Always apply markup to the subcontractor's price — not to the GC's estimate of the work cost independently.

7. D — The IBC requires a minimum ceiling height of 7 feet 6 inches for habitable rooms in Group R-2 residential occupancies. Non-habitable spaces — hallways, bathrooms, storage — may have lower ceiling heights. The 7-foot 6-inch minimum is a directly tested IBC provision that differs from the 7-foot minimum sometimes referenced for accessory spaces. Using the wrong minimum height in framing layout produces code violations discovered at rough framing inspection.
8. B — "VIF" (verify in field) is a standard construction drawing notation instructing the contractor to measure the actual existing conditions before fabricating or ordering materials for that element. The notation acknowledges that the drawing dimension may not reflect actual field conditions — particularly in renovation projects where as-built dimensions may differ from original drawings. Acting on an unverified VIF dimension is a common source of costly material mismatches.
9. A — Finish schedule notation uses columns for wall, ceiling, and floor finishes respectively. "PT-2 / PT-2 / VCT-3" reads: walls receive Paint Type 2, ceiling receives Paint Type 2, and floor receives VCT Type 3 vinyl composition tile. This three-column format is standard in commercial finish schedules where each room's complete finish package is tabulated. Misreading the column order causes the wrong finish to be installed on the wrong surface.
10. A — $\text{Weight} = 1,440 \text{ LF} \times 1.043 \text{ lb/LF} = 1,501.9 \text{ lb}$. $\text{Cost} = 1,501.9 \times \$0.68 = \$1,021.29$ — rounds to \$1,021. The calculation sequence is: total linear footage \times unit weight per linear foot = total weight in pounds, then \times unit price per pound = total material cost. Never skip the weight conversion step — applying the price per pound directly to linear footage produces an incorrect result.
11. D — Under the IBC, "occupant load" is calculated by dividing the floor area of the space by the applicable occupant load factor from Table 1004.5 — expressed in square feet per person — for the specific use of the space. The calculation produces the design occupant load used for egress sizing, exit count, corridor width, and other life safety determinations. Actual headcounts, posted capacities, and sprinkler design loads are all different values used for different purposes.
12. B — With 27.07 spaces rounded up to 28 spaces, the number of joists = $28 + 1 = 29$. The extra joist accounts for the fact that n spaces require $n+1$ members. Always add one to the number of spaces to get the number of joists — a consistent arithmetic rule that applies to all regularly spaced framing members.
13. C — A concrete cylinder break of 4,150 psi exceeds the specified minimum f_c of 4,000 psi by 3.75%. Higher-than-specified compressive strength is acceptable — ACI 318 sets a minimum, not a maximum. Concrete that exceeds the specified strength provides additional structural margin and does not require retesting, special review, or rejection. The structural engineer designs to the minimum specified strength, so achieving more is always favorable from a structural standpoint.

14. A — The IBC defines a high-rise building as one that has an occupied floor located more than 55 feet above the lowest level of fire department vehicle access. This threshold triggers additional requirements including automatic sprinkler systems, smoke control systems, emergency voice/alarm communication systems, and firefighter emergency operation provisions. Knowing the precise 55-foot threshold is critical for project planning because the high-rise designation significantly increases construction cost and complexity.
15. D — ACI 305 (Hot Weather Concreting) establishes that when the evaporation rate from fresh concrete surfaces reaches or exceeds 0.20 lb/ft²/hr, plastic shrinkage cracking is likely and protective measures must be implemented. At 0.25 lb/ft²/hr, the risk is high and immediate action is required — windbreaks, evaporation retarders, wet curing, or fogging over the fresh surface. Waiting until the rate exceeds a higher threshold results in cracks that cannot be repaired to original strength.
16. B — ACI 318 requires Class B tension lap splices to have a minimum lap length of 1.3 times the development length (l_d) of the bar. Class A splices — used when more than half the bars are spliced at the same location or when the area of steel provided is less than twice that required — require 1.3 l_d . Class A splices in locations where the provided steel area exceeds twice the required area require 1.0 l_d . The 1.3 l_d requirement for Class B is the more common specification tested on licensing exams.
17. C — A vapor barrier beneath a slab on grade prevents moisture migration downward through the concrete. However, bleed water — the excess mix water that naturally rises to the surface during the early hydration period — cannot escape through the bottom. This causes bleed water to accumulate at the top surface at higher volumes than on a slab without a vapor barrier, potentially extending the finishing window and increasing the risk of surface dusting if the finisher works the surface while bleed water is still present.
18. A — Placing concrete through a tremie pipe that extends to the bottom of the water-filled pier excavation is the standard method for underwater concrete placement. The tremie is filled with concrete and gradually withdrawn as concrete rises — the pipe end always remains embedded in the fresh concrete, preventing water from entering and washing out the cement paste. Dropping concrete from height, pumping rapidly, or dewatering first (if groundwater pressure prevents it) all risk cement washout and structural deficiency.
19. D — ACI 318 Section 26.4.2.1 limits maximum aggregate size to three-fourths the minimum clear spacing between individual reinforcing bars and three-fourths the minimum clear cover to the form surface. These dual limitations ensure concrete can flow around reinforcement and into form corners without aggregate bridging that creates honeycombed voids. The three-fourths rule is a directly tested ACI provision on contractor licensing exams.
20. B — Field-cured cylinders are cured under actual job site temperature conditions — unlike standard-cured cylinders maintained at 73°F in the laboratory. When field-cured cylinders exceed

the specified minimum strength, they directly reflect the concrete's in-place condition at the time of testing and provide the most accurate indication that the concrete in the structure has achieved the required strength for stressing. Post-tensioning engineers routinely rely on field-cured cylinders for stressing authorization.

21. C — Additional water = $7.5 \text{ gal} \times 8.33 \text{ lb/gal} = 62.5 \text{ lb total} \div 8 \text{ CY} = 7.8 \text{ lb/CY}$. New water content = $270 + 7.8 = 277.8 \text{ lb/CY}$. New w/c = $277.8 \div 600 = 0.463$. At 0.463, the mix slightly exceeds the 0.45 maximum for severe freeze-thaw exposure with deicing chemicals — a directly code-violating addition. The calculation demonstrates why even modest job-site water additions can push a compliant mix into non-compliance with durability requirements.
22. A — When a concrete column under combined axial load and bending fails by concrete crushing before the tension steel yields, the failure mode is classified as compression-controlled. This is a brittle failure with no warning — the column fails suddenly without significant prior deformation. ACI 318 discourages compression-controlled design in members subject to seismic loads and requires strength reduction factors that account for the reduced ductility of compression-controlled sections.
23. D — Horizontal tie positions: at 0, 2, 4, 6, 8, 10, 12, 14, 16, 18, 20 feet = 11 positions. Vertical tie rows: at 2, 4, 6, 8, 10 feet = 5 rows (ties typically begin at a height above the footing, not at grade). Total ties = $11 \times 5 = 55$. Form tie counts depend on both the horizontal and vertical spacing and whether ties are placed at the wall perimeter or offset from it. Always count both dimensions carefully — the product of positions in each direction gives the total tie count.
24. B — The modulus of rupture (f_r) is the measure of concrete's flexural tensile strength — its resistance to cracking when bent. ACI 318 defines $f_r = 7.5\lambda\sqrt{f'_c}$ for normal weight concrete, where f'_c is in psi and λ is the modification factor for lightweight concrete. The modulus of rupture is approximately 8 to 10 times lower than the compressive strength and is used in deflection calculations and in assessing cracking behavior under service loads.
25. C — ACI 318 Table 19.2.1.1 establishes the minimum specified compressive strength for structural concrete as 2,500 psi for normal weight concrete not subject to special exposure class requirements. Exposure classes for freezing, sulfates, or corrosion may require higher minimums. The 2,500 psi floor represents the threshold below which the ACI code does not provide design provisions for structural use — using lower-strength concrete creates structural inadequacy that cannot be compensated by other means.
26. A — ASTM C231 is the standard pressure method for measuring the air content of freshly mixed concrete. The test uses a calibrated pressure meter with a sealed chamber — the pressure drop when air pressure is applied to the fresh concrete sample is proportional to the air content. This method is applicable to concrete made with normal dense aggregates. ASTM C173 is used for lightweight concrete where the aggregate voids affect the C231 result.

27. D — Rain falling on fresh unfinished concrete dilutes the surface paste, dramatically increasing the water-cement ratio of the surface layer. The weakened surface layer hardens with reduced compressive strength, increased porosity, and reduced abrasion resistance. Rain damage to fresh concrete surfaces produces dusting, scaling, and premature deterioration that cannot be repaired by surface treatments. Stopping placement and protecting the surface — tenting or tarping — is the correct response when rain is imminent.
28. B — Minor surface rust on structural steel is a normal condition resulting from exposure to humidity and moisture after manufacture. ASTM A992 does not require rust-free delivery — the specification governs chemical and mechanical properties of the steel, not its surface condition at delivery. Surface rust does not affect the structural capacity of the steel member. The specified SSPC-SP3 power tool cleaning will remove the surface rust before painting, meeting the surface preparation requirement.
29. C — ASTM A992 was specifically developed for wide flange sections used in seismic moment frames and requires: minimum F_y of 50 ksi, maximum F_y of 65 ksi, maximum yield-to-tensile ratio of 0.85, and a carbon equivalency limit that makes the steel weldable under standard procedures. ASTM A572 Grade 50 lacks the yield-to-tensile ratio cap and the specific chemical limits of A992. In seismic applications, the missing ratio cap means columns could develop higher-than-anticipated yield forces, potentially overloading panel zones and connections not designed for the overage.
30. A — Before the crane releases a newly set steel member, there must be enough bolts installed and tightened to safely hold the member under erection loads. For most bolted connections, this means at least two bolts snug-tight at each connection. A damaged joist must be replaced or repaired under engineering supervision — partially damaged structural members cannot be loaded even partially because their actual residual capacity is unknown and may be inadequate for even reduced construction loads.
31. D — $35,000 \div 55,000 = 63.6\%$ of rated capacity. Crane lifts below 75% of rated capacity are generally considered routine lifts that may proceed with standard rigging procedures and a qualified rigger. Critical lifts — typically defined as those exceeding 75% of rated capacity, lifting over energized lines, or involving unusual conditions — require a formal lift plan. At 64% capacity with no other complicating factors, standard rigging procedures are sufficient.
32. A — Bearing-type bolted connections transfer shear loads through bolt shear and bearing of the bolt against the walls of the bolt holes in the connected plates. Slip-critical connections transfer shear through friction between the clamping surfaces (faying surfaces) generated by the pretension force in the bolts — the bolts must be fully pretensioned and the faying surfaces must meet specified surface condition requirements. Bearing connections allow slip when load exceeds the friction capacity; slip-critical connections are designed to never slip under service loads.

33. C — OSHA Subpart R requires that before the erection crew moves to a new erection area, all permanent connections in the completed bay must be made and the structural frame must be stable. Leaving partially connected bays creates instability that increases the risk of progressive collapse if a member or connection fails during subsequent erection operations in adjacent bays. The fully bolted-up requirement is a sequencing control that ensures structural stability is maintained throughout the erection process.
34. A — Corrosion protection must be applied to all exposed surfaces of steel members throughout their height, including the exterior of HSS columns. While the base is subject to the most aggressive chemical environment from deicing salts and water, unprotected surfaces at any height can initiate corrosion that progresses along the member. For HSS columns specifically, the sealed ends prevent interior corrosion but all exterior surfaces require the specified paint system for the design service life.
35. D — OSHA Subpart R requires that a controlled access zone be established below steel erection operations and that all tools and materials on elevated steel be secured against accidental displacement. Dropped bolts, tools, and connection hardware have caused serious and fatal injuries to workers below erection operations. Securing all materials and establishing a controlled zone beneath the work — preventing worker access without authorization — is the primary falling object protection strategy required by the standard.
36. B — Camber in a structural steel beam is an intentional upward bow built into the beam during fabrication to offset the anticipated downward deflection caused by dead loads in service. A 3/4-inch camber means the beam is fabricated with a 3/4-inch upward curvature at midspan. When dead loads — concrete slab, mechanical systems, and ceiling finishes — are applied, the beam deflects downward by approximately 3/4 inch, resulting in a nearly level beam under service conditions.
37. C — In an X-brace configuration under lateral loads applied in one direction, one diagonal member goes into tension while the other goes into compression. The tension member is fully effective; the compression member may buckle if it is a slender rod or angle. When the lateral load reverses direction — as in seismic events — the roles reverse. Modern seismic design typically accounts for compression member buckling by relying primarily on the tension member's capacity and treating the compression member's contribution as a reduction.
38. A — AWS D1.1 specifies minimum weld sizes based on the base metal thickness, not maximum sizes. Providing a 3/8-inch fillet weld where 5/16 inch is the minimum specified is acceptable — the larger weld provides greater capacity than the minimum required. There is no "too large" concern for fillet welds other than economic efficiency and heat input considerations on thin material. Submitting for correction to match the exact minimum would create unnecessary delay without structural benefit.

39. D — OSHA 1926.1427 requires crane operators to be qualified or certified. Certification must be from an accredited crane operator testing organization such as NCCCO, or the operator may be qualified through an audited employer program that meets specified criteria, or through a government entity program. A written examination alone, state licensure (NC does not require it for most cranes), or experience documentation alone do not meet the OSHA requirement without the certification component from an accredited organization.
40. B — The Wood Frame Construction Manual and IRC provisions for high-wind construction in coastal NC counties require continuous lateral bracing at mid-height of gable end wall studs to reduce the effective unbraced length and increase resistance to wind-induced bending. Gable end walls are particularly vulnerable to wind pressure because they are not triangulated by the roof system — the continuous lateral brace provides the intermediate support needed to prevent stud buckling under design wind loads.
41. C — LVL headers must be installed with the laminations oriented vertically — standing on edge — so that the beam's strong axis aligns with the direction of bending. LVL is manufactured as flat laminations with the grain running parallel to the length of the member. Installing it flat (laminations horizontal) places it in the weak axis orientation, dramatically reducing its bending strength. The on-edge orientation maximizes the section modulus and moment of inertia for vertical load resistance.
42. A — BCSI requires that at least three lateral braces be installed connecting a newly erected truss to the previously erected trusses before the crane is released. Three points of lateral connection provide adequate stability against overturning in either direction along the building length. Two connections might allow rotation about the vertical axis; three connections create stable resistance to the lateral-torsional buckling mode that kills workers when unsupported trusses fail.
43. D — IRC Section R317 requires sill plates bearing on concrete or masonry foundations to be made from pressure-treated lumber or naturally decay-resistant species because the concrete-to-wood contact creates persistent moisture and decay conditions. Pressure treatment with the appropriate retention level — typically 0.25 pcf for above-ground contact or 0.40 pcf for ground contact — provides long-term resistance to fungal decay and insect attack that untreated wood cannot provide in this application.
44. B — When the concrete slab MVER exceeds the hardwood flooring manufacturer's maximum limit, a moisture mitigation system must be installed before proceeding with flooring. Epoxy moisture mitigation coatings or polyurethane membranes reduce vapor transmission to within acceptable limits. Simply using a thicker vapor barrier, waiting for the slab to dry, or installing over sleepers may not reduce the MVER sufficiently or may violate the manufacturer's warranty requirements. The manufacturer's specified mitigation method must be followed to maintain warranty coverage.

45. C — In conventional stick-framed roofs, the ridge board is not a structural beam — it is simply a nailing surface that connects the tops of opposing rafters and holds them in alignment. Structural stability against outward thrust is provided by the ceiling joists or collar ties that tie the opposing rafter feet together. If a ridge board is improperly supported or removed, the structure does not collapse because the actual structural work is done by the ceiling joists below. This is a commonly misunderstood structural principle in wood roof framing.
46. A — Installing blocking panels between joists at midspan increases the stiffness and natural frequency of the floor system by engaging multiple joists to act together under point loads. Higher natural frequency moves the floor system away from the frequency range of walking excitation (1.8 to 2.2 Hz for normal walking), reducing the resonant response that causes vibration perception. Blocking is the most accessible and cost-effective intervention for an already-framed floor where deflection technically meets code but vibration is objectionable.
47. D — When an owner stops payment on a private project, the most time-critical action is to stop incurring additional unpaid costs and to carefully track the last date of furnishing labor or materials — because this date starts the 120-day clock for filing a Claim of Lien on Real Property. Missing the 120-day deadline permanently eliminates the lien remedy. Stopping work preserves the last-furnishing date at the current amount and prevents the contractor from digging a deeper financial hole on an unpaid project.
48. B — The NC Prompt Pay Act principle requires that undisputed amounts be paid promptly while disputed amounts may be withheld pending resolution. The general contractor must pay the undisputed \$70,000 within seven days of receiving the corresponding owner payment and may retain the disputed \$15,000 while the defect claim is investigated and resolved. Withholding the full application amount because of a partial dispute violates the prompt payment obligation for the undisputed portion.
49. C — A Building Contractor license authorizes construction work but does not include the authority to provide architectural or engineering design services. Design-build projects require that the design services be performed by and under the responsible charge of licensed architects and engineers as required by their respective NC licensing boards. The contractor may serve as the design-build entity — managing both design and construction — but must engage licensed design professionals for the architectural and engineering design components.
50. A — Submitting false lien waiver certifications to induce payment constitutes fraud and obtaining property by false pretenses under NC General Statutes — both criminal offenses. The NCLBGC may also investigate and revoke the contractor's license as a disciplinary matter because the conduct reflects directly on the contractor's fitness and integrity. The combination of criminal prosecution potential and license revocation makes false lien waiver submissions one of the most serious acts a contractor can commit.

51. D — Revenue \$4,200,000 – direct costs \$3,600,000 – overhead \$504,000 = \$96,000 net profit. The calculation simply subtracts all costs from the total contract revenue. This represents approximately a 2.3% net profit margin on total revenue — a thin but positive margin. Understanding the difference between gross profit (revenue minus direct costs) and net profit (revenue minus all costs including overhead) is essential for accurate financial management of a contracting business.
52. B — A claims-made CGL policy covers only claims that are both reported during the policy period and arising from occurrences during the policy period. When a claims-made policy expires without tail coverage (extended reporting period endorsement), any claim filed after expiration has no coverage regardless of when the underlying construction occurred. Without tail coverage, the contractor has a gap in completed operations coverage that exposes them to uninsured construction defect liability for the full statute of limitations period.
53. C — "License lending" — allowing an unlicensed person or entity to use a contractor's license to bid or perform work they could not legally obtain — is specifically prohibited under NC Chapter 87 and is grounds for Board disciplinary action. This practice undermines the entire purpose of contractor licensing, which is to ensure that only qualified, examined individuals are performing licensed construction work. License lending exposes the license holder to disciplinary action, civil liability, and potentially criminal exposure for any harm caused by the unlicensed operator.
54. A — When a business entity converts its legal structure — from a sole proprietorship to an LLC, from a partnership to a corporation — a new legal entity is created. NC contractor licenses are issued to specific legal entities and are non-transferable. The new LLC must apply to the NCLBGC for its own license as a new applicant, even if the same qualifier and owner are involved. The existing sole proprietorship license cannot simply be assigned to the LLC, and operating under the old license after conversion constitutes operating without a license.
55. D — When an undisclosed existing utility or drainage structure is discovered during construction, the correct immediate response is to stop all work in the affected area and await written direction from the engineer before proceeding. The engineer must evaluate the impact on the design, determine whether the existing structure affects the project design, and provide specific instructions for how to proceed. Proceeding without direction risks damaging the structure, creating liability, and implementing an incorrect solution that must be undone.
56. B — The NC Administrative Code requires that the approved Erosion and Sedimentation Control Plan be maintained on site at all times during land-disturbing activities and be available for inspection upon request. Failure to have the plan on site is a specific, independent regulatory violation even if all BMPs are functioning correctly. The plan must be present because inspectors use it to verify that the installed measures match the approved design and to assess compliance with phasing and sequencing requirements.

57. C — Minimum invert elevation at Manhole B = $228.40 - (0.007 \times 400) = 228.40 - 2.80 = 225.60$. The 0.7% minimum slope requires 0.007 feet of drop per linear foot of pipe. Over 400 feet, the total required drop is 2.80 feet. Subtracting from the upstream invert gives the minimum downstream invert elevation. Pipe slope calculations must use the slope as a decimal — 0.7% = 0.007 — and multiply by the pipe length to get the total fall.
58. A — The finish grade at 312.5 feet is higher than the existing grade at 308.7 feet by 3.8 feet. When the design elevation is higher than the existing ground surface, the earthwork operation required is fill — placing and compacting soil to raise the grade. When design is lower than existing, the operation is cut (excavation). Understanding cut versus fill from grade relationships is a fundamental earthwork concept tested in plan reading and estimating sections of the licensing exam.
59. D — Before any directional boring operation — regardless of whether it is under a roadway, building, or open ground — a locate request must be submitted to NC 811 to have all underground utilities in the bore path identified and marked. Directional boring without utility locates is prohibited by NC 811 law because a bore head traveling underground can strike gas lines, electric conduits, and fiber optic cables at distances that the operator cannot see from the surface, creating severe hazards.
60. B — When a sediment basin fills to capacity with accumulated sediment, the effective storage volume for capturing new runoff is dramatically reduced. Partially blocked outlet riser perforations prevent normal outflow, causing the water level to rise more rapidly than designed and reaching the emergency spillway prematurely. A sediment-filled basin and blocked riser act together to eliminate the basin's buffering capacity, making overflow during even moderate storms the expected result rather than an emergency condition.
61. C — Brick veneer walls are non-structural cladding systems — the veneer carries only its own self-weight, which is transferred to a shelf angle or foundation ledge at each floor level. Lateral wind loads are transferred from the veneer through wall ties to the structural backup system — steel studs, CMU, or concrete — which carries these loads to the structure. The structural backup, not the veneer, provides the building's lateral resistance. This distinction between veneer and structural masonry is critical for both design and construction management.
62. A — Stack bond masonry lacks the interlocking that running bond provides, making it structurally inferior for lateral load resistance. In a structurally engineered exterior masonry wall, the bond pattern is a structural specification — not an aesthetic choice — and the running bond requirement must be met. All 60 incorrectly laid bricks must be removed and reinstalled in the correct running bond pattern before construction continues above this point. Supplemental reinforcement does not fully compensate for the structural deficiency of an incorrect bond pattern in this location.
63. D — ACI 530 permits coarse grout to be placed in pours up to 24 feet high when the minimum grout space dimension is 3 inches by 3 inches. This maximum pour height for the largest grout

space configuration is a directly tested masonry code provision. The high-lift grouting method with 3×3-inch spaces and coarse grout is the most efficient masonry grouting configuration, allowing 24-foot-tall walls to be grouted in a single continuous operation with mandatory reconsolidation.

64. B — ASTM C90 permits surface crazing on CMU face shells provided the units meet all minimum mechanical and dimensional requirements. Crazing — a network of fine surface cracks — is a cosmetic condition that occurs during rapid initial drying of the unit and does not indicate structural weakness if the unit's compressive strength, absorption, and dimensional tolerances comply with the standard's requirements. The units must be tested and accepted based on their measured properties, not rejected on the basis of surface appearance alone.
65. C — Mortar that has begun initial set has crossed a chemical threshold that cannot be reversed by adding water. The calcium silicate hydrate crystals that have begun forming at the cement particle surfaces are disrupted by remixing and water addition, producing a mortar with severely reduced compressive strength and bond strength compared to fresh mortar. At 85°F with a 90-minute working time already elapsed, partial set is highly likely. The mortar must be discarded — the risk to the masonry assembly from using partially set mortar is too great.
66. D — Pilasters are thickened sections of masonry wall that act as stiffening ribs, reducing the effective unsupported span of the wall panel between them and increasing the wall's resistance to out-of-plane lateral loads from wind and seismic activity. By providing intermediate lateral support points along the wall length, pilasters reduce the bending moment in the wall panel and allow the wall to span the distance between pilasters at the panel's full lateral capacity. This structural function is the reason pilasters are required by ACI 530 at specified maximum intervals in long masonry walls.
67. D — Membrane tenting or bridging — areas where the EPDM has separated from the substrate but seams remain intact — is most commonly caused by inadequate adhesive coverage during the original installation. Spots or areas where the adhesive was applied too thinly, missed entirely, or failed to transfer properly from the membrane to the insulation create zones where the membrane is not bonded to the substrate. Thermal cycling then lifts the unattached areas into the characteristic tent or blister shape. This is a warranty deficiency requiring adhesive repair.
68. B — Base flashing at parapet walls must extend a minimum of 8 inches above the finished roof surface to prevent wind-driven rain from overtopping the flashing and entering the building interior at the wall-roof junction. The 8-inch minimum height is established in most roofing industry standards and in many manufacturers' installation specifications. Shorter base flashing is routinely overtopped during driving rain events, creating the most common leak location on low-slope commercial roofs.
69. C — Installing a new TPO membrane over an existing EPDM system requires verification that the EPDM adhesive or surface is compatible with the TPO adhesive system, that the existing EPDM is in good condition and fully adhered, that the structural deck can support the additional dead

load, and that the local building code permits the overlay application. TPO and EPDM are chemically different materials, and adhesive compatibility must be confirmed by the TPO manufacturer before proceeding with a recovery installation.

70. A — Popping and clicking sounds in standing seam metal roofing during temperature changes are caused by thermal expansion and contraction of the panels. When the concealed clips that attach the panels to the substrate bind rather than allowing free sliding movement, the restrained panel accumulates thermal stress until it suddenly slips — producing the characteristic popping sound. Free-sliding clips that allow unimpeded panel movement prevent stress accumulation and the associated noise. Binding clips are typically caused by over-driven fasteners or improper clip installation.
71. D — In coastal NC counties with design wind speeds exceeding 130 mph, the NC Building Code and IRC require enhanced asphalt shingle installation including both six nails per shingle (rather than the standard four) and ring-shank nails that provide greater withdrawal resistance than smooth-shank nails. These two enhancements — more fasteners and better fastener geometry — work together to significantly increase the shingle's resistance to wind uplift forces that would otherwise detach individual shingles or lift the leading edges.
72. C — The correct two-ply modified bitumen installation sequence is: self-adhere the SBS base sheet first, allowing it to cure and achieve full bond to the insulation per the manufacturer's requirements, then torch-apply the APP cap sheet over the adhered base sheet. This sequence ensures each layer is properly installed before the subsequent layer is applied. Installing the cap sheet first would leave the base sheet unprotected from moisture and prevent inspection of the base sheet adhesion before it is covered.
73. C — 5 inches of polyiso at R-6 per inch = R-30 total. Two layers of 2-1/2 inch polyiso = 5 total inches × R-6 = R-30, with the critical advantage that the joints between boards are offset in both directions, eliminating the continuous thermal bridges that would exist at the joints of a single-layer installation. A single 5-inch board would technically achieve R-30 but is not standard practice — two-layer offset installation is the industry standard for achieving the design R-value in practice.
74. A — The specification establishes the required root zone depth as 12 inches — a minimum, not a target range. Accepting average compliance allows some areas to be significantly deficient while others are correct. Root zone depth is critical for long-term turf performance — shallow root zones limit rooting depth, increase drought stress, and reduce surface stability under traffic. All deficient areas must be brought to the full 12-inch specification before turf installation proceeds.
75. D — ASTM F1936 establishes a maximum Gmax of 200 for all football field playing surfaces — both artificial turf and natural turf systems. Gmax measures peak deceleration during a standard drop test impact. Values above 200 indicate a surface that is too hard and presents an elevated risk of head and extremity injuries from player contact with the surface. The 200 Gmax maximum is

the universal safety threshold for North American football field playing surfaces regardless of surface type.

76. B — The IBC accessible seating table specifies minimum accessible spaces based on total fixed seating capacity. For a 500-seat facility, the table requires 6 accessible spaces. These must be distributed throughout the seating area and integrated with the general audience seating. Concentrated accessible seating in a single location or at inferior viewing positions does not satisfy the distribution requirement even if the count is correct.
77. B — Calcined clay materials are added to the infield skin surface to improve drainage capacity and maintain footing stability under wet conditions. The calcined clay particles absorb surface moisture rapidly, reducing the amount of free water on the skin surface and preventing the mud and slip conditions that make the field unplayable after rain. The characteristic reddish-brown color is a secondary aesthetic benefit, not the functional purpose of the material.
78. A — OSHA Subpart L requires that a covered walkway providing protection equivalent to a 2-inch plank floor system be installed beneath scaffold platforms used over public pedestrian areas when workers could drop materials onto persons below. This protection must deflect falling objects and protect pedestrians from injuries. Warning cones, safety nets positioned below the scaffold, and flagpersons do not meet the standard for overhead protection of the public — a physical overhead barrier is specifically required.
79. D — OSHA's Hazard Communication Standard requires that Safety Data Sheets be readily accessible to employees during all work shifts when the hazardous chemicals covered by those SDSs are present at the work site. "Readily accessible" means immediately available without delay — locked in an office, stored off-site, or available only on request to a supervisor does not satisfy the standard. Electronic SDS systems are acceptable only when a computer or terminal is immediately accessible to workers at all times during the shift.
80. B — The employer's obligations during and after a cave-in emergency include immediately calling 911 for emergency rescue services, stopping all work in and around the excavation to prevent additional cave-in, protecting the buried victims from further soil movement using available shielding or boards, and reporting the incident to NC OSHA within the required timeframes — 8 hours for fatalities and 24 hours for hospitalizations. Attempting to rescue buried workers using untrained company employees risks additional cave-in and secondary casualties.
81. C — OSHA 1926.416(a)(1) requires that before any employee works on or near electrical equipment that is not de-energized, all energized parts to which the employee might be exposed must be guarded by insulation or other effective protective means — insulating barriers, protective shields, or insulating materials that prevent accidental contact. De-energizing and lockout/tagout is the preferred method, but when energized work must be performed, the guarding requirement protects workers from inadvertent contact with live parts.

82. B — The NC Energy Code establishes minimum duct insulation requirements based on the duct's location, the supply air temperature differential, and the climate zone. Project specifications translate these requirements into specific R-values for each duct condition. These are legal minimum requirements — not guidelines — and may not be reduced without a formal code compliance alternative path review. A contractor who installs R-4 where R-6 is specified has created a code violation that must be corrected before the project can receive a certificate of occupancy.
83. B — Terrazzo has a perfectly flat surface but contains grout joints, aggregate variations, and fine surface irregularities that will telegraph through thin, flexible sheet vinyl flooring as visible lines and bumps under raking light. A self-leveling underlayment fills all joints and surface imperfections, creating the smooth, flat substrate required for sheet vinyl installation. Grinding the terrazzo is expensive, creates dust, and may damage the surface without achieving the flatness needed. Plywood over terrazzo adds unnecessary height and creates edge transitions.
84. B — The most critical ceiling coordination step is confirming the exact locations of all HVAC supply and return grilles with the mechanical contractor and comparing them to the proposed ceiling grid layout. Grilles must align with duct connections above the ceiling — if the grid layout places tile joints where grilles need to be, or if grille sizes don't align with grid module dimensions, the entire grid layout must be redesigned. This coordination must happen before a single wire hanger is installed to avoid costly rework.
85. C — NC 811 law applies to all excavation in North Carolina without exception — residential property, shallow depth, private property ownership, and absence of known utilities are not exemptions. A 24-inch-deep hole can strike gas lines, electrical conduit, telecommunications cables, and water service lines that are installed at or above this depth. The landscaping contractor violated NC 811 law by digging without a locate request. The absence of damage does not eliminate the violation — the violation occurred at the moment excavation began without notification.
86. A — The tolerance zone extends 18 inches on each side of any marked utility, and within this zone, only hand tools or vacuum excavation are permitted. When the contractor discovers that the actual utility location differs from the marked location by 18 inches — placing the real utility at the edge of the tolerance zone — mechanical excavation must stop immediately. The contractor must hand dig to physically expose and verify the exact location of the gas line before allowing any mechanical equipment to continue in that area. A mark is an approximation — hand digging confirms reality.
87. D — The county's delegated erosion control program has adopted a one-half-acre threshold for plan approval — lower than the state's one-acre threshold. The 1.2-acre project exceeds both the county's threshold of one-half acre and the state's threshold of one acre. The contractor was required to obtain an approved plan from the local program before beginning any land disturbance.

Beginning without an approved plan is a violation of the SPCA regardless of whether any erosion has actually occurred or been observed.

88. B — Clearing within the designated stream buffer zone is a serious violation of the approved Erosion and Sedimentation Control Plan and potentially of NC buffer rules. The correct immediate response is to stop all work in the buffer area immediately, report the unauthorized clearing to DEMLR or the local program, and implement corrective measures including restoration of the buffer to the extent possible. Allowing a subcontractor's error to continue or simply adding BMPs does not correct the underlying buffer violation and will result in regulatory penalties.
89. C — The NCLBGC has full authority under NC General Statutes Chapter 87 to investigate complaints against licensed contractors, conduct formal hearings, and impose disciplinary action — including suspension or revocation of the contractor's license — based on substantiated findings of project abandonment, fraud, incompetence, or other violations of the licensing statutes. The Board's authority is independent of civil court proceedings — the Board does not need a court judgment before acting on its own investigative findings. License revocation is the most serious action available.
90. B — Under NC Chapter 44A, lien rights for materialmen generally require that materials be incorporated into the improvement — merely delivering materials to the project site and having them stored in a laydown area does not constitute incorporation. If the materials are ultimately used in the building, the lien rights attach upon incorporation. However, if the materials are returned, rejected, or used elsewhere, no lien right attaches for unincorporated stored materials. The supplier should track the materials carefully and file the Claim of Lien promptly after confirmed incorporation to preserve rights within the 120-day deadline.