

STRUCTURAL PLAN REVIEW REMINDER LIST

Please note that in no way does the completion of this reminder list constitute a complete structural plan review. The purpose of this list is to guard against routine oversights and to achieve a minimum level of uniformity.

Where specific code provisions can be cited, the relevant provisions are included as Endnotes. Click on the [Endnote] to link to appropriate Code language (each Endnote includes a link to return to the appropriate portion of the Reminder List).

TABLE OF CONTENTS

- I. ARCHITECTURAL 3**
 - A. General..... 3
 - B. Specifications 3
 - C. Roofs and Roofing – Chapter 15 3
 - D. Ceilings and Soffits – Chapter 25A..... 4
 - E. Steel Studs, Window Walls, and Exterior Finishes 4
 - F. Cabinets and Shelves..... 5
 - G. Moveable Partitions 5
 - H. Veneer – Chapter 14A..... 5
 - I. Safety Glazing – Chapter 24 5

- II. MECHANICAL AND PLUMBING 6**
 - A. Equipment 6
 - B. Shear Wall Penetrations 6
 - C. Underground Pipes..... 6
 - D. Pipe and Duct Support 6
 - E. Suspended Ceilings..... 6
 - F. Elevators 6
 - G. Mechanical Observation 6

- III. ELECTRICAL 7**
 - A. Equipment 7
 - B. Conduits, Raceways, Cable Trays, and Bus Ducts 7
 - C. Pendant Mounted Light Fixtures..... 7
 - D. Light Fixtures in Suspended Ceilings 7
 - E. Scoreboards 7
 - F. Underground Conduits 7
 - G. Shear Wall Penetrations 7
 - H. Electrical Observation..... 7

IV. STRUCTURAL	8
A. General Design Requirements – Chapter 16A	8
B. Tests and Inspections – Chapter 17A.....	9
C. Foundations and Grading – Chapters 18A and 33	10
D. Concrete – Chapter 19A.....	11
E. Masonry – Chapter 21A.....	13
F. Steel – Chapter 22A	14
G. Wood – Chapter 23A.....	15
V. MISCELLANEOUS.....	19
VI. OVER THE COUNTER REMINDER LIST	19
 ENDNOTES.....	21

I. ARCHITECTURAL

A. General

1. Sheet Index.
2. Vicinity Map.
3. Plot plan showing proposed and existing construction. DSA application numbers must be shown for all existing construction, including alterations to existing buildings.
4. Documentation showing that all construction of (and, if applicable, all alterations to) existing buildings affected by the proposed work has been certified by DSA.
5. Determine the [project classification](#) per IR A-7.

B. Specifications

1. Specifications must include General Conditions, A.I.A., or equivalent.
2. Require compliance with Title 24, Parts 1 through 6, and Part 9. Include Part 7 if elevators are included.
3. See Title 24, Part 1, § 4-317 (c). For additions and alterations, a note must be included in the specifications to indicate that existing non-complying work must be brought into compliance with Title 24; the prescribed note is shown in [\[Endnote 1\]](#).
4. Addenda must be signed by the architect and approved by DSA [\[Endnote 2\]](#).
5. Change Orders [\[Endnote 3\]](#) and Preliminary Change Orders [\[Endnote 4\]](#) must be signed by the architect and owner and approved by DSA.
6. The inspector must be employed by the owner and approved by the architect, structural engineer, and DSA [\[Endnote 5\]](#).
7. Substitutions shall be considered as a change order and be approved by DSA prior to fabrication or use. (Substitutions of major structural elements such as roof joists must be stamped and signed by the Architect and Structural Engineer. If they do not wish to stamp and sign the "shop drawings," a new set of contract drawings reflecting the change of system must be provided [\[Endnote 6\]](#)).
8. Check the specifications for alternates, which conflict with the other requirements of the project.

C. Roofs and Roofing

1. Roofing slope minimum 1/4 inch per foot per § 1506.1 [\[Endnote 7\]](#).
2. Overflow drains are required at each roof drain and shall be located 2" above the low point of the roof. Overflow drains shall not be connected to roof drains and should discharge to locations that are readily apparent (so that a clear indication that roof drains may be clogged is provided). Overflow scuppers shall be three times the size of the roof drain with a minimum height of 4" and shall be located 2" above the low point of the roof. No drainage is permitted to flow over public property. See § 1506 [\[Endnote 8\]](#) and Title 24, Part 5 (CPC) Appendix D.

3. Metal roofing and fasteners; see § 1507.8 [Endnote 9].
4. Nails for slate shingles and clay or concrete tile must be copper, brass, or stainless steel. Ring shank nails are required for roof plywood less than 3/4" thick. See § 1507.1.1.1 [Endnote 10], 1507.7.1, and IR M-7.
5. Verify ply clips are provided for unblocked plywood sheathing: 1 clip required for joist spacing at 24 inches on center; 2 clips required for 48 inch joist spacing.
6. Check skylight and rooftop mechanical unit specifications for resistance to high snow loads.

D. Ceilings and Soffits

1. Lay-in T-bar ceilings. See § 2501A.5 [Endnote 11] and IR 25-2.
2. Compression struts required at splay wire locations. Compression struts shall be designed to AISC Equation E2.2. See § 2501A.5.7.2 [Endnote 12].
3. Light fixtures and air terminals must be positively attached (with screws) to ceiling grid runners. Caddy clips or 'fold-out ears' found on many light fixtures are not acceptable.
4. Suspended gypsum board or plaster ceilings are not permitted at exterior soffits (unless compression struts for wind uplift are provided). Check ceiling runner and hanger arrangement per Table 25A-A. Typically 0.475 lb/ft, 1-1/2", cold rolled channels are used as main runners. This limits hanger wire spacing to 3' x 4' or 3.5' x 3.5' or 4' x 3'. #9 gauge hanger wires are acceptable for this spacing. See § 2504A and IR 25-3.
5. Plaster soffit lath attachment. #9 gauge, 1-1/2" long, ring-shank, J-nails are required *in addition to* lath attachment set forth in table 25A-C. See § 2505A.3 and 2506A.5 [Endnote 13].
6. Require complete ceiling joist framing layout and connection details.

E. Steel Studs, Window Walls, and Exterior Finishes

1. Properties. Show fully dimensioned profile and thickness in inches. Show punch outs and holes if applicable. Specify area, section modulus, and moment of inertia. Indicate specific manufacturer and catalog number if known.
2. Lath must be furred out 1/4 inch from vertical support. Require a note that says that the installation of self-furring lath is subject to a satisfactory jobsite demonstration of installation technique. See Table 25A-B, Footnote 2 [Endnote 14].
3. Check wind or seismic forces on exterior studs. Use 5 psf min. on interior studs.
4. Check combined wind or seismic loads at studs supporting casework.
5. Check connection details at top and bottom of the studs.
6. Detail framing at openings. Ensure adequate headers are provided over openings in tall walls for both vertical and horizontal forces.
7. Look for unsupported compression flanges; review for lateral torsional buckling etc. See Chapter 22, Division VII.

8. Check bottom flanges of exterior beams which receive wall studs and window walls for strength, torsional rotation, stability, and connections at ends.
9. Check that full height window walls have adequate deformation compatibility and detailing to accommodate drift.

F. Cabinets and Shelves

1. Provide anchorage details for vertical and seismic load. Reference Tables 16A-B and 16A-O.
2. Clearly show all required blocking, studs, and anchors. Check for nail congestion at clips at each end of blocks.
3. Look for long, unsupported lengths of countertop and unsupported, freestanding casework.

G. Moveable Partitions

1. Review connection to structure for vertical and lateral loads. See § 1611A.5 [\[Endnote 15\]](#).
2. Check that framing is adequate to support partitions and is properly supported and braced. Check deflections. Check for concentrated load at any point if moveable partition can be "stacked" at any point on its track.

H. Veneer – Chapter 14A

1. Check thickness limitations for adhered and/or anchored veneer.
2. Verify that anchors and screws to substrate are all corrosion resistant.
3. Verify bedding of anchors for anchored veneer. Verify that anchor is adequate to resist loads toward the face of the wall.
4. Verify that non-combustible, corrosion-resistant lintels and supports are provided over openings; see § 1403A.6.2 [\[Endnote 16\]](#).
5. Check stud deflection; see Table 16A-W [\[Endnote 17\]](#).
6. Check maximum stud height. See § 1403A.1.2 [\[Endnote 18\]](#), 1403A.5.3 [\[Endnote 19\]](#), and 1403A.6.2.
7. Veneer Specifications:
 - a) Full time special inspection is required. See § 1405A.1 [\[Endnote 20\]](#).
 - b) Shear test adhered veneer to 100psi (one test per every 5000 square feet of floor area, with two tests minimum). Test method should be described. See § 1403A.5.6 [\[Endnote 21\]](#).

I. Safety Glazing – Chapter 24

1. Indicate location on drawings (preferably on the door and window schedule).
2. Specifications must clearly call for labeling or etching of safety glazing per § 2406.2 [\[Endnote 22\]](#).
3. Verify that pass-through windows in kitchens and snack bars are safety glazing.

II. MECHANICAL and PLUMBING

A. Equipment

1. Show weights and locations on plans.
2. Show equipment locations on structural framing plans (coordinate).
3. For large or unusual equipment, it may be necessary to indicate the location of the center of gravity.
4. Anchor equipment for gravity and seismic loads. (33% increase in allowable strength of connectors is not permitted.) § 1632A.1 [Endnote 23]
5. Anchorage must consider worst case load from any direction.
6. Isolators and curbs must be analyzed for overturning and shear about their base.
7. Review Mechanical Specifications for references to anti-vibration or isolator bases and hangers. Verify that the drawings show such. Verify that calculations include $a_p = 2.5$ and $R_p = 1.5$. Use double the resulting force if expansion anchors are used for anchoring isolators. § 1632A.2 and Table 16A-O, Footnote 14 [Endnote 24].
8. For anchorage of equipment to existing concrete or masonry walls, use anchors which are not susceptible to weakening in a fire or from vibratory motion.

B. Shear Wall Penetrations. Check all shear walls for duct and pipe group penetrations. Look for recessed heaters or other equipment that will interrupt plywood.

C. Underground Pipes. Coordinate site plans with foundation plans; verify that pipe trenches will not undermine foundations. See § 1806A.11 [Endnote 25].

D. Pipe and Duct Support. Require details for support and anchorage of pipes and ducts (unless the requirements of § 1632A.6 [Endnote 26] are met). The 1998 SMACNA Seismic Restraint Manual Guidelines for Mechanical Systems may be referenced in lieu of providing specific details for most ordinary pipe and duct support and bracing.

E. Suspended Ceilings. New air registers installed in existing ceiling systems as part of alterations shall be independently supported if the existing ceiling does not comply with code requirements. Air terminals must be positively attached (with screws) to ceiling grid runners. 'Caddy clips' are not acceptable. Coordinate with architectural ceiling details. See paragraph above, Table 16A-O, Footnote 26, IR M-3, § 2501A.5.4.2, and § 2501A.5.8.

F. Elevators. Drawings must show all guide rails, support brackets, and connections (unless a deferred approval is granted).

G. Mechanical Observation. Verify that a mechanical engineer is listed on the application to provide observation of construction, or require a special mechanical inspector.

III. ELECTRICAL

A. Equipment - See II.A. above.

1. Check anchorage details for all equipment including switchboards, transformers, speaker clusters, etc.
2. Television mounting brackets. Consider amplification of seismic loads for cantilevered brackets. Check forces in connections, blocking, wall studs, and connections. Review PA or OSHPD 'R' number approvals.
3. Verify that transformers on roofs are shown on architectural roof and structural roof framing plans.

B. Conduits, Raceways, Cable Trays, and Bus Ducts. Check anchorage and bracing details; see Table 16A-O, Footnote 12 [\[Endnote 27\]](#) and § 1632A.6.

C. Pendant Mounted Light Fixtures. Pendant mounted light fixtures must be able to swing 45 degrees without hitting anything, or be braced against such movement. See Table 16A-O, Footnote 25 [\[Endnote 28\]](#).

D. Light Fixtures in Suspended Ceilings. Light fixtures and air terminals must be positively attached (with screws) to ceiling grid runners. 'Caddy clips' or 'fold-out ears' found on many light fixtures are not acceptable. Coordinate with architectural ceiling details. See Paragraph D in Section I above, Table 16A-O, Footnote 26; § 2501A.5.4.2; § 2501A.5.8 and IR 25-2.

E. Scoreboards. Specifications call for scoreboards to be provided with a certificate of compliance with Title 24 for wind requirements.

F. Underground Conduits. Coordinate site plans with foundation plan; verify that conduit trenches will not undermine foundations. See § 1806A.11. For large numbers of conduit and require details for trenches and backfilling; recommend that vaults be provided, as these will provide better access for repairs.

G. Shear Wall Penetrations. Check all shear walls for duct and pipe group penetrations. Look for recessed heaters or other equipment that will interrupt plywood.

H. Electrical Observation. Verify that an electrical engineer is listed on the application to provide observation of construction, or require a special electrical inspector.

IV. STRUCTURAL

A. General Design Requirements – Chapter 16A

1. Calculations and complete drawings must be included for all structures included in the scope of work.
2. Roof dead load shall include the weight of at least one re-roofing (also applies to seismic design). § 1607A.4.1 [Endnote 29]
3. Snow load must be verified with DSA's Snow Book. Note that loads in this book cannot be reduced by C_e per Appendix Chapter 16, § 1640 (on page 2-387), and Table A-16-A (on page 2-389) of the California Building Code.
4. The percentage of snow load that must be included in the mass of the building for seismic load calculations shall be taken as at least:
 - 0% for snow loads of 30 psf or less.
 - 25% of the snow load for elevations below 5000 feet
 - 33% of the snow load for elevations equal to or greater than 5000 feet.§ 1630A.1.1 [Endnote 30]
5. Recommend adding the load of a 4" sprinkler main plus a 250# pipe fitter as a point load to rafters, joists, beams, and purlins.
6. Check drifts, provide adequate building separations. § 1633A.2.11 [Endnote 31]
7. Table 16A-K. Check importance factors for wind and seismic.
8. Wind Design Load must comply with exposure C requirements unless information justifying exposure B is provided. § 1619A [Endnote 32]
9. Table 16A-Q. C_a for seismic zone and soil type.
10. Table 16A-R. C_v for seismic zone and soil type.
11. Tables 16A-S and 16A-T. Near source factors for seismic source and distance to fault.
12. Table 16A-N. R for structural systems.
13. Table 16A-P for non-building systems.
14. Spacing of vertical-resisting elements (100' & 125'). § 1613A.2.2.3 [Endnote 33]
15. Use $R_p = 3.0$ & $a_p = 1.5$; and consider eccentricities, etc. for block and concrete wall connections to the diaphragm. § 1633A.2.8.1.
16. Table 16A-L: Vertical structural irregularities.
17. Table 16A-M: Plan structural irregularities.
18. Table 16A-V: Diaphragm span-depth ratio.
19. Seismic increment of earth pressure. § 1630A.1.1.5 [Endnote 34]
20. Foundation and superstructure-to-foundation connections. § 1633A.2.12 [Endnote 35]
21. Sliding and passive pressure on footings to resist lateral loads.
22. Wind load at elements and components. § 1622A [Endnote 36]
23. Seismic load elements and components. (Connectors for anchorage of non-structural components cannot use 33% allowable stress increase.) § 1632A.1 [Endnote 37]
24. System rationality, stability, and capacity for wind and seismic loads. § 1605A [Endnote 38]

25. Deformation compatibility between parts of buildings; and nonstructural elements and the structures to which they attach. § 1633A.2.4 and § 1632A.4.
26. Shear path: diaphragm to chord or strut.
27. Shear path: diaphragm to shear wall or frame.
28. Check coordination between architectural and structural drawings.
29. Check dimensions as necessary to verify structural design. (e.g. shear wall lengths).
30. Floor live load, and roof snow load, posting requirements. § 1607A.3.5 and § 1614A.1 [Endnote 39]
31. Deflection criteria. § 1613A [Endnote 40]
32. Truss top chords are braced for $L/r > 200$ for compression members and $L/300$ for tension members.

B. Tests and Inspections – Chapter 17A

1. All tests shall be performed by a testing facility acceptable to the architect and DSA. The testing facility shall be directly employed by the school district and no other entity or individual. See Title 24, Part 1, § 4-335(b) [Endnote 41].
2. Test reports shall be addressed to, and sent to, the school district by the testing facility. Copies of all test reports shall be sent to DSA, the architect, the structural engineer, and the project inspector by the testing facility. All reports shall be sent within 14 days of the date of the test. See Title 24, Part 1, § 4-335(d) [Endnote 42].
3. A Verified Report, signed by the California licensed civil engineer in charge of the testing facility which conducted the tests, shall be submitted to DSA upon completion of the project. The verified report shall state that all tests and inspections were made as required by the DSA approved documents. If the tests or inspections indicate that materials or workmanship did not meet the requirements of the DSA approved documents, the Verified Report shall list all noncompliant work. A copy of all test reports involving unresolved noncompliant work shall be attached to the Verified Report. In the event that not all required tests or inspections were made by the testing facility making this verified report, those tests and inspections not made shall be listed on the verified report. See Title 24, Part 1, § 4-335(e) [Endnote 43].
4. Special inspection is always required for masonry, glued-laminated lumber fabrication, manufactured trusses (except for certain plywood web joists), welding and steel fabrication, high strength bolt installation, precast and/or prestressed concrete operations, post-tensioning operations and pile driving. Special inspection may also be required for wood framing using timber connectors, epoxy repair of concrete or wood, shotcrete application, electrical and mechanical work. See Title 24, Part 1, § 4-333(c) [Endnote 44].

C. Foundations and Grading – Chapter 18A and Chapter 33

1. Details
 - a) Typical formed or unformed footing (add 2 inches to dimension).
§ 1806A.1 [Endnote 45]
 - b) Stepped footing detail (steps no more than 18"; slope no more than 1:2). § 1806A.4 [Endnote 46]
 - c) Pipe trench at footing. § 1806A.11 [Endnote 47]
 - d) Pipe crossing at footing. § 1806A.11
 - e) Footing reinforcement at corners and intersections.
 - f) Adequate ventilation is provided below floor framing.
 - g) Typical masonry starter wall detail.
 - h) Show depth and extent of engineered building pad.
 - i) Coordinate footing depths with soil report.
 - j) Footings on or adjacent to slopes steeper than 1:3. § 1806A.5
 - k) Anchor bolts are weldable steel; and provide adequate projection of threaded portion to accommodate short columns.
 - l) Curbs below tall walls are calculated for resistance to out of plane forces from wind or seismic load on wall.
2. Notes and Specifications
 - a) Reference to soil investigation report on plans.
 - b) Allowable soil bearing pressure and type of soil must be shown on plans.
§ 1804A.3 [Endnote 48]
 - c) Earthwork specifications must coordinate with soils report including material, and compaction, specifications. § 1804A.1 [Endnote 49]
 - d) Specifications must require continuous inspection of placement and compaction of engineered fill by a representative of the geotechnical engineer. § 3301.1 [Endnote 50]
 - e) Inspection of piles and caissons. § 1809A.6 and 1809A.7
 - f) Acceptance of Geologic Hazards Report by the California Geologic Survey (CGS). All mitigation measures clearly shown on plans and specifications. IR A-4 and Title 24, Part 1, § 4-317 (e) [Endnote 51]
3. Design
 - a) Retaining walls less than four feet high above the top of the footing need not be submitted for review. § 1611A.6 [Endnote 52]
 - b) IR 16-3 Segmental Retaining Walls (SRW's):
 - (1) SRW's must be shown on the plans and may not be a deferred approval.
 - (2) SRW's may not support permanent structures.
 - (3) Maximum height shall be 12 feet.
 - (4) Walls 10'-0" or higher which support parking or roads must be designed for the seismic force of the retained soil mass.
 - (5) Any wall 4'-0" or less need not be reviewed, but should be shown on the drawings.

- c) Retaining walls that resist saturated soil or undrained conditions must be designed in compliance with recommendations for using passive pressure and friction under such conditions, as provided by the geotechnical engineer.
- d) Foundation wall reinforcement. § 1914A.10 [Endnote 53]
- e) Footing design. § 1915A
- f) Shear wall or frame footings must resist sliding and passive pressures. § 1915A.2.4 [Endnote 54]
- g) Special foundation requirements. § 1809A
- h) Review requirements for static and seismic settlement required in the soil report. Verify the footing design gives consideration to this. § 1804A.3.5 [Endnote 55]
- i) Pier and pile design. § 1807A and § 1808A

D. CONCRETE - CHAPTER 19A

1. Details

- a) Reinforcement bar bends and lap splices. § 1907A and § 1912A
- b) Reinforcement at wall corners and intersections. § 1914A.2.6 [Endnote 56]
- c) Typical Wall reinforcement. § 1914A.3
- d) Additional column ties at top and bottom. § 1921A.4.4.8 [Endnote 57]
- e) #5 bar at top and bottom of foundation wall reinforcing (includes continuous footings). § 1914A.10 [Endnote 58]
- f) Pier reinforcement. § 1914A.9 [Endnote 59]
- g) Reinforcement at openings – walls, slabs. § 1913A.4 and § 1914A.3
- h) Minimum spacing of parallel reinforcing bars. § 1907A.6
- i) Vertical boundary reinforcement at shear walls – ties. § 1921A.6.6.6
- j) 75% tilt-up wall horizontal steel is developed into a pilaster or into adjacent walls. § 1916A.11 [Endnote 60]
- k) Construction joint details (all types). § 1906A.4
- l) Specify expansion anchor manufacturer, catalog number, depth of embedment and testing requirements (test 50% for equipment anchorage, 10% if tension < 75#, or if loaded only in shear. Test all up to 20 if one fails). Provide for stainless steel anchors for exposed conditions. § 1923A.3.5 [Endnote 61] and IR 19-1
- m) Concrete on steel deck – minimum transverse reinforcement 0.0018. § 1907A.12
- n) DSA does not allow use of ferrule loop inserts since these are electrical resistance welded and this welding cannot be inspected.

2. Notes and Specifications

- a) Form work and construction joints. § 1906A
- b) Reinforcing Steel
 - (1) Material specifications for reinforcement. For welded reinforcing use A 706 or require chemical analysis (CE < 0.75). § 1903A.5.2 [Endnote 62]

- (2) Provision of mill certificates and chemical analyses; and tests for reinforcing steel. § 1929A.2 [Endnote 63]
- (3) Inspection of welding rebar. § 1929A.12 [Endnote 64]
- c) Concrete: Material Specifications
 - (1) Cement conforms to ASTM C150, C845, C595, or C1157. § 1903A.2 [Endnote 65]
 - (2) Aggregates conform to ASTM C33, C330, C332, and C144. § 1903A.3 [Endnote 66]
 - (3) Grading of aggregates conform to the requirements of the appropriate ASTM specification.
 - (4) Water shall be clean and free of injurious amounts of oils, acids, alkalis, salts, organic materials, and any other substance deleterious to concrete or reinforcement. § 1903A.4 [Endnote 67]
 - (5) Admixtures. § 1903A.6 [Endnote 68]
 - (6) Fly ash: Use Class N or F; and limit fly ash admixture to 15% of total cementitious weight. § 1903A.6.6 [Endnote 69]
 - (7) Concrete strength shown on plans. § 1905A.1.3
 - (8) Selection of concrete proportions. § 1905A.2
 - (9) Waiver of material testing. § 1929A.6 [Endnote 70]
 - (10) Batch plant inspection. § 1929A.4
 - (11) If the complying batch plant option for waiver of continuous batch plant inspection is desired, add the following note to the specifications or plans: "The testing lab must certify and submit evidence of compliance to DSA and obtain DSA approval prior to mixing concrete."
 - (12) Waiver of material testing (only on small jobs with $f'_c=3500$ psi, and designed for 2500 psi). § 1929A.6
 - (13) Tests:
 - (a) Cement. § 1929A.1 [Endnote 71]
 - (b) Aggregate. § 1903A.3 [Endnote 72]
 - (c) Evaluation and acceptance of concrete. § 1905A.6
 - (14) Shotcrete testing and inspection. § 1929A.10 and § 1929A.11 [Endnote 73]
 - (15) Mixing and placing of concrete. § 1905A.7, .8, .9, and .10
 - (16) P/C panels – 28 days old before connecting to permit shrinkage of concrete prior to locking in stresses by chord bar welding. § 1916A.12.5 [Endnote 74]
- 3. Design
 - a) On-site precast wall panels. § 1916A.12
 - b) Bolts and headed studs. Include use of 1.3 load increase on foundation anchor bolts designed using Ω_0 force level. § 1923A.2 [Endnote 75]

- c) If concrete is specified for $f'_c = 3500$ psi but the design is based on $f'_c = 2500$ psi some material testing requirements may be waived. Note that embedment and lap lengths must be based on $f'_c = 2500$ psi as well. § 1929A.6 [Endnote 76]
- d) Slender wall design. § 1914A.8
- e) 3000 psi minimum for frames and shear walls. § 1921A.2.4.1 [Endnote 77]

E. MASONRY – CHAPTER 21A

1. Details
 - a) Typical reinforcement. (0.003 A_g min. in walls). One #5 or two #4 around the openings in walls with $48d_b \geq 24$ inches beyond edge of opening. § 2106A.1.12.4 [Endnote 78]
 - b) Vertical reinforcing spaced at 16" o.c. max. with stack bond. § 2104A.6.1.2.1.4 [Endnote 79]
 - c) Horizontal reinforcement at corners and intersections.
 - d) Equations (7A-9) and (7A-10); development length. § 2107A.2.2.3;
 - e) Lap splice = 48 bar diameters minimum. § 2107A.2.2.6 [Endnote 80]
 - f) Anchorage of flexural reinforcement. § 2106A.3.4 [Endnote 81]
 - g) Anchorage of shear reinforcement. § 2106A.3.5 [Endnote 82]
 - h) 1" grout around bolts. § 2106A.2.14.1 [Endnote 83]
 - i) Use hex head bolts, or bolts with double nuts. Bent bar anchor bolts shall not be used. § 2106A.2.14.1
 - j) Grout all cells. § 2104A.6.1.2.1 [Endnote 84]
 - k) Typical reinforcing around wall openings. § 2106A.1.12.4 [Endnote 85]
 - l) Terminate shear wall horizontal reinforcement with a standard hook, which encircles the vertical reinforcing. § 2106A.1.12.4.2.1 [Endnote 86]
 - m) Wall piers ($L < 3W$), design as columns; ($L: 3$ to $5 W$, or $H < 1/2$ x opening height): provide horizontal ties. § 2106A.2.3.3 [Endnote 87]
 - n) Adequate crack control joints are shown or noted. Adequate differential expansion is provided between dissimilar materials.
 - o) New openings in existing masonry walls are made so as to conform to the requirements for minimum steel around openings; and for any loads imposed.
 - p) Construction joint at top of concrete. § 1906A.4.7 [Endnote 88]
2. Notes and Specifications:
 - a) Units.
 - b) Grout.
 - c) Mortar Type S; 1800 psi if laboratory tested to ASTM C270, 1500 psi if field tested to UBC Standard 21-16.
 - d) Water.
 - e) Admixtures and Reinforcement.

- f) Reference to concrete section for addition of fly ash or other mineral admixtures in grout. § 2102A.2.2.3 [\[Endnote 89\]](#)
 - g) Weight of concrete block units – light, medium, or normal.
 - h) Construction of block walls. § 2104A
 - i) Low and high lift requirements. (C.M.U. and brick). 2 feet max. for low lift C.M.U. § 2104A.6.1.2.2 and .2.3 and IR 21-2 and 21-3
 - j) Tests: § 2102A and § 2103A
 - (1) Units or prism tests, 5 prior to construction, 3 for each 5000 square feet of wall. § 2105A.3.1 [\[Endnote 90\]](#), § 2105A.3.2 [\[Endnote 91\]](#), § 2105A.3.3 [\[Endnote 92\]](#)
 - (2) Testing of mortar and grout, 1 test for 3 days prior and 1 per week after, and as job conditions change. § 2105A.3.4.2 [\[Endnote 93\]](#)
 - (3) Cores, minimum 2 from each building, one from each 5000 square feet of floor space. § 2105A.3.1
 - (4) Masonry Inspection. § 2105A.7 [\[Endnote 94\]](#)
3. Design
- a) $f'_m = 1500$ psi (concrete units Type N-I). § 2105A.3.0 [\[Endnote 95\]](#)
 - b) Allowable stresses design of masonry. § 2107A.2.5 to § 2107A.2.17
 - c) Strength design of masonry. § 2108A
 - d) Anchor bolt design. § 2107A.1.5
 - e) Staff Minute (S.M.) 4-87 Drilled in anchors.
 - f) Pier and wall thickness. § 2106A.2.3.3
 - g) Slender wall design method. § 2108A.2.4
 - h) Strength design method for shear walls. § 2108A.2.5
 - i) Moment Resisting Wall Frames. § 2108A.2.6

F. STEEL – Chapter 22A C.B.C.

- 1. Details
 - a) AISC Manual Table J2.3 and J2.4 Minimum weld size.
 - b) Oversize holes and load transfer between base plates and anchor bolts. § 2205A.12 [\[Endnote 96\]](#)
 - c) Metal deck is dimensioned, and minimum bearing width is specified.
- 2. Notes and Specifications
 - a) Steel and bolts – ASTM Grades. § 2203A.2 [\[Endnote 97\]](#)
 - b) Non-shrink grout or drypack.
 - c) Testing of steel and bolt. § 2231A.1 and A.2 [\[Endnote 98\]](#)
 - d) Testing of welded studs. § 2231A.3 [\[Endnote 99\]](#)
 - e) Testing open web joists. § 2231A.7 [\[Endnote 100\]](#)
 - f) Provision of a Welding Procedure Specification; and full-time welding inspection. § 2231A.5 [\[Endnote 101\]](#)
 - g) Inspection of high strength bolts. § 2231A.6 [\[Endnote 102\]](#)
 - h) Moment connections – welding to be done prior to tightening of High-Strength Bolts. § 2209A.4 [\[Endnote 103\]](#)

3. Design
 - a) Use min. 20 ga. steel deck for diaphragms unless testing is performed on the deck. § 2205A.4.1 [\[Endnote 104\]](#)
 - b) Use 1/3 ICBO allowable values for welded studs in "non-composite" uses. § 2205A.13 [\[Endnote 105\]](#)
 - c) IR 22-1 Metal deck with concrete fill.
 - d) Special moment resisting space frame. § 2213A.7
 - (1) Column strength. § 2213A.5
 - (2) Girder to column connection. § 2213A.7.1
 - (3) Panel zone. § 2213A.7.2
 - (4) Continuity plates. § 2213A.7.4
 - (5) Strength ratio. § 2213A.7.5
 - e) Ordinary Moment Resisting Space Frames. § 2213A.6
 - f) Braced frames.
 - (1) Slenderness ratio. § 2213A.8.2.1
 - (2) Stress reduction. § 2213A.8.2.2
 - (3) Lateral force distribution. § 2213A.8.2.3
 - (4) Connections. § 2213A.8.3
 - (5) Chevron bracing must be multiplied by 1.5. § 2213A.8.4.1
 - (6) K-bracing is prohibited. § 2213A.8.4.2
 - (7) Frames not meeting the requirements may be used in buildings designed for $3R_w/8$ times code static forces. § 2213A.8.5

G. WOOD – CHAPTER 23A

1. Details
 - a) Wood framing may not support more than two floors and a roof unless a shrinkage analysis is provided and accepted by DSA. § 2308A [\[Endnote 106\]](#)
 - b) Enclosed attics and rafter spaces are cross ventilated. § 1505.3 [\[Endnote 107\]](#)
 - c) Framing at openings – floor, roof and wall shall be detailed on the plans.
 - d) Table 23A-II-H and Table 23A-II-I-1 shear wall and roof plywood layout. Watch for staggered plywood joint spliced over a beam. § 2315A.1 [\[Endnote 108\]](#), 2320A.8.4 [\[Endnote 109\]](#)
 - e) Provide 3x blocking at continuous panel joints at shear walls more than one panel in height. Table 23A-II-I-1, Footnote 4 [\[Endnote 110\]](#)
 - f) Minimum 3x studs, blocking, and sill plates with staggered nailing at highly loaded shear walls and walls with sheathing on each face of the wall. Table 23A-II-I-1, Footnote 2 [\[Endnote 111\]](#)
 - g) Minimum 3x flat blocking for plywood receiving 10d nails. Table 23A-II-H, Footnote 3 [\[Endnote 112\]](#)
 - h) Space nails at 6 inches on center where plywood diaphragms span 48 inches. Table 23A-II-B-1 [\[Endnote 113\]](#)
 - i) T & G Deck: 2-8d each joist and 3 each end. Two boards between joints on same joist. § 2315A.3.1 [\[Endnote 114\]](#)

DSA Structural Plan Review Reminder List

- j) Use minimum 3x nominal member where framing clips occur on both sides.
- k) IR 23-2 Shear blocking – maximum nailing.
- l) Disallow use of highly loaded diaphragm nailing, as it is not cyclically tested.
- m) Double top plate splice-fastened on each side of splice.
- n) Blocking or bridging. § 2316A.2.22 [\[Endnote 115\]](#) and NDS 4.4.1.2
- o) DSA TJI List For review of premanufactured plywood web trusses.
 - (1) Provide dimensioned TJI profiles and properties on drawings.
 - (2) Provide midspan bridging on joists deeper than 16 inches with spans over 16 feet in length.
 - (3) Verify that camber is shown on the drawings. Disallow camber for rim joists over shear walls.
 - (4) Provide complete TJI blocking details on drawings.
 - (5) Check rotation and end connections on TJI blocking.
 - (6) Verify that complete Truss-Joist open web truss elevations and details are provided.
 - (7) Verify that a detail of plywood nailing to double chord joists (TJ60's for example) is provided.
- p) Wall corner details must be on the drawings showing min. 3 studs. Verify that intersecting shear walls are properly nailed to transfer wall shear.
§ 2320A.11.2 [\[Endnote 116\]](#)
- q) Sill plates bear on 1/2" dry pack or grout; and min. 5/8" x 12 inch anchor bolts at 48 inches on center, with minimum 2 bolts in each piece, 9 inches from each end. Verify that adequate bolt extension and embedment is clearly shown on the drawings. § 2320A.6 [\[Endnote 117\]](#)
- r) Curbs at exterior walls and toilet rooms. § 2306A.4 [\[Endnote 118\]](#) and IR 23-3
- s) Hole and notch details or notes. § 2320A.11.9 [\[Endnote 119\]](#) and 2320A.11.10 [\[Endnote 120\]](#)
- t) Minimum nailing schedule. § 2304A.3 [\[Endnote 121\]](#) and Table 23A-II-B-1
 - (1) Common or box.
 - (2) Only one type per project to prevent mixing types of nails.
- u) Verify note disallowing upset threads on anchor bolts.
- v) Verify note disallowing shot-pins at curbs and slab edges. Disallow expansion anchors at curbs.
- w) Simpson HDA's shall be 1" minimum clear above sill plate.
- x) Table 19A-D, Footnote 1 [\[Endnote 122\]](#). Holdown bolts may not be bent bar, "L" or "J" bolts.
- y) Verify that holdown bolts do not replace sill plate anchor bolts.
- z) NER-126 Avoid close nail spacing parallel to glue-lines on Micro-lam wood. (Simpson A35 clips for example).

- aa) When metal-plate-connected wood trusses are used verify that complete elevations and details are provided. § 2318A.7.5 [\[Endnote 123\]](#)
 - bb) Verify that a note is provided calling for retightening of bolts before closing in.
 - cc) Disallow nails in bending, and clips in nail tension.
2. Notes and Specifications
- a) Specify lumber grades and species.
 - b) Specify grading rules and stamp for lumber. § 2304A.1 [\[Endnote 124\]](#)
 - c) MSR lumber shall be identified as to grade in order to verify that nail values in such lumber are not compromised.
 - d) Specify grade, grading rules (PS 1-95) and stamp for plywood. § 2304A.1 [\[Endnote 125\]](#) and UBC STD 23-2
 - e) Limit minimum plywood width to 24 inches in diaphragms; and 12 inches in shear walls. § 2315A.3.3 [\[Endnote 126\]](#)
 - f) Redwood sill plate shall be foundation grade redwood. § 2306A.4 [\[Endnote 127\]](#)
 - g) Treated sill plates – D.F. #2 grade minimum and each piece shall bear a stamp of an approved independent agency operating under ALSC overview. § 2306A.4
 - h) Specify in plans or specifications, the treating of cuts and holes in pressure-treated wood. § 2320A.6 [\[Endnote 128\]](#)
 - i) Type of grout or dry pack below sill plates is specified or referenced.
 - j) Machine nailing. § 2315A.3.3 [\[Endnote 129\]](#)
 - k) Gang-nail plate truss and Truss-Joist open web Truss Inspection. § 2337A.3 [\[Endnote 130\]](#)
 - l) Glued laminated beam fabrication and inspection. § 2316A.2.28 and § 2316A.2.29 [\[Endnote 131\]](#) and § 2337A.1
3. Design
- a) NDS 7.3.2 Reduce capacity of the bolts and members to 90% of allowable for duration reduction factor.
 - b) Repetitive member adjustment factor shall be 1.0. § 2316A.2.3 [\[Endnote 132\]](#)
 - c) NDS 5.3.2 Volume factor for glu-lam beams.
 - d) Maximum spacing for tension rods in curved glu-lam beams and arches is $d/4$. § 2216A.23 [\[Endnote 133\]](#)
 - e) IR 23-2 Partially blocked diaphragm limitations.
 - f) Timber connectors and fasteners. § 2304A.3 [\[Endnote 134\]](#)
 - (1) NDS 7.3.6 Group factor (C_g) reduction of bolt values for bolts in a row.
 - (2) Require a 50% reduction for toenails. § 2318A.3.1 [\[Endnote 135\]](#)
 - (3) Toenails shall not resist loads in withdrawal. § 2318A.3.2 [\[Endnote 136\]](#)

- (4) Use 50% of allowable loads for lags and wood screws in withdrawal under continuous loads and use 4 screws maximum per connection. (Use length of threaded portion only in withdrawal case). § 2318A.6.1 [\[Endnote 137\]](#)
- (5) Verify embedment of lag bolts is based on actual thread length, not total length of bolt.
- g) IR 23-2 Nailing limitations on plywood diaphragms.
- h) Table 16A-V Diaphragm ratio limitations.
- i) Restrictions on plywood diaphragm in rotation. § 2315A.1 [\[Endnote 138\]](#)
- j) Anchorage of concrete or masonry walls to a wood diaphragm. § 1633A.2.8.1 [\[Endnote 139\]](#)
- k) Plywood shear walls supporting buildings with concrete or masonry walls shall be: § 2315A.2 [\[Endnote 140\]](#)
 - (1) 1 story maximum.
 - (2) h/w ratio ≤ 1.0 .
 - (3) § 2315A.3.3 [\[Endnote 141\]](#) 1/2 allowable shear values.
- l) Plywood diaphragms shall not to resist earth loads or other continuously applied forces. § 2315A.2 [\[Endnote 142\]](#)
- m) NDS 5.4.1 Cross-grain /radial tension for curved glu-lams limited to 15 psi for D.F. For wind or seismic loading in all wood construction $F_v/3$.
- n) Cross-grain bending or tension not permitted with concrete or CMU walls. § 1633A.2.9.5 [\[Endnote 143\]](#)
- o) 0.82 reduction factor for allowable shear when using foundation grade redwood sill plate (Group III). Table 23A-II-I-1, Footnote 1 [\[Endnote 144\]](#)
- p) Electrical panels, duct penetrations in shear walls.
- q) Complete gang-nail plate truss calculations. IR 25-4.
- r) Complete truss-joist computer calculations for open web trusses.
- s) Check top plates for point loads from trusses.
- t) NDS 3.4.5 Check plates and ledgers on concrete or masonry for reduced horizontal shear at bolts.

V. MISCELLANEOUS

- A.** NIC items and future items – verify that the Architect intends these items to be under this application. If not, add the note: "Not part of this DSA approval."
- B.** Architect must stamp and sign all plans and specifications. Structural, mechanical, and electrical engineers must stamp and sign structural, mechanical, and electrical plans respectively as well as the specifications.
- C.** Verify that the Geohazards Report has been accepted by the California Geologic Survey (CGS) and that all mitigation measures recommended by the Report have been implemented on the drawings and specifications.
- D.** Verify that (optional) review for energy incentives has been completed/approved.
- E.** Complete and coordinate T & I list, plan check worksheet, and documents required list in TRACKER. Tentative T & I list must be attached to the front sheet of the drawings for the use of the design architect and SE. The plan check worksheet must be turned-in to the DSA plan review supervisor.
- F.** Minimize deferred approval items – must have DSA plan review supervisor's approval – provide list and 'paste-on' note on first sheet of plans.
- G.** Paste on notes.

VI. OVER THE COUNTER REMINDER LIST

- A.** Verify that all sheets are stamped and signed; or that the architect provided a "Statement of Examination and Incorporation."
- B.** Review each line of the application for completeness and consistency.
- C.** Construction status.
 - 1. For new buildings note: "new building, fabricated specifically for this application."
 - 2. For relocation of buildings show the application number for the original construction of the building on the drawings.
 - 3. For relocation of buildings from stockpiles clearly show the stockpile application number.
 - 4. For stockpiles show the number of buildings in the stockpile on the cover sheet.
- D.** Complete the Receipt of Materials form.
- E.** Verify that the comparison set (PC set) is identical to the submitted set.
- F.** Check for snow load, library floor load, fire separation walls or other conditions that require different requirements than those addressed on the comparison set.
- G.** Check for obvious changes to the ramp drawings.
- H.** If no mechanical engineer is listed on the application, look for or ask for the following statement, or something like it: "Existing services for water supply and sewage have been reviewed and found adequate for the requirements of the new construction."
- I.** If no electrical engineer is listed on the application, look for, or ask for the following statement, or something like it: "Existing services for electrical power

have been reviewed and found adequate for the requirements of the new construction."

J. Check for the following:

1. Provision of a vicinity map, site map, and listing of previous application numbers for surrounding buildings.
2. Locations of buildings are completely dimensioned; and finished floor elevation and corner grades are provided.
3. The distance from grade to framing varies from 2" < d < 18"; and that corner grades are consistent with Precheck Drawings.
4. Under-floor ventilation and drainage is provided and is adequate.
5. Separation of 4 inches for "restrained foundations" or 12 inches for "unrestrained foundations" is clearly shown.
6. Ramp configurations meet requirements of building ingress and egress (e.g. not blocked by a wall mounted mechanical unit).

K. Verify increments are noted on the drawings and specifications cover master.

L. Verify the percentage and increments are noted on the Plancheck Worksheet, and TRACKER. Inform FLS and ACS of increments and percentage.

M. Note the comparison set (PC) application number on the yellow sheet.

N. Note on the Plancheck Worksheet that a Class 4 inspector is required.

O. Watch for relocations of application number 57142; nails are rusted. Ask supervisor for direction.

ENDNOTES

[Endnote 1]:

Excerpt from Section 4-317. Plans, Specifications, Calculations and Other Data. (c) Specifications.

“Due to the difficulty of anticipating every unsatisfactory condition that might be found in existing construction where alteration, rehabilitation or reconstruction work is proposed, the following clause or one of similar meaning shall be included in all specifications for alteration, rehabilitation or reconstruction projects: "The intent of these drawings and specifications is that the work of the alteration, rehabilitation or reconstruction is to be in accordance with Title 24, California Code of Regulations. Should any existing conditions such as deterioration or non-complying construction be discovered which is not covered by the contract documents wherein the finished work will not comply with Title 24, California Code of Regulations, a change order, or a separate set of plans and specifications, detailing and specifying the required work shall be submitted to and approved by the Office before proceeding with the work."

[Return to Reminder List.](#)

[Endnote 2]:

Excerpt from Section 4-338. Addenda and Change Orders.

(a) General. Work shall be executed in accordance with the approved plans, addenda, and change orders. Changes in the plans and specifications shall be made by addenda or change orders approved by DSA [See Section 4-318 (b)].

(b) Addenda. Changes or alterations of the approved plans or specifications prior to letting a construction contract for the work involved shall be made by means of addenda which shall be submitted to and approved by DSA prior to distribution to contractors. Original copies of addenda shall be stamped and signed by the architect or engineer in general responsible charge of preparation of the plans and specifications and by the architect or registered engineer delegated responsibility for the portion affected by the addenda. [See Section 4-317 (h).] One copy of each addendum is required for the files of DSA.

[Return to Reminder List.](#)

[Endnote 3]:

Excerpt from Section 4-338. Addenda and Change Orders.

(c) Change Orders. Changes or alterations of the approved plans or specifications after a contract for the work has been let shall be made only by means of change orders submitted to and approved by DSA prior to commencement of the work shown thereon. Change orders shall state the reason for the change and the scope of work to be accomplished, and, where necessary, shall be accompanied by supplementary drawings referenced in the text of the change order. All change orders and supplementary drawings shall be stamped and signed by the architect or engineer in general responsible charge of observation of the work of construction of the project and by the architect or registered engineer delegated responsibility for observation of the portion of the work of construction affected by the change order, shall bear the approval

of the school board and shall indicate the associated change in the project cost, if any. One copy of each change order is required for the files of DSA.

[Return to Reminder List.](#)

[Endnote 4]:

Excerpt from Section 4-338. Addenda and Change Orders.

(d) Preliminary Change Orders. In order to expedite construction, preliminary change orders may be submitted to DSA. Preliminary change orders shall meet all the requirements necessary for a change order, with the exception of the approval of the school board and the associated change, if any, in costs. The preliminary change order does not require the stamp or seal, but does require the signature of the architect or engineers. Work may proceed in accordance with the approved preliminary change order.

[Return to Reminder List.](#)

[Endnote 5]:

Excerpt from Section 4-333. Observation and Inspection of Construction.

(b) Inspection by Project Inspector. The school board must provide for and require competent, adequate, and continuous inspection by an inspector satisfactory to the architect or registered engineer in general responsible charge of observation of the work of construction, to any architect or registered engineer delegated responsibility for a portion of the work, and to DSA. The cost of project inspection shall be paid for by the school board. An inspector shall not have any current employment relationship with any entity that is a contracting party for the construction. An approved project inspector may be removed and replaced if the work performed is not in conformance with accepted inspection standards as determined by the school district and the project architect and engineer with the concurrence of DSA.

For every project there shall be a project inspector who shall have personal knowledge as defined in Sections 17309 and 81141 of the Education Code of all work done on the project or its parts as defined in Section 4-316. No work shall be carried on except under the inspection of a project inspector approved by DSA. On large projects adequate inspection may require the employment of one or more approved assistant inspectors. The employment of special inspectors or assistant inspectors shall not be construed as relieving the project inspector of his or her duties and responsibilities under Sections 17309 and 81141 of the Education Code and Sections 4-336 and 4-342 of these regulations. A project inspector shall, under the direction of the architect and/or engineer, be responsible for monitoring the work of the special inspectors and testing laboratories to ensure that the testing program is satisfactorily completed.

The project inspector and any assistant inspector must be approved by DSA for each individual project. An inspector shall have had at least three years experience in inspection or construction work on building projects of a type similar to the project for which the inspector is applying for approval. An inspector shall not be less than 25

years of age. Prior to being eligible for approval, any project inspector or any assistant inspector must also be DSA-certified.

An inspector becomes DSA-certified by successfully completing a written examination administered by DSA. The examination measures the applicant's ability to read and comprehend construction plans as well as the construction, inspection, and testing requirements of the California Building Standards Code. Examinations are given in four classes. A Class 1 certified inspector might be approved to inspect any project. A Class 2 certified inspector might be approved to inspect any project, except a project containing one or more new large structures with a primary lateral load-resisting system of steel, masonry, or concrete. A Class 3 certified inspector might be approved to inspect projects containing alterations to approved buildings, site placement of relocatable buildings and construction of minor structures. A Class 4 certified inspector may be approved to inspect projects containing site placement of relocatable buildings and associated side work.

DSA may charge an examination fee to recover reasonable fees and costs. Application for approval of a project inspector or assistant inspector shall be made on Form DSA-5 [see Section 4-341 (d)]. DSA forms are available at any of the DSA regional offices, or on the Internet at www.dgs.ca.gov/dsa.

[Return to Reminder List.](#)

[Endnote 6]:

Excerpt from Section 4-338. Addenda and Change Orders.

(a) General. Work shall be executed in accordance with the approved plans, addenda, and change orders. Changes in the plans and specifications shall be made by addenda or change orders approved by DSA [See Section 4-318 (b)].

Excerpt from Section 4-318. Procedure for Approval of Application and Voidance of Application.

(c) Voidance of Application. Any change, erasure, alteration, or modification of any plans or specification bearing the stamp of DSA may result in voidance of the approval of the application. However, the written approval of plans may be extended by DSA to include revised plans and specifications after documents are submitted for review and approved. (See Section 4-323 for revised plans and Section 4-338 for addenda and change orders.)

Excerpt from Section 4-343. Duties of the Contractor.

(b) Performance of the Work. The contractor shall carefully study the approved plans and specifications and shall plan a schedule of operations well ahead of time. If at any time it is discovered that work is being done which is not in accordance with the approved plans and specifications, the contractor shall correct the work immediately.

All inconsistencies or items which appear to be in error in the plans and specifications shall be promptly called to the attention of the architect or registered engineer, through

the inspector, for interpretation or correction. In no case, however, shall the instruction of the architect or registered engineer be construed to cause work to be done which is not in conformity with the approved plans, specifications, and change orders.

The contractor must notify the project inspector, in advance, of the commencement of construction of each and every aspect of the work.

[Return to Reminder List.](#)

[Endnote 7]:

SECTION 1506 -- ROOF DRAINAGE

Section 1506.1 General. Roofs shall be sloped a minimum of 1 unit vertical in 48 units horizontal (2% slope) for drainage unless designed for water accumulation in accordance with Section 1611 and approved by the building official.

[Return to Reminder List.](#)

[Endnote 8]:

SECTION 1506 -- ROOF DRAINAGE

Section 1506.2 Roof Drains. Unless roofs are sloped to drain over roof edges, roof drains shall be installed at each low point of the roof.

Roof drains shall be sized and discharged in accordance with the Plumbing Code.

Section 1506.3 Overflow Drains and Scuppers. Where roof drains are required, overflow drains having the same size as the roof drains shall be installed with the inlet flow line located 2 inches (51 mm) above the low point of the roof, or overflow scuppers having three times the size of the roof drains and having a minimum opening height of 4 inches (102 mm) may be installed in the adjacent parapet walls with the inlet flow line located 2 inches (51 mm) above the low point of the adjacent roof.

Overflow drains shall discharge to an approved location and shall not be connected to roof drain lines.

Section 1506.4 Concealed Piping. Roof drains and overflow drains, where concealed within the construction of the building, shall be installed in accordance with the Plumbing Code.

Section 1506.5 Over Public Property. Roof drainage water from a building shall not be permitted to flow over public property.

EXCEPTION: Group R, Division 3 and Group U Occupancies.

[Return to Reminder List.](#)

[Endnote 9]:

Section 1507.8 Metal Roof Covering. Metal roof covering exposed to the weather shall be corrosion resistant. *[For DSA/SS, OSHPD 1, 2, and 4] Metal roof covering which is continuously supported by roof deck shall have a minimum thickness as indicated below.*

Corrugated or ribbed steel shall not be less than 0.013 inch (0.33 mm) (No. 30 galvanized sheet gage).

Flat steel sheets shall not be less than 0.013 inch (0.33mm) (No. 30 galvanized sheet gage). Other ferrous sections or shapes shall not be less than No. 26 galvanized sheet gage.

Flat nonferrous sheets shall not be less than 0.0159 inch (0.40 mm) (No. 28 B.&S. gage). Other nonferrous sections or shapes shall not be less than 0.0179 inch (0.45 mm) (No. 25 B. & S. gage).

Corrugated or otherwise shaped sheets or sections shall be designed to support the loads required by Chapter 16 *[for DSA/SS, OSHPD 1 and 2] and shall comply with the provisions of Chapters 20 and 22.*

Ferrous sheets or sections shall comply with Chapter 22, Division V.

[Return to Reminder List.](#)

[Endnote 10]:

Excerpt from Section 1507.1.1.1 Fasteners. *Nails for slate shingles and clay or concrete tile shall be copper, brass, or stainless steel with gage and length per common ferrous nails.*

[Return to Reminder List.](#)

[Endnote 11]:

Section 2501A.5 Suspended Acoustical Ceiling Systems for Public School, Hospital, and State-owned or State-leased Essential Services Buildings. *Metal ceiling suspension systems used primarily to support acoustical tile or other types of lay-in panels shall be designed and installed in accordance with ASTM C 635, ASTM C 636 and this chapter. The member sizes, connections, support systems, light fixture, and ventilating grille attachments, partition supports and installation of bracing to resist lateral forces shall be fully detailed on the approved plans and/or specifications.*

[Return to Reminder List.](#)

[Endnote 12]:

Section 2501A.5.7.2 Lateral force bracing. *Where substantiating design calculations are not provided, horizontal restraints shall be effected by four No. 12 gage wires secured to the main runner with four tight twists in 1 1/2 inches (38 mm) and within 2 inches (51 mm) of the cross runner intersection and splayed 90 degrees from each other at an angle not exceeding 45 degrees from the plane of the ceiling. A strut*

fastened to the main runner at the convergence of the splayed wires shall be extended to and be fastened to the roof or floor structural members above or to such other framing deemed acceptable to the enforcement agency. These horizontal restraint points shall not be placed more than 12 feet by 12 feet (3658 mm by 3658 mm) on centers for school buildings and 8 feet by 12 feet (2438 mm by 3658 mm) on centers for hospital and essential services buildings. There shall be a restraint point a distance of not more than one half of the above spacing from each surrounding wall.

Attachment of the restraint wires to the structure above shall be adequate for the load imposed.

Lateral force bracing members shall be spaced a minimum of 6 inches (152 mm) from all horizontal piping or ductwork that is not provided with bracing restraints for horizontal forces. Bracing wires shall be attached to the grid and to the structure in such a manner that they can support a design load of not less than 200 pounds (890 N) or the actual design load, whichever is greater, with a safety factor of 2 without yielding.

[Return to Reminder List.](#)

[Endnote 13]:

Excerpt from Section 2505A.3 Application of Metal Plaster Bases. The type and weight of metal lath, and the gage and spacing of wire in welded or woven lath, the spacing of supports, and the methods of attachment to wood supports shall be as set forth in Tables 25A-B and 25A-C.

Where interior lath is attached to horizontal wood supports, either of the following attachments shall be used in addition to the methods of attachment set forth in Table 25A-C:

1. Secure lath to alternate supports with ties consisting of a double strand of No. 18 W & M gage galvanized annealed wire at one edge of each sheet of lath. Wire ties shall be installed not less than 3 inches (76 mm) back from the edge of each sheet and shall be looped around stripping, or attached to an 8d common wire nail driven into each side of the joist 2 inches (51 mm) above the bottom of the joist or to each end of a 16d common wire nail driven horizontally through the joist 2 inches (51 mm) above the bottom of the joist and the ends of the wire secured together with three twists of the wire.

2. Secure lath to each support with 1/2-inch-wide (12.7 mm), 1-1/2-inch-long (38 mm) No. 9 W & M gage, ring shank, hook staple placed around a 10d common nail laid flat under the surface of the lath not more than 3 inches (76 mm) from edge of each sheet. Such staples may be placed over ribs of 3/8-inch (9.5 mm) rib lath or over back wire of welded wire fabric or other approved lath, omitting the 10d nails.

{Note: 2506A.5 includes identical requirements for exterior lath}

[Return to Reminder List.](#)

[Endnote 14]:

Excerpt from Table 25A-B, Footnote 2.

Metal lath and wire fabric lath used as reinforcement for cement plaster shall be furred out away from vertical supports at least 1/4 inch (6.4 mm). Self-furring lath meets furring requirements. *The use of self-furring lath is subject to a satisfactory jobsite demonstration for each project of the lath installation, with approval by the project architect and the enforcement agency.*

EXCEPTION: Furring of expanded metal lath is not required on supports having a bearing surface width of 1-5/8 inches (41 mm) or less.

[Return to Reminder List.](#)

[Endnote 15]:

Section 1611.A5 Interior Wall Loads. Interior walls, permanent partitions, and temporary partitions that exceed 6 feet (1829 mm) in height shall be designed to resist all loads to which they are subjected but not less than a load, *L*, of 5 psf (0.24 kN/m²) applied perpendicular to the walls. The 5 psf (0.24 kN/m²) load need not be applied simultaneously with wind or seismic loads. The deflection of such walls under a load of 5 psf (0.24 kN/m²) shall not exceed 1/240 of the span for walls with brittle finishes and 1/120 of the span for walls with flexible finishes. See Table 16A-O for earthquake design requirements where such requirements are more restrictive.

EXCEPTION: Flexible, folding, or portable partitions are not required to meet the load and deflection criteria but must be anchored to the supporting structure to meet the provisions of this code.

[Return to Reminder List.](#)

[Endnote 16]:

Section 1403A.6.2 Height and support limitations. Anchored veneers shall be supported on footings, foundations, or other noncombustible support except as provided under Section 2307A.

In Seismic Zones 2, 3 and 4, the weight of all anchored veneers installed on structures more than 30 feet (9144 mm) in height above the noncombustible foundation or support shall be supported by noncombustible, corrosion-resistant structural framing. The structural framing shall have horizontal supports spaced not more than 12 feet (3658 mm) vertically above the initial 30-foot (9144 mm) height. The vertical spacing between horizontal supports may be increased when special design techniques, approved by the *enforcement agency*, are used in the construction.

Noncombustible, non-corrosive lintels and noncombustible supports shall be provided over all openings where the veneer unit is not self-spanning. The deflections of all structural lintels and horizontal supports required by this subsection shall not exceed 1/600 of the span under full load of the veneer.

[Return to Reminder List.](#)

[Endnote 17]:

TABLE 16A-W -- MAXIMUM ALLOWABLE DEFLECTION NORMAL TO THE SURFACE OF WALL ELEMENT UNDER LATERAL FORCE LOADING

WALL ELEMENT	LOADING CONDITION	MAXIMUM ALLOWABLE DEFLECTION¹
<i>Exterior walls – brittle construction</i>	<i>Seismic or wind</i>	<i>L/240</i>
<i>Exterior walls - flexible construction</i>	<i>Seismic or wind</i>	<i>L/180</i>
<i>Veneered walls, anchored veneers and adhered veneers over 1 inch (25 mm) thick, including the mortar backing</i>	<i>Seismic</i>	<i>L/480</i>

¹L is the span between vertical or horizontal supports.

[Return to Reminder List.](#)

[Endnote 18]:

Section 1403A.1.2 Limitations. Exterior veneer shall not be attached to wood-frame construction at a point more than 25 feet (7620 mm) in height above the *adjacent ground elevation except when approved by the enforcement agency considering special construction is designed to provide for differential movement.*

Where wood-frame construction provides lateral support for veneer, studs, or similar vertical load-supporting members shall be continuous between the foundation and the top of the veneer.

[Return to Reminder List.](#)

[Endnote 19]:

Section 1403A.5.3 Unit size limitations. Veneer units shall not exceed 36 inches (914 mm) in the greatest dimension or more than 720 square inches (0.46m²) in total area and shall not weigh more than 10 pounds per square foot (psf) (48.8 kg/m²) unless approved by the *enforcement agency.*

Units of tile, masonry, stone or terra cotta which exceed 5/8 inch (16 mm) in thickness shall be applied as for anchored veneer where used over exit ways or more than 20 feet (6096 mm) in height above adjacent ground elevation.

EXCEPTION: Veneer units weighing less than 3 psf (14.6 kg/m²) shall not be limited in dimension or area.

[Return to Reminder List.](#)

[Endnote 20]:

SECTION 1405A -- INSPECTION

Section 1405A.1 *All veneer shall be continuously inspected during application by an inspector specially approved for that purpose by the enforcement agency.*

[Return to Reminder List.](#)

[Endnote 21]:

Section 1403A.5.6 Bond strength and tests. *Veneer shall develop a bond to the supporting element of sufficient strength to provide a working shear stress of 50 psi (345 kPa).*

Not less than two shear tests shall be performed for the adhered veneer between the units and the supporting element. At least one shear test shall be performed at each building for each 5,000 square feet (465 m²) of floor area or fraction thereof.

The bond strength as determined by the tests shall have a minimum shear strength of 100 psi (690 kPa).

[Return to Reminder List.](#)

[Endnote 22]:

Section 2406.2 Identification. Each light of safety glazing material installed in hazardous locations as defined in Section 2406.4 shall be identified by a permanent label that specifies the labeler, whether the manufacturer or installer, and state that safety glazing material has been utilized in such installation. *[For DSA/SS, OSHPD 1 and 4] The identification shall be etched or ceramic fired on the glass and readable from the inside of the building after installation.* For additional identification requirements and for limitation on size and use by category classification, see UBC Standard 24-2, Part I.

Each unit of tempered glass shall be permanently identified by the manufacturer. The identification shall be etched or ceramic fired on the glass and be visible when the unit is glazed. Tempered spandrel glass is exempted from permanent labeling but such glass shall be identified by the manufacturer with a removable paper label.

[Return to Reminder List.](#)

[Endnote 23]:

SECTION 1632A -- LATERAL FORCE ON ELEMENTS OF STRUCTURES, NONSTRUCTURAL COMPONENTS, AND EQUIPMENT SUPPORTED BY STRUCTURES.

Section 1632A.1 General. Elements of structures and their attachments, permanent nonstructural components and their attachments, and the attachments for permanent equipment supported by a structure shall be designed to resist the total design seismic forces prescribed in Section 1632A.2.

Attachments shall include anchorages and required bracing. Welded, bolted, or other intermittent connections, such as inserts for anchorage of nonstructural components,

shall not be allowed the one-third increase in allowable stresses permitted in Section 1612A.3.2. Friction resulting from gravity loads shall not be considered to provide resistance to seismic forces.

When the structural failure of the lateral-force-resisting systems of non-rigid equipment would cause a life hazard, such systems shall be designed to resist the seismic forces prescribed in Section 1632A.2.

When permissible design strengths and other acceptance criteria are not contained in or referenced by this code, such criteria shall be obtained from approved national standards subject to the approval of the *enforcement agency*.

[Return to Reminder List.](#)

[Endnote 24]:

Table 16A-O, Footnote 14. *Vibration isolators supporting equipment shall be designed for lateral loads or restrained from displacing laterally by other means. Restraint shall also be provided, which limits vertical displacement, such that lateral restraints do not become disengaged. a_p and R_p for equipment supported on vibration isolators shall be taken as 2.5 and 1.5, respectively, except that if the isolation mounting frame is supported by shallow or expansion anchors, the design forces for the anchors calculated by Formula (32A-1), (32A-2) or (32A-3) shall be additionally multiplied by a factor of 1.3.*

[Return to Reminder List.](#)

[Endnote 25]:

Section 1806A.11 Pipes and Trenches. *Unless otherwise recommended by the soils report, open or backfilled trenches parallel with a footing shall not be below a plane having a downward slope of 1 unit vertical to 2 units horizontal (50% slope) from a line 9 inches (229 mm) above the bottom edge of the footing, and not closer than 18 inches (457 mm) from the face of such footing.*

Where pipes cross under footings, the footings shall be specially designed. Pipe sleeves shall be provided where pipes cross through footings or footing walls and sleeve clearances shall provide for possible footing settlement, but not less than 1 inch (25 mm) all around pipe.

[Return to Reminder List.](#)

[Endnote 26]:

Section 1632A.6 HVAC Ductwork, Plumbing/Piping, and Conduit Systems. *All pipes, ducts, and conduit shall be braced to resist the forces prescribed in Section 1630A.2. Ductwork shall be constructed in accordance with provisions contained in Part 4, Title 24, California Mechanical Code. Where possible, pipes, conduit, and their connections shall be constructed of ductile materials (copper, ductile iron, steel, or aluminum and brazed, welded, or screwed connections). Pipes, conduits and their connections, constructed of non-ductile materials (e.g., cast iron, no-hub pipe and plastic), shall have the brace spacing reduced to one-half of the spacing allowed for*

ductile material in accordance with Section 1630A.5 or other standards approved by the enforcing agency.

Seismic restraints may be omitted for the following conditions, where flexible connections are provided between components and the associated ductwork, piping and conduit:

- 1. Fuel piping less than 1 inch (25 mm) inside diameter.*
- 2. All other piping less than 2.5 inches (64 mm) diameter, except medical gas including vacuum piping, or*

*All piping suspended by individual hangers 12 inches (305 mm) or less in length from the top of the pipe to the bottom of the structural support for the hanger, or
All electrical conduit less than 2.5 inches (64 mm) trade size.*

- 3. All rectangular air-handling ducts less than 6 square feet (0.56 m²) in cross-sectional area, or*

All round air-handling ducts less than 28 inches (711 mm) in diameter, or

All ducts suspended by hangers 12 inches (305 mm) or less in length from the top of the duct to the bottom of the structural support for the hanger, where the hangers are detailed to avoid bending of the hangers and their connections.

Where lateral restraints are omitted the piping, ducts, or conduit shall be installed such that lateral motion of the piping or duct will not cause damaging impact with other systems or structural members, or loss of vertical support.

[Return to Reminder List.](#)

[Endnote 27]:

Table 16A-O, Footnote 12.

Seismic restraints may be omitted from electrical raceways, such as cable trays, conduit, and bus ducts, if all the following conditions are satisfied:

- 12.1 Lateral motion of the raceway will not cause damaging impact with other systems.
- 12.2 Lateral motion of the raceway does not cause loss of system vertical support.
- 12.3 Rod-hung supports of less than 12 inches (305 mm) in length have top connections that cannot develop moments.
- 12.4 Support members cantilevered up from the floor are checked for stability.

[Return to Reminder List.](#)

[Endnote 28]:

Table 16A-O, Footnote 25.

Suspension systems for light fixtures which have passed shaking table tests approved by the enforcement agency, or which, as installed, are free to swing a minimum of 45 degrees from the vertical in all directions without contacting obstructions, shall be assumed to comply with the lateral-force requirements of Section 1632A.2. Unless the cable-type, free-swinging suspension systems shall have a safety wire or cable attached to the fixture and structure at each support capable of supporting four times the supported load.

[Return to Reminder List.](#)

[Endnote 29]:

Section 1607A.4.1 General. Roofs shall be designed for the unit live loads, L_r set forth in Table 16A-C. The live loads shall be assumed to act vertically upon the area projected on a horizontal plane. *The design dead loads shall provide for the weight of at least one re-roofing in addition to other applicable loadings if the new roofing can be applied over the original roofing without its removal.*

[Return to Reminder List.](#)

[Endnote 30]:

Excerpt from Section 1630A.1.1 Earthquake Loads.

3. Design snow loads of 30 psf (1.44 kN/m²) or less need not be included. Where design snow loads exceed 30 psf (1.44 kN/m²), the design snow load shall be included, but may be reduced up to 75 percent where consideration of siting, configuration, and load duration warrant when approved by the *enforcement agency*.

[Return to Reminder List.](#)

[Endnote 31]:

Section 1633A.2.11 Building separations. All structures shall be separated from adjoining structures. Separations shall allow for the displacement Δ_M . Adjacent buildings on the same property shall be separated by at least Δ_{MT} where:

$$\Delta_{MT} = \sqrt{[(\Delta_{M1})^2 + (\Delta_{M2})^2]} \quad (33A-2)$$

and Δ_{M1} and Δ_{M2} are the displacements of the adjacent buildings. When a structure adjoins a property line not common to a public way, that structure shall also be set back from the property line by at least the displacement Δ_M of that structure.

EXCEPTION: Smaller separations or property line setbacks may be permitted when justified by rational analyses based on maximum expected ground motions.

[Return to Reminder List.](#)

[Endnote 32]:

Section 1619A Exposure. An exposure shall be assigned at each site for which a building or structure is to be designed. *The wind design shall comply with Exposure C*

requirements unless the architect or structural engineer in general responsible charge can justify to the enforcement agency that the building site and surrounding terrain conform to the criteria for Exposure B. Minimum data to establish the exposure category shall be a topographic map (e.g., United States Geological Survey quadrangle maps) and aerial photographs.

EXCEPTION: *For Exposure B sites located within urban areas, a vicinity map of sufficient size and scale to verify compliance may be provided.*

Excerpt from Section 1616A:

EXPOSURE B has terrain with buildings, forest, or surface irregularities, covering at least 20 percent of the ground level area extending 1 mile (1.61 km) or more from the site.

EXPOSURE C has terrain that is flat and generally open, extending 1/2 mile (0.81 km) or more from the site in any full quadrant *or having scattered obstructions extending one-half mile or more from the site in any full quadrant. This category includes flat or gently rolling open country and grasslands. Sites normally considered as Exposure B, but which are subject to topographic amplification or canalization, such as ridge tops or draws, shall be considered as Exposure C.*

EXPOSURE D represents the most severe exposure in areas with basic wind speeds of 80 miles per hour (mph) (129 km/h) or greater and has terrain that is flat and unobstructed facing large bodies of water over 1 mile (1.61 km) or more in width relative to any quadrant of the building site. Exposure D extends inland from the shoreline 1/4 mile (0.40 km) or 10 times the building height, whichever is greater.

[Return to Reminder List.](#)

[Endnote 33]:

Section 1613A.2.2.3 Location of vertical lateral-force-resisting elements. *In buildings having horizontal wood diaphragms or horizontal rod bracing systems and with continuous steel or reinforced concrete framing or continuous reinforced grouted masonry walls, vertical lateral-force-resisting elements shall be provided parallel to the length of the building so that in each resisting plane there is at least one vertical lateral-force-resisting element within 125 feet (38 100 mm) of any portion of the building length.*

In buildings of wood construction having horizontal wood diaphragms or horizontal rod bracing systems, vertical lateral-force-resisting elements shall be provided parallel to the length of the building so that, in each resisting plane, there is at least one vertical lateral-force-resisting element within 100 feet (30 480 mm) of any portion of the building length.

[Return to Reminder List.](#)

[Endnote 34]:

Excerpt from Section 1630A.1.1 Earthquake Loads.

5. Where buildings provide lateral support for walls retaining earth, and the exterior grades on opposite sides of the building differ by more than 6 feet (1829 mm), the load combination of the seismic increment of earth pressure due to earthquake acting on the higher side, as determined by a civil engineer qualified in soils engineering plus the difference in earth pressures shall be added to the lateral forces provided in this section.

[Return to Reminder List.](#)

[Endnote 35]:

Section 1633A.2.12 Foundations and superstructure-to-foundation connections.

The foundation shall be capable of transmitting the design base shear and the overturning forces from the structure into the supporting soil.

The foundation and the connection of the superstructure elements to the foundation shall have the strength to resist, in addition to gravity loads, the lesser of the following seismic loads:

1. The strength of the superstructure elements.
2. The maximum forces that would occur in the fully yielded structural system
3. Ω_0 times the forces in the superstructure elements due to the seismic forces as prescribed in this chapter.

EXCEPTIONS: *1. Where structures are designed using R less than or equal to 2.2 such as for inverted pendulum-type structures.*

2. When it can be demonstrated that inelastic deformation of the foundation and superstructure-to-foundation connection will not result in a weak story or cause collapse of the structure.

Where moment resistance is assumed at the base of the superstructure elements, the rotation and flexural deformation of the foundation as well as deformation of the superstructure-to-foundation connection shall be considered in the drift and deformation compatibility analyses.

[Return to Reminder List.](#)

[Endnote 36]:

SECTION 1622A - ELEMENTS AND COMPONENTS OF STRUCTURES. Design wind pressures for each element or component of a structure shall be determined from Formula (20A-1) and C_q values from Table 16A-H, and shall be applied perpendicular to the surface. For outward acting forces the value of C_e shall be obtained from Table 16A-G based on the mean roof height and applied for the entire height of the structure. Each element or component shall be designed for the more severe of the following loadings:

1. The pressures determined using C_q values for elements and components acting over the entire tributary area of the element.

2. The pressures determined using C_q values for local areas at discontinuities such as corners, ridges, and eaves. These local pressures shall be applied over a distance from a discontinuity of 10 feet (3048 mm) or 0.1 times the least width of the structure, whichever is less, as follows:

2.1 At Walls	Corners
2.2 At Roofs	Corners, eaves, rakes, ridges, and the width of any overhangs

The wind pressures from Sections 1621A and 1622A need not be combined. A complete load path for resistance to wind uplift forces shall be provided.

[Return to Reminder List.](#)

[Endnote 37]:

SECTION 1632A -- LATERAL FORCE ON ELEMENTS OF STRUCTURES, NONSTRUCTURAL COMPONENTS AND EQUIPMENT SUPPORTED BY STRUCTURES

Section 1632A.1 General. Elements of structures and their attachments, permanent nonstructural components and their attachments, and the attachments for permanent equipment supported by a structure shall be designed to resist the total design seismic forces prescribed in Section 1632A.2.

Attachments shall include anchorages and required bracing. *Welded, bolted, or other intermittent connections, such as inserts for anchorage of nonstructural components, shall not be allowed the one-third increase in allowable stresses permitted in Section 1612A.3.2.* Friction resulting from gravity loads shall not be considered to provide resistance to seismic forces.

When the structural failure of the lateral-force-resisting systems of non-rigid equipment would cause a life hazard, such systems shall be designed to resist the seismic forces prescribed in Section 1632A.2.

When permissible design strengths and other acceptance criteria are not contained in or referenced by this code, such criteria shall be obtained from approved national standards subject to the approval of the *enforcement agency*.

[Return to Reminder List.](#)

[Endnote 38]:

Section 1605A.2 Rationality. Any system or method of construction to be used shall be based on a rational analysis in accordance with well-established principles of mechanics. Such analysis shall result in a system that provides a complete load path capable of transferring all loads and forces from their point of origin to the load-resisting

elements. The analysis shall include, but not be limited to, the provisions of Sections 1605A.2.1 through 1605A.2.3.

[Return to Reminder List.](#)

[Endnote 39]:

Section 1607A.3.5 Live loads posted. *The live loads used in the design of floor and other areas listed in Category 8, 9, 10, 11, 17, 18, 19 or 20 of Table 16A-A, or for other special-purpose areas shall be conspicuously posted in that part of each story in which they apply using durable metal signs. The sign shall be in letters not less than 1 inch (25 mm) high on contrasting background.*

Section 1607A.3.5.1 [For DSA-SS]. The owner or school board shall be responsible for keeping the actual load below the allowable limits.

Section 1614A.1 Snow Load Posting. *Snow loads used in design shall be posted as for live loads. See Section 1607A.3.5. Snow accumulation removal shall begin when the depth of snow creates loadings of 75 percent of the design values.*

[Return to Reminder List.](#)

[Endnote 40]:

1613A -- DEFLECTION

1613A.1 General. The deflection of any structural member shall not exceed the values set forth in Table 16A-D, based on the factors set forth in Table 16A-E. The deflection criteria representing the most restrictive condition shall apply. Deflection criteria for materials not specified shall be developed *by the project architect or structural engineer* in a manner consistent with the provisions of this section *and approved by the enforcement agency.* See Section 1611A.7 for camber requirements. * * * For concrete, see Section 1909A.5.2.6; for aluminum, see Section 2003A; for glazing framing, see Section 2404.2.

[Return to Reminder List.](#)

[Endnote 41]:

Excerpt from Section 4-335. Tests.

(b) Performance of Tests. The school board shall, with the advice of the architect or structural engineer, select a testing agency acceptable to DSA to conduct the required tests and inspections for the project. The testing agency shall be directly employed by the school board and not be in the employ of any other agency or individual.

An acceptable testing agency shall have management, laboratory, and field supervisory personnel with at least five years experience in the inspection and testing of the work and materials of construction. The testing agency shall further have adequate facilities, equipment, and technical references to permit the performance of inspections and testing in compliance with applicable regulations and standards.

A letter of acceptance by DSA shall be issued to the testing agency and shall state that the testing agency has demonstrated that it has met the criteria established by DSA for performance of the inspection of work and testing of materials.

Test samples or specimens of material for testing shall be taken by the architect or registered engineer, his or her representative, the inspector, or a representative of the testing agency. In no case shall the contractor or vendor select the sample or specimens.

Sampling, preparation of samples and tests shall be in accordance with the standards as provided for in the approved specifications or in the applicable building regulations.

Where a sample has failed to pass the required tests the architect or engineer, subject to the approval of DSA, may permit retest of the sampled material.

[Return to Reminder List.](#)

[Endnote 42]:

Excerpt from Section 4-335. Tests.

(d) Test Reports. One copy of all test reports shall be forwarded to DSA, the architect, the structural engineer, and the project inspector by the testing agency within 14 days of the date of the test. Such reports shall include all tests made, regardless of whether such tests indicate that the material is satisfactory or unsatisfactory. Records of special sampling operations as required shall also be reported. The reports shall show that the material or materials were sampled and tested in accordance with the requirements of these regulations and with the approved plans and specifications. In the case of materials such as masonry, concrete, or steel, test reports shall show the specified design strength. All reports of test results shall also definitely state whether or not the material or materials tested comply with requirements of the plans and specifications. Reports of test results of materials not found to be in compliance with the requirements of the plans and specifications shall be forwarded immediately to DSA, the architect, the structural engineer, and the project inspector.

[Return to Reminder List.](#)

[Endnote 43]:

Excerpt from Section 4-335. Tests.

(e) Verification of Test Reports. Each testing agency shall submit to DSA at the completion of the testing program or when required by DSA a verified report covering all of the tests and inspections that were required to be made by that agency. Such report shall be furnished any time that work on the project is suspended, or services of the testing lab are terminated, covering the tests up to that time.

The verified report shall be signed, under penalty of perjury, by the professional engineer charged with engineering managerial responsibility for the laboratory. The verified report shall indicate that all tests and inspections were made as required by the approved plans and specifications, and shall list any noncompliant tests or inspections that have not been resolved by the date of the verified report. In the event that not all

required tests or inspections were made by the laboratory making this verified report, those tests or inspections not made shall be listed on the verified report.

[Return to Reminder List.](#)

[Endnote 44]:

Excerpt from Section 4-333. Observation and Inspection of Construction.

(c) Special Inspection. Special inspection by inspectors specially approved by DSA may be required on masonry construction, glued-laminated lumber fabrication, wood framing using timber connectors, manufactured trusses, epoxy repair of wood or concrete, concrete batching, shotcrete application, prestressed concrete member fabrication or post-tensioning operations, structural steel fabrication, high-strength steel bolt installations, shop and field welding, pile driving, electrical, and mechanical work.

A special inspector may be required to be approved by DSA for an individual project. Application for approval of a special inspector shall be made on an Inspector's Qualification Form (Form DSA-5) and submitted to DSA for review. A special inspector shall not be less than 25 years of age, shall have had at least three years' experience in construction work or inspection responsibilities on one or more projects similar to the project for which the inspector is applying, shall have a thorough knowledge of the building materials of his or her specialty, and shall be able to read and interpret plans and specifications. DSA may require evidence of the proposed inspector's knowledge and experience by successful completion of a written and/or oral examination by the applicant before approval is granted. DSA may charge a fee to administer such examinations. DSA will maintain a list of special inspectors who have successfully completed an examination by DSA, and continued eligibility to remain on that list will be dependent on demonstrated acceptable performance of duties assigned.

The project inspector may perform special inspections if the project inspector has been specially approved by DSA for such purpose and has the time available to complete the special inspections in addition to project inspection work.

The detailed inspection of all work covered by this section is the responsibility of the project inspector when special inspection is not provided (see Section 4-342).

Where responsibility for observation of construction for mechanical work and electrical work is not delegated to professional engineers registered in these particular branches of engineering [See Section 4-316 (b)], special mechanical and electrical inspection shall be provided.

DSA may require special inspection for any shop fabrication procedures that preclude the complete inspection of the work after assembly. DSA may require special inspection at the site in addition to those listed above if found necessary because of the special use of material or methods of construction.

Approved special inspectors shall submit in a timely manner verified reports as required by Section 4-336 for the special work covered.

Special inspectors shall periodically submit reports of inspections to DSA, the design professional in general responsible charge of observation, the structural engineer, and the project inspector.

Construction work that the special inspector finds not to be in compliance with the approved plans and specifications, and which is not immediately corrected upon notifying the contractor, shall be reported immediately to the project inspector, DSA, the architect and the structural engineer.

The costs of all special inspection required by this subsection shall be paid for by the school board, but if so specified in the contract documents the amount paid may be collected from the contractor by the school board.

[Return to Reminder List.](#)

[Endnote 45]:

SECTION 1806A -- FOOTINGS.

Excerpt from Section 1806A1. General. Footings and foundations shall be constructed of masonry or concrete *unless prior approval has been obtained from the enforcement agency* and shall extend below the frost line. *The horizontal dimensions of unformed concrete footings shall be increased 1 inch (25 mm) at every vertical surface at which concrete is placed directly against the soil.*

[Return to Reminder List.](#)

[Endnote 46]:

Section 1806A.4 Stepped Foundations. Foundations for all buildings where the surface of the ground slopes more than 1 unit vertical in 10 units horizontal (10% slope) shall be level or shall be stepped so that both top and bottom of such foundation are level.

Individual steps in continuous footings shall not exceed 18 inches (457 mm) in height and the slope of a series of such steps shall not exceed 1 unit vertical to 2 units horizontal (50% slope) unless otherwise recommended by a soils report. The steps shall be detailed on the drawings. The local effects due to the discontinuity of the steps shall be considered in the design of the foundation.

[Return to Reminder List.](#)

[Endnote 47]:

Section 1806A.11 Pipes and Trenches. *Unless otherwise recommended by the soils report, open or backfilled trenches parallel with a footing shall not be below a plane having a downward slope of 1 unit vertical to 2 units horizontal (50% slope) from a line 9 inches (229 mm) above the bottom edge of the footing, and not closer than 18 inches (457 mm) from the face of such footing.*

Where pipes cross under footings, the footings shall be specially designed. Pipe sleeves shall be provided where pipes cross through footings or footing walls and sleeve clearances shall provide for possible footing settlement, but not less than 1 inch (25 mm) all around pipe.

[Return to Reminder List.](#)

[Endnote 48]:

Section 1804A.3 Reports. The soil classification and design-bearing capacity of the soil shall be shown on the plans * * *. The *enforcement agency* may require submission of a written report of the investigation, which shall include, but need not be limited to, the following information:

1. A plot showing the location of all test borings and/or excavations.
2. *Logs of all explorations, including* descriptions and classifications of the materials encountered.
3. Elevation of the water table, if encountered.
4. Recommendations for foundation type and design criteria, including bearing capacity, provisions to mitigate the effects of expansive soils, provisions to mitigate the effects of liquefaction and soil strength, and the effects of adjacent loads.
5. Expected total and differential settlement.
6. *The report shall consider the effects of stepped footings addressed in Section 1806A.4.*
7. *The geotechnical engineer shall assess the potential for liquefaction during the geotechnical investigation for the project. Any significant liquefaction hazard shall be considered in arriving at an appropriate foundation system and design parameters and in evaluating foundation performance. The geotechnical report should include estimated amounts of foundation settlement and differential settlement and recommended means for mitigating settlements associated with potential liquefaction.*
8. *In areas subject to high sulphate soils, an evaluation of the impact on the durability of concrete foundations shall be considered*

[Return to Reminder List.](#)

[Endnote 49]:

Section 1804A.1 General. *Soil investigation reports which include foundation or pile capacity recommendations, recommendations regarding installation, and, in the case of engineered fills, directions as to materials and construction procedures shall be prepared by a geotechnical engineer qualified to undertake investigations for foundation and earthwork design. Investigations involving test borings, exploration shafts or load tests shall be made under the engineering control of such a geotechnical engineer.*

Site investigations and reports pertaining to geologic hazards shall be made where required by Sections 39002 and 39002.5 of the Education Code for public school buildings, Sections 15044 and 15045 of the Health and Safety Code for hospital buildings, and Section 16014 of the Health and Safety Code for essential services buildings. See also Section 1629A.3

[Return to Reminder List.](#)

[Endnote 50]:

SECTION 3301 – EXCAVATION AND FILLS

Excerpt from Section 3301.1. *[For DSA/SS and OSHPD 1 and 4] All fills used to support the foundations of any building or structure shall be placed under the direction of a geotechnical engineer, and the placement of the fill shall be inspected by the geotechnical engineer or his or her qualified representative. It shall be the responsibility of such geotechnical engineer to see that the procedures used in placing fills meet the requirements of the specifications and to coordinate all fill inspection and testing during the construction involving such fills.*

The duties of the geotechnical engineer shall include, but need not be limited to, the observation of cleared areas and benches prepared to receive fill; observation of the removal of all unsuitable soils and other materials; the approval of soils to be used as fill material; the inspection of placement and compaction of fill materials; the testing of the completed fills; and the inspection or review of geotechnical drainage devices where required by the soils investigation, buttress fills or other similar protective measures.

A verified report shall be submitted to the enforcement agency by the geotechnical engineer. The report shall indicate that all the tests required by the plans and specifications were completed and that the tested materials were in compliance with the plans and specifications and the recommendations of the soils investigation report.

NOTE: See Section 1804A.3 [for OSHPD 1 and 4] 1804B.3.

For footings on adjacent slopes, see Section 1806.5. [For DSA/SS] See Section 1806A.4 [for OSHPD 1 and 4] 1806B.4.

[Return to Reminder List.](#)

[Endnote 51]:

Excerpt from Section 4-317. Plans, Specifications, Calculations, and Other Data.

(e) Site Data. Site data for all school sites shall include a soil investigation report including subsurface site work, laboratory testing, an evaluation of site soil conditions, a recommendation for the type of foundations to be used, and an allowable design value for the soil-bearing capacity.

For new school sites located in the "Special-Studies Zones" (commonly known as Alquist-Priolo Zones) or in the Seismic Safety Element of the Local General Plan as described in Section 17212 of the Education Code, a geologic and earthquake hazard report shall be submitted with the application. The report shall include an evaluation of both known and potentially active local and regional fault systems and of slope stability and liquefaction potential as hazards to school structures. In accordance with Education Code Section 17212.5, DSA may require a similar geologic and earthquake hazard study for a new school site outside of the boundaries of any special studies zone.

For existing school sites, DSA may require the District to employ a California-certified engineering geologist in consultation with a California-registered geotechnical engineer to prepare a geologic hazards statement evaluating the potential for geologic and earthquake damage for projects involving alterations, rehabilitation, additions, or new construction. A geologic and earthquake hazard report as indicated above may be required for existing sites in accordance with Sections 17212.5 and 81033.5 of the Education Code. Geologic hazard reports shall include an evaluation of potential for damage due to flooding.

No school building shall be constructed, rehabilitated, reconstructed, or relocated within 50 feet of the trace of a geologic fault along which surface rupture can reasonably be expected to occur within the life of the school building.

[Return to Reminder List.](#)

[Endnote 52]:

Section 1611A.6 Retaining Walls. Retaining walls shall be designed to resist loads due to the lateral pressure of retained material in accordance with accepted engineering practice. *Retaining walls higher than 12 feet (3658 mm), as measured from the top of the foundation, shall be designed to resist the additional earth pressure caused by seismic ground shaking.* Walls retaining drained soil, where the surface of the retained soil is level, shall be designed for a load, H , equivalent to that exerted by a fluid weighing not less than 30 psf per foot of depth (4.71 kN/m²/m) and having a depth equal to that of the retained soil. Any surcharge shall be in addition to the equivalent fluid pressure.

Retaining walls shall be designed to resist sliding by at least 1.5 times the lateral force and overturning by at least 1.5 times the overturning moment, using allowable stress design loads.

The resultant of the vertical loads and lateral pressures acting on the wall and its base shall pass through the middle half of the bottom of the footing.

Retaining walls shall be restrained against sliding by friction of the base against the earth, by passive resistance of the soil or by a combination of the two. When used, keys may be assumed to lower the plane of frictional resistance and depth of passive resistance to the level of the bottom of the key. Passive resistance pressures shall be assumed to act on a vertical plane located at the toe of the footing. Overturning shall be computed about the bottom of the spread footing. Passive resistance on the face of the wall may be included in computing resistance to overturning. Frictional resistance on the face of the wall may be included in computing resistance to overturning, except when lateral loads include seismic forces. See Section 1611A.13 for overturning provisions for freestanding walls.

Gravity-type retaining walls utilizing precast concrete units may be used as an alternative to the conventional cantilever retaining systems only after they have been accepted by the enforcement agency.

[Return to Reminder List.](#)

[Endnote 53]:

Section 1914A.10 Foundation Walls. *Horizontal reinforcing of concrete foundation walls for wood-frame or light-steel buildings shall consist of the equivalent of not less than one No. 5 bar located at the top and bottom of the wall. Where such walls exceed 3 feet (914 mm) in height, intermediate horizontal reinforcing shall be provided at spacings not to exceed 2 feet (610 mm) on center. Minimum vertical reinforcing shall consist of No. 3 bars at 24 inches (610 mm) on center.*

Where concrete foundation walls or curbs extend above the floor line and support wood-frame or light-steel exterior, bearing or shear walls, they shall be doweled to the foundation wall below with a minimum of No. 3 bars at 24 inches (610 mm) on center. Where the height of the wall above the floor line exceeds 18 inches (457 mm), the wall above and below the floor line shall meet the requirements of Section 1914A.3. See Section 1633A.2.12 for additional requirements.

[Return to Reminder List.](#)

[Endnote 54]:

Section 1915A.2.2 Base area of footing.

Section 1915A.2.4 *External forces and moments applied to footings shall be transferred to supporting soil without exceeding permissible soil pressures.*

[Return to Reminder List.](#)

[Endnote 55]:

Excerpt from Section 1804A.3 Reports. The soil classification and design-bearing capacity of the soil shall be shown on the plans * * *. The enforcement agency may require submission of a written report of the investigation, which shall include, but need not be limited to, the following information:

5. Expected total and differential settlement.

[Return to Reminder List.](#)

[Endnote 56]:

SECTION 1914A -- WALLS

Section 1914A.2.6 Walls shall be anchored to intersecting elements such as floors or roofs or to columns, pilasters, buttresses, and intersecting walls and footings with reinforcement at least equivalent to No. 4 bars 12 inches (305 mm) on center for each layer of reinforcement.

[Return to Reminder List.](#)

[Endnote 57]:

Section 1921A.4.4.8 Ties at anchor bolts. Anchor bolts which are set in the top of a column shall be provided with ties which enclose at least four vertical column bars. Such ties shall be in accordance with Section 1907A.1.3, Item 3, shall be within 5 inches (127 mm) of the top of the column, and shall consist of at least two No. 4 or three No. 3 bars.

[Return to Reminder List.](#)

[Endnote 58]:

Section 1914A.10 Foundation Walls. Horizontal reinforcing of concrete foundation walls for wood-frame or light-steel buildings shall consist of the equivalent of not less than one No. 5 bar located at the top and bottom of the wall. Where such walls exceed 3 feet (914 mm) in height, intermediate horizontal reinforcing shall be provided at spacings not to exceed 2 feet (610 mm) on center. Minimum vertical reinforcing shall consist of No. 3 bars at 24 inches (610 mm) on center.

Where concrete foundation walls or curbs extend above the floor line and support wood-frame or light-steel exterior, bearing or shear walls, they shall be doweled to the foundation wall below with a minimum of No. 3 bars at 24 inches (610 mm) on center. Where the height of the wall above the floor line exceeds 18 inches (457 mm), the wall above and below the floor line shall meet the requirements of Section 1914A.3. See Section 1633A.2.12 for additional requirements.

[Return to Reminder List.](#)

[Endnote 59]:

Section 1914A.9 Wall Piers. Every pier or wall section which width is less than 2 1/2 times its thickness shall be designed and constructed as required for columns if such wall section is a structural member. Every pier or wall section which width is between 2 1/2 and 6 times its thickness shall have all of its horizontal steel in the form of ties.

[Return to Reminder List.](#)

[Endnote 60]:

Section 1916A.11 Reinforcement. Perimeters of precast walls shall be reinforced continuously with a minimum of one No. 5 bar extending the full height and width of the wall panel. Bars shall be continuous around corners. Where wall panels do not abut columns or other wall panels, perimeter bars shall be retained by hooked wall bars. Edges of openings in precast walls shall be reinforced with a minimum of one No. 5 bar continuous past corners sufficient to develop the bar.

A continuous tie or bond beam shall be provided at the roof line either as a part of the roof structure or part of the wall panels as described in the next paragraph below. This tie may be designed as the edge member of the roof diaphragm but, in any case, shall not be less than equivalent to two No. 6 bars continuous. A continuous tie equivalent to two No. 5 bars minimum shall also be provided either in the footing or with an enlarged section of the floor slab.

Wall panels of shear wall buildings shall be connected to columns or to each other in such a manner as to develop at least 75 percent of the horizontal wall steel. Half of this continuous horizontal reinforcing may be concentrated in bond or tie beams at the top and bottom of the walls and at points of intermediate lateral support. If possible, cast in-place joints with reinforcing bars extending from the panels into the joint a sufficient distance to meet the splice requirements of Section 1912A.15 for Class A shall be used. The reinforcing bars or welded tie details shall not be spaced over eight times the wall thickness vertically nor fewer than four used in the wall panel height. Where wall panels are designed for their respective overturning forces, the panel connections need not comply with the requirements of this paragraph.

Where splicing of reinforcement must be made at points of maximum stress or at closer spacing than permitted by Section 1907A.6, welding may be used when the entire procedure is suitable for the particular quality of steel used and the ambient conditions. Unless the welds develop 125 percent of the specified yield strength of the steel used, reinforcement in the form of continuous bars or fully anchored dowels shall be added to provide 25 percent excess steel area and the welds shall develop not less than the specified yield strength of the steel.

Where reinforcing bars are used to transfer shear across a joint the shear value for bolts set forth in Table 19A-D may be used.

Wall panels shall be positively connected to all floors and roofs as specified in Sections 1605A, 1611A and 1633A.2.4.2. They shall be connected to the foundations when not anchored to the floor slab or otherwise properly anchored.

See Sections 1910A.10, 1910A.11, 1910A.12 and 1910A.13 for design of compression forces in the precast walls.

[Return to Reminder List.](#)

[Endnote 61]:

Section 1923A.3.5 Drilled-in expansion bolts or chemical-type anchors in concrete. When drilled-in expansion-type anchors are used in lieu of cast-in place bolts, the allowable shear and tension values and test loads shall be acceptable to the enforcement agency.

When expansion-type anchors are listed for sill plate bolting applications, 10 percent of the anchors shall be tension tested.

When expansion-type anchors are used for other structural applications, all such expansion anchors shall be tension tested. Expansion-type anchors shall not be used as hold-down bolts.

When expansion-type anchors are used for nonstructural applications such as equipment anchorage, 50 percent, or alternate bolts in a group, including at least one-half the anchors in each group, shall be tension tested.

The tension testing of the expansion anchors shall be done in the presence of the project inspector and a report of the test results shall be submitted to the enforcement agency. If any anchors fail the tension-testing requirements, the additional testing requirements shall be acceptable to the enforcement agency. The above requirements shall also apply to bolts or anchors set in concrete with chemical if the long-term durability and stability of the chemical material and its resistance to loss of strength and chemical change at elevated temperatures are established to the satisfaction of the enforcement agency.

[Return to Reminder List.](#)

[Endnote 62]:

Section 1903A.5 Steel Reinforcement.

Section 1903A.5.2 Welding of reinforcing bars shall conform to *approved nationally recognized standards*. Type and location of welded splices and other required welding of reinforcing bars shall be indicated on the design drawings or in the project specifications. ASTM reinforcing bar specifications, except for A 706, shall be supplemented to require a report of material properties necessary to conform to requirements in UBC Standard 19-1.

If mill test reports are not available, chemical analysis shall be made of bars representative of the bars to be welded. Bars with a carbon equivalent (C.E.) above 0.75 shall not be welded. Welding shall not be done on or within two bar diameters of any bent portion of a bar that has been bent cold. Welding of crossing bars shall not be permitted for assembly of reinforcement unless authorized by the structural engineer and approved by the enforcement agency per approved procedures.

[Return to Reminder List.](#)

[Endnote 63]:

Section 1929A.2 Tests of Reinforcing Bars. Where samples are taken from bundles as delivered from the mill, with the bundles identified as to heat number and provided the mill analyses accompany the report, one tensile test and one bend test shall be made from a specimen from each 10 tons (9080 kg) or fraction thereof of each size of reinforcing steel.

Where positive identification of the heat number cannot be made or where random samples are to be taken, one series of tests shall be made from each 2 1/2 tons (2270 kg) or fraction thereof of each size of reinforcing steel. See Section 1929A.6 for waiver of tests.

[Return to Reminder List.](#)

[Endnote 64]:

Section 1929A.12 Inspection of Welded Reinforcing Bars. Inspection of all shop and field structural welding operations shall be made by a qualified welding inspector approved by the enforcement agency. Such inspector shall be trained and thoroughly experienced in inspecting reinforcing bar welding operations. The inspector's ability to distinguish between sound and unsound welding shall be reliably established.

The welding inspector shall make a systematic record of all welds. This record shall include:

1. Identification marks of welders.
2. List of defective welds.
3. Manner of correction of defects.

The welding inspector shall check the material, equipment, details of construction, and procedures as well as the welds. The inspector shall also check the ability of the welder. The welding inspector shall furnish the architect, structural engineer and the enforcement agency with a verified report that the welding which is required to be inspected is proper and has been done in conformity with the approved plans and specifications. The welding inspector shall use all means necessary to determine the quality of the weld. The inspector may use gamma ray, magnaflux, trepanning, sonics or any other aid to visual inspection which the inspector may deem necessary to assure the adequacy of the welding.

[Return to Reminder List.](#)

[Endnote 65]:

Section 1903A.2 Cement.

1. ASTM C 845, Expansive Hydraulic Cement
2. ASTM C 150, Portland Cement
3. ASTM C 595 or ASTM C 1157, Blended Hydraulic Cements

[Return to Reminder List.](#)

[Endnote 66]:

Section 1903A.3.1 Recognized standards.

1. ASTM C 33, Concrete Aggregates
2. ASTM C 330, Lightweight Aggregates for Structural Concrete
3. ASTM C 332, Lightweight Aggregates for Insulating Concrete
4. ASTM C 144, Aggregate for Masonry Mortar
5. Aggregates failing to meet the above specifications but which have been shown by special test or actual service to produce concrete of adequate strength and durability may be used where authorized by the enforcement agency.

[Return to Reminder List.](#)

[Endnote 67]:

Section 1903A.4 Water.

Section 1903A.4.1 Water used in mixing concrete shall be clean and free from injurious amounts of oils, acids, alkalis, salts, organic materials or other substances deleterious to concrete or reinforcement.

Section 1903A.4.2 Mixing water for prestressed concrete or for concrete that will contain aluminum embedments, including that portion of mixing water contributed in the form of free moisture on aggregates, shall not contain deleterious amounts of chloride ions. See Section 1904A.4.1.

Section 1903A.4.3 Nonpotable water shall not be used in concrete unless the following are satisfied:

Section 1903A.4.3.1 Selection of concrete proportions shall be based on concrete mixes using water from the same source.

Section 1903A.4.3.2 Mortar test cubes made with nonpotable mixing water shall have seven-day and 28-day strengths equal to at least 90 percent of strengths of similar specimens made with potable water. Strength test comparison shall be made on mortars, identical except for the mixing water, prepared and tested in accordance with ASTM C 109 (Compressive Strength of Hydraulic Cement Mortars).

[Return to Reminder List.](#)

[Endnote 68]:

Section 1903A.6 Admixtures.

Section 1903A.6.1 Admixtures to be used in concrete shall be subject to prior approval by the enforcement agency.

Section 1903A.6.2 An admixture shall be shown capable of maintaining essentially the same composition and performance throughout the work as the product used in establishing concrete proportions in accordance with Section 1905A.2.

Section 1903A.6.3 Calcium chloride or admixtures containing chloride from other than impurities from admixture ingredients shall not be used in prestressed concrete, in

concrete containing embedded aluminum, or in concrete cast against stay-in-place galvanized steel forms. See Sections 1904A.3.2 and 1904A.4.1.

Section 1903A.6.4 ASTM C 260, Air-entraining Admixtures for Concrete

Section 1903A.6.5 ASTM C 494 and C 1017, Chemical Admixtures for Concrete

[Return to Reminder List.](#)

[Endnote 69]:

Section 1903A.6.6 Fly ash or other pozzolan can be used as a partial substitute for ASTM 150 portland cement, as follows:

1. Fly ash or other pozzolan shall conform to ASTM C 618 for Class N or Class F materials (Class C is not permitted), and
2. More than 15 percent by weight of fly ash or other pozzolans shall be permitted to be substituted for ASTM C 150 portland cement if the mix design is proportioned by Method B or C. See Section 1904A for durability requirements.
3. More than 40 percent by weight of ground, granulated blast-furnace slag conforming to ASTM C 989 shall be permitted to be substituted for ASTM C 150 portland cement if the mix design is proportioned by Method B or C. See Section 1904A for durability requirements.

[Return to Reminder List.](#)

[Endnote 70]:

Section 1929A.6 Waiver of Material Testing. Tests of cement and reinforcing bars may be waived by the architect or structural engineer with the approval of the enforcement agency for one-story buildings where the specified compressive strength of the concrete f'_c delivered to the jobsite is 3,500 psi (24.13 MPa) and where the f'_c used in design is 2,500 psi (17.24 MPa).

[Return to Reminder List.](#)

[Endnote 71]:

Section 1929A.1 Cementitious Material Test. The concrete supplier shall furnish to the enforcement agency certification from the cement manufacturer that the cement proposed for use on the project has been manufactured and tested in compliance with the requirements of ASTM C 150 for portland cement and ASTM C 595 for blended hydraulic cement, whichever is applicable. When a mineral admixture or ground granulated blast-furnace slag is proposed for use, the concrete supplier shall furnish to the enforcement agency certification from the manufacturer that they have been manufactured and tested in compliance with ASTM C 618 or ASTM C 989, whichever is applicable. An affidavit shall be provided by the concrete supplier which identifies the cementitious material used for the project by the manufacturer's lot number, date of shipment from the manufacturer, date of receipt of cementitious material by the

concrete supplier, place of storage and date of use of the cementitious material. If such information is not available, one grab sample of cementitious material used on the project shall be taken for each day's pour and shall be tested as directed by the structural engineer, architect or enforcement agency. See Section 1929A.6 for waiver of tests.

[Return to Reminder List.](#)

[Endnote 72]:

Section 1903A.3 Aggregates.

Section 1903A.3.1 Recognized standards.

1. ASTM C 33, Concrete Aggregates
2. ASTM C 330, Lightweight Aggregates for Structural Concrete
3. ASTM C 332, Lightweight Aggregates for Insulating Concrete
4. ASTM C 144, Aggregate for Masonry Mortar
5. Aggregates failing to meet the above specifications but which have been shown by special test or actual service to produce concrete of adequate strength and durability may be used where authorized by the enforcement agency.

[Return to Reminder List.](#)

[Endnote 73]:

Section 1929A.10 Inspection of Pneumatically Placed Concrete Work (Shotcrete).

All shotcrete work shall be continuously inspected during placing by an inspector specially approved for that purpose by the enforcement agency. The special shotcrete inspector shall check the materials, placing equipment, details of construction and construction procedure. The inspector shall furnish a verified report that of his or her own personal knowledge the work covered by the report has been performed and materials used and installed in every material respect in compliance with the duly approved plans and specifications.

Section 1929A.11 Tests of Shotcrete. Testing shall follow the provisions of Section 1924A.10 and the general requirements of Section 1905A.6.

[Return to Reminder List.](#)

[Endnote 74]:

Section 1916A.12 On-site Cast Precast Wall Panels.

Section 1916A.12.5 Panels shall be allowed as much time as possible in the erect position before making longitudinal connections with an elapsed time of 28 days minimum between casting and connecting the panels.

[Return to Reminder List.](#)

[Endnote 75]:

Section 1923A.2 Strength Design. The factored loads on embedded anchor bolts and headed studs shall not exceed the design strengths determined by Section 1923A.3.

All bolts shall be accurately and securely set prior to placement of concrete except as indicated in Section 1916A.7.1.

*In addition to the load factors in Section 1909A.2, a multiplier of 1.3 shall be used. * * *
When anchors are embedded in the tension zone of a member, the load factors in Section 1909A.2 shall have a multiplier of 2.*

[Return to Reminder List.](#)

[Endnote 76]:

Section 1929A.6 Waiver of Material Testing. Tests of cement and reinforcing bars may be waived by the architect or structural engineer with the approval of the enforcement agency for one-story buildings where the specified compressive strength of the concrete f_c delivered to the jobsite is 3,500 psi (24.13 MPa) and where the f_c used in design is 2,500 psi (17.24 MPa).

[Return to Reminder List.](#)

[Endnote 77]:

Section 1921A.2.4 Concrete in members resisting earthquake-induced forces.

Section 1921A.2.4.1 Compressive strength f_c shall not be less than 3,000 psi (20.69 MPa). Members with compressive strengths that shall not be less than 3,000 psi (20.7 MPa) include all structural members above and below the base, including foundations which are required to resist the forces resulting from earthquake loading, except foundations for one-story wood-frame or one-story light steel buildings and isolated mat-type foundations supporting equipment only may be designed and constructed for compressive strengths not less than 2,500 psi (17.2 MPa).

[Return to Reminder List.](#)

[Endnote 78]:

Excerpt from Section 2106A.1.12.4 Special provisions for Seismic Zones 3 and 4.

Wall reinforcement. *The total area of reinforcement in reinforced masonry walls shall not be less than 0.003 times the sectional area of the wall. Neither the horizontal nor the vertical reinforcement shall be less than one third of the total. Horizontal and vertical bars shall be spaced at not more than 24 inches (610 mm) center to center. The minimum reinforcing shall be No. 4, except that No. 3 bars may be used for ties and stirrups. Vertical wall steel shall have dowels of equal size and equal matched spacing in all footings. Reinforcement shall be continuous around wall corners and through intersections. Only reinforcement which is continuous in the wall shall be considered in computing the minimum area of reinforcement. Reinforcement with splices conforming to Section 2107A.2.2.6 shall be considered as continuous reinforcement.*

Horizontal reinforcement shall be provided in the top of footings, at the top of wall openings, at roof and floor levels, and at the top of parapet walls. For walls 12 inches (nominal) (305 mm) or more in thickness, reinforcing shall be equally divided into two layers, except where designed as retaining walls. Where reinforcement is added above the minimum requirements, such additional reinforcement need not be so divided.

In bearing walls of every type of reinforced masonry, there shall not be less than one No. 5 bar or two No. 4 bars on all sides of, and adjacent to, every opening which exceeds 24 inches (610 mm) in either direction, and such bars shall extend not less than 48 diameters, but in no case less than 24 inches (610 mm) beyond the corners of the opening. The bars required by this paragraph shall be in addition to the minimum reinforcement elsewhere required.

When the reinforcement in bearing walls is designed, placed and anchored in position as for columns, the allowable stresses shall be as for columns. The length of the wall to be considered effective shall not exceed the center-to-center distance between loads nor shall it exceed the width of the bearing plus four times the wall thickness.

[Return to Reminder List.](#)

[Endnote 79]:

Section 2104A.6.1.2 Reinforced hollow-unit masonry.

Excerpt from Section 2104A.6.1.2.1 General.

4. Bond shall be provided by lapping units in successive vertical courses. Where stack bond is used in reinforced hollow-unit masonry, the open-end type of unit shall be used with vertical reinforcement spaced a maximum of 16 inches (406 mm) on center.

[Return to Reminder List.](#)

[Endnote 80]:

Section 2107A.2.2.6 Splices. *Splices may be made only at such points and in such a manner that the structural strength of the member will not be reduced. The amount of lap of lapped splices shall be sufficient to transfer the allowable stress of the reinforcement as specified in Sections 2106A.3.4, 2107A.2.2.3 and 2107A.2.12. In no case shall the length of the lap splice be less than 36 bar diameters for compression or 48 bar diameters for tension.*

Bars of size No. 8 and larger resisting tensile stresses shall be spliced by welding or by approved mechanical connectors.

Welded or mechanical connections shall develop 125 percent of the specified yield strength of the bar in tension.

EXCEPTION: For compression bars in columns that are not part of the seismic-resisting system and are not subject to flexure, only the compressive strength need be developed.

When adjacent splices in grouted masonry are separated by 3 inches (76 mm) or less, the required lap length shall be increased 30 percent.

EXCEPTION: Where lap splices are staggered at least 24 bar diameters, no increase in lap length is required.

See Section 2107A.2.12 for lap splice increases.

[Return to Reminder List.](#)

[Endnote 81]:

Section 2106A.3.4 Anchorage of flexural reinforcement. The tension or compression in any bar at any section shall be developed on each side of that section by the required development length. The development length of the bar may be achieved by a combination of an embedment length, anchorage or, for tension only, hooks.

Except at supports or at the free end of cantilevers, every reinforcing bar shall be extended beyond the point at which it is no longer needed to resist tensile stress for a distance equal to 12 bar diameters or the depth of the beam, whichever is greater. No flexural bar shall be terminated in a tensile zone unless at least one of the following conditions is satisfied:

1. The shear is not over one half that permitted, including allowance for shear reinforcement where provided.
2. Additional shear reinforcement in excess of that required is provided each way from the cutoff a distance equal to the depth of the beam. The shear reinforcement spacing shall not exceed $d/8r_b$.
3. The continuing bars provide double the area required for flexure at that point or double the perimeter required for reinforcing bond.

At least one third of the total reinforcement provided for negative moment at the support shall be extended beyond the extreme position of the point of inflection a distance sufficient to develop one half the allowable stress in the bar, not less than 1/16 of the clear span, or the depth d of the member, whichever is greater.

Tensile reinforcement for negative moment in any span of a continuous restrained or cantilever beam, or in any member of a rigid frame, shall be adequately anchored by reinforcement bond, hooks or mechanical anchors in or through the supporting member.

At least one third of the required positive moment reinforcement in simple beams or at the freely supported end of continuous beams shall extend along the same face of the beam into the support at least 6 inches (153 mm). At least one fourth of the required positive moment reinforcement at the continuous end of continuous beams shall extend along the same face of the beam into the support at least 6 inches (153 mm).

Compression reinforcement in flexural members shall be anchored by ties or stirrups not less than $3/8$ inch (9.5 mm) in diameter, spaced not farther apart than 16 bar diameters or 48 tie diameters, whichever is less. Such ties or stirrups shall be used throughout the distance where compression reinforcement is required.

[Return to Reminder List.](#)

[Endnote 82]:

Section 2106A.3.5 Anchorage of shear reinforcement. Single, separate bars used as shear reinforcement shall be anchored at each end by one of the following methods:

1. Hooking tightly around the longitudinal reinforcement through 180 degrees.
2. Embedment above or below the mid-depth of the beam on the compression side a distance sufficient to develop the stress in the bar for plain or deformed bars.
3. By a standard hook, as defined in Section 2107A.2.2.5, considered as developing 7,500 psi (52 MPa), plus embedment sufficient to develop the remainder of the stress to which the bar is subjected. The effective embedded length shall not be assumed to exceed the distance between the mid-depth of the beam and the tangent of the hook.

The ends of bars forming a single U or multiple U stirrup shall be anchored by one of the methods set forth in Items 1 through 3 above or shall be bent through an angle of at least 90 degrees tightly around a longitudinal reinforcing bar not less in diameter than the stirrup bar, and shall project beyond the bend at least 12 stirrup diameters.

The loops or closed ends of simple U or multiple U stirrups shall be anchored by bending around the longitudinal reinforcement through an angle of at least 90 degrees and project beyond the end of the bend at least 12 stirrup diameters.

[Return to Reminder List.](#)

[Endnote 83]:

Section 2106A.2.14.1 General. Placement requirements for anchor bolts shall be determined in accordance with this subsection. *Anchor bolts shall be hex headed bolts conforming to ASTM A 307 with the dimensions of the hex head conforming to ANSI/ASME B18.2.1 or plain rod conforming to ASTM A 36 with threaded ends and double hex nuts at the anchored end. Bent bar anchor bolts shall not be used.*

The maximum size anchor shall be 1/2-inch (13 mm) diameter for 6-inch (152 mm) nominal masonry, 3/4-inch (19 mm) diameter for 8-inch (203 mm) nominal masonry, 7/8-inch (22 mm) diameter for 10-inch (254 mm) nominal masonry, and 1-inch (25 mm) diameter for 12-inch (304.8 mm) nominal masonry.

The effective embedment depth l_b for * * * anchor bolts shall be the length of embedment measured perpendicular from the surface of the masonry to the bearing surface of the head of the anchorage. All bolts shall be grouted in place with at least 1 inch (25 mm) of grout between the bolt and the masonry, *and shall be accurately set with templates.*

[Return to Reminder List.](#)

[Endnote 84]:

Excerpt from Section 2104A.6.1.2.1 General. Reinforced hollow-unit masonry is that type of construction made with hollow-masonry units in which cells are continuously filled with grout, and in which reinforcement is embedded. All cells shall be solidly filled with grout in reinforced hollow-unit masonry, except as provided in Section 2112A.1. Construction shall be one of the two following methods: The low-lift method where the maximum height of construction laid before grouting is 2 feet (610 mm), or the high-lift method where the full height of construction between horizontal cold joints is grouted in one operation.

[Return to Reminder List.](#)

[Endnote 85]:

Excerpt from Section 2106A.1.12.4 Special provisions for Seismic Zones 3 and 4. All masonry structures shall be so designed and constructed *that the unit stresses do not exceed those set forth in Section 2107A, and the following additional requirements are met.*

Wall reinforcement. In bearing walls of every type of reinforced masonry, there shall not be less than one No. 5 bar or two No. 4 bars on all sides of, and adjacent to, every opening which exceeds 24 inches (610 mm) in either direction, and such bars shall extend not less than 48 diameters, but in no case less than 24 inches (610 mm) beyond the corners of the opening. The bars required by this paragraph shall be in addition to the minimum reinforcement elsewhere required.

[Return to Reminder List.](#)

[Endnote 86]:

Excerpt from Section 2106A.1.12.4 Special provisions for Seismic Zones 3 and 4
2. Shear Walls.

2.1 Reinforcement. The portion of the reinforcement required to resist shear shall be uniformly distributed and shall be joint reinforcement, deformed bars or a combination thereof. The spacing of reinforcement in each direction shall not exceed 24 inches (610 mm) each way.

Joint reinforcement used in exterior walls and considered in the determination of the shear strength of the member shall be hot-dipped galvanized in accordance with UBC Standard 21-10.

Reinforcement required to resist in-plane shear shall be terminated with a standard hook as defined in Section 2107A.2.2.5 *which encircles the vertical reinforcing* or with an extension of proper embedment length beyond the reinforcement at the end of the wall section. The hook or extension may be turned up, down or horizontally. Provisions shall be made not to obstruct grout placement. Wall reinforcement terminating in columns or beams shall be fully anchored into these elements.

[Return to Reminder List.](#)

[Endnote 87]:

Excerpt from Section 2106A.2.3.3 Walls and Piers.

Piers. Every pier or wall section which width is less than three times its thickness shall be designed and constructed as required for columns if such pier is a structural member. Every pier or wall section which width is between three and five times its thickness or less than one half the height of adjacent openings shall have all horizontal steel in the form of ties except that in walls 12 inches (305 mm) or less in thickness such steel may be in the form of hairpins.

[Return to Reminder List.](#)

[Endnote 88]:

Section 1906A.4 Construction Joints.

Section 1906A.4.7 The surface of all horizontal construction joints shall be cleaned and roughened by removing the entire surface and exposing clean aggregate solidly embedded in mortar matrix.

In the event that the contact surface becomes coated with earth, sawdust, etc., after being cleaned, the entire surface so coated shall be recleaned.

[Return to Reminder List.](#)

[Endnote 89]:

SECTION 2102A -- MATERIAL STANDARDS

Excerpt from Section 2102A.2 Standards of Quality. The standards listed below labeled a "UBC Standard" are also listed in Chapter 35, Part II, and are part of this code. The other standards listed below are *American Society for Testing and Materials (ASTM)* or *American Concrete Institute (ACI)* standards and are part of this code. See Sections 3503 and 3504.

2. Cement.

2.3 UBC Standard 21-14, Mortar Cement, except the maximum limit for fly ash indicated in Table 21-14-B shall be 15 percent.

[Return to Reminder List.](#)

[Endnote 90]:

Section 2105A.3.1 Masonry core testing. Not less than two cores having a diameter of 6 inches (152 mm) shall be taken from each project. Two cores shall be taken from each building for each 5,000 square feet (465 m²) of the greater of the masonry wall area or the floor area or fraction thereof. The architect or structural engineer in responsible charge of the project or his/her representative (inspector) shall select the areas for sampling. One half of the number of cores taken shall be tested in shear. The shear wall loadings shall test both joints between the grout core and the outside wythes of the masonry. Core samples shall not be soaked before testing. Materials and workmanship shall be such that for all masonry when tested in compression, cores shall show an ultimate strength at least equal to the f'_m assumed in design, but not less than

1,500 psi (10.34 MPa). When tested in shear, the unit shear on the cross section of the core shall not be less than $2.5 \times \sqrt{f'_m}$ psi.

Shear testing apparatus shall be of a design approved by the enforcement agency. Visual examination of all cores shall be made to ascertain if the joints are filled.

The project inspector or testing agency shall inspect the coring of the masonry walls and shall prepare a report of coring operations for the testing laboratory files and mail one copy to the enforcement agency. Such reports shall include the total number of cores cut, the location, and the condition of all cores cut on each project, regardless of whether the core specimens failed during cutting operation. All cores shall be submitted to the laboratory for examination.

[Return to Reminder List.](#)

[Endnote 91]:

Section 2105A.3.2 Masonry prism testing. The compressive strength of masonry determined in accordance with UBC Standard 21-17 for each set of prisms shall equal or exceed f'_m . Compressive strength of prisms shall be based on tests at 28 days. Compressive strength at seven days or three days may be used provided a relationship between seven-day and three-day and 28-day strength has been established for the project prior to the start of construction. Verification by masonry prism testing shall meet the following:

1. A set of five masonry prisms shall be built and tested in accordance with UBC Standard 21-17 prior to the start of construction. Materials used for the construction of the prisms shall be taken from those specified to be used in the project. Prisms shall be constructed under the observation of the engineer or special inspector or an approved agency and tested by an approved agency.
2. * * * A set of three prisms shall be built and tested during construction in accordance with UBC Standard 21-17 for each 5,000 square feet (465 m²) of wall area, but not less than one set of three masonry prisms for the project.

[Return to Reminder List.](#)

[Endnote 92]:

Section 2105A.3.3 Masonry prism test record. Compressive strength verification by masonry prism test records shall meet the following:

1. A masonry prism test record approved by the *enforcement agency* of at least 30 masonry prisms which were built and tested in accordance with UBC Standard 21-17. Prisms shall have been constructed under the observation of an engineer or special inspector or an approved agency and shall have been tested by an approved agency.
2. Masonry prisms shall be representative of the corresponding construction.

3. The average compressive strength of the test record shall equal or exceed $1.33 f'_m$.
4. * * * A set of three masonry prisms shall be built during construction in accordance with UBC Standard 21-17 for each 5,000 square feet (465 m²) of wall area, but not less than one set of three prisms for the project.

[Return to Reminder List.](#)

[Endnote 93]:

Excerpt from Section 2105A.3.4 Unit strength method. Verification by the unit strength method shall meet the following:

*2. **Mortar and grout tests.** At the beginning of all masonry work, at least one test sample of the mortar and grout shall be taken on three successive working days and at least at one-week intervals thereafter. The samples shall be continuously stored in moist air until tested. They shall meet the minimum strength requirement given in Sections 2103A.3 and 2103A.4 for mortar and grout, respectively. Additional samples shall be taken whenever any change in materials or job conditions occur, or whenever in the judgment of the architect, structural engineer or the enforcement agency such tests are necessary to determine the quality of the material.*

Test specimens for mortar and grout shall be made as set forth in UBC Standards 21-16 and 21-18. In making the mortar test specimens, the mortar shall be taken from the unit soon after spreading. After molding, the molds shall be carefully protected by a covering which shall be kept damp for at least 24 hours, after which the specimens shall be stored and tested as required for concrete cylinders.

In making grout test specimens, the masonry unit molds shall be broken away after the grout has taken its set, but before it has hardened. If an absorbent paper liner is used, the mold may be left in place until the specimen has hardened. The prisms shall be stored as required for concrete cylinders. They shall be tested in the vertical position.

[Return to Reminder List.](#)

[Endnote 94]:

Section 2105A.7 Masonry Inspection. All structural masonry work shall be continuously inspected during laying and grouting by an inspector specially approved for that purpose by the enforcement agency. The inspector shall make test samples and perform such tests as are required and shall check the materials, details of construction, and construction procedures.

The special masonry inspector shall furnish a verified report that, of his own personal knowledge, the work covered by the report has been performed, and materials used and installed in every material respect in compliance with the duly approved plans and specifications.

[Return to Reminder List.](#)

[Endnote 95]:

Section 2105A.3 Compliance with f'_m .

Section 2105A.3.0 f'_m . *The specified compressive strength, f'_m , assumed in design shall be 1,500 psi (10.34 MPa) for all masonry construction using materials and details of construction required herein.*

EXCEPTION: *Subject to the approval of the enforcement agency, higher values of f'_m may be used in the design of reinforced grouted masonry and reinforced hollow-unit masonry. The approval shall be based on test results submitted by the architect or engineer which demonstrate the ability of the proposed construction to meet prescribed performance criteria for strength and stiffness. The design shall assume that the reinforcement will be placed in a location that will produce the largest stresses within the tolerances allowed in Section 2104A.5 and shall take into account the mortar joint depth. In no case shall the f'_m assumed in design exceed 2,500 psi (17.24 MPa).*

Where an f'_m greater than 1,500 psi (10.34 MPa) is approved, the architect or structural engineer shall establish a method of quality control of the masonry construction acceptable to the enforcement agency which shall be described in the contract specifications. Compliance with the requirements for the specified compressive strength of masonry f'_m shall be in accordance with Section 2105A.3.2, 2105A.3.3, 2105A.3.4 or 2105A.3.5.

[Return to Reminder List.](#)

[Endnote 96]:

Section 2205A.12 Column Base Plate. **[For DSA/SS]** *When shear or tensile forces are intended to be transferred between column base plates and anchor bolts, provision shall be made in the design to eliminate the effects of oversized holes permitted in base plates by Division I, Section 2205A.11 * * * by use of shear lugs or welded shear transfer plates when the oversized holes are larger than the anchor bolt by more than 1/8 inch (3.2 mm). When welded shear transfer plates are used, the anchor bolts shall be checked for the induced bending stresses in combination with the shear stresses using Formula 12A-1 as follows:*

$$f_v / F_v + f_b / F_b \leq 1.0 \quad (12A-1)$$

[Return to Reminder List.](#)

[Endnote 97]:

Excerpt from Section 2203A.2 Structural Steel. *Structural steel shall be identified by the mill in accordance with approved national standards. When such steel is furnished to a specified minimum yield point greater than 36,000 pounds per square inch (psi) (248 MPa), the American Society for Testing and Materials (ASTM) or other specification designation shall be so indicated.*

[Return to Reminder List.](#)

[Endnote 98]:

Section 2231A.1 Tests of Structural Steel. All steel used for structural purposes shall be identified as required by Section 2203A. Manufacturer's mill analyses and test reports are acceptable for properly identified steel, but the enforcement agency may require additional testing to determine the quality of the steel if there is any doubt as to its acceptability. Any steel not properly identified shall be tested to meet the minimum chemical and mechanical requirements of the ASTM standard appropriate for the steel specified for the structure. **CHAP. 22A, DIV. XII**

EXCEPTION: No mechanical tests are required for unidentified steel when the minimum yield stress required by the design is less than or equal to 25 ksi (172 MPa) and the steel is not part of the designated lateral-force-resisting system.

Section 2231A.2 Tests of High-strength Bolts, Nuts and Washers. High-strength bolts, nuts and washers shall be sampled and tested by an approved independent testing laboratory for conformance with the requirements of Division III.

[Return to Reminder List.](#)

[Endnote 99]:

Section 2231A.3 Tests of End-welded Studs. End-welded studs shall be sampled, tested and inspected per the requirements of the Structural Welding Code-Steel, 1994 edition, published by the American Welding Society.

[Return to Reminder List.](#)

[Endnote 100]:

Excerpt from Section 2231A.7 Open-web Steel Joists and Joist Girders-Design Verification Tests. If the design is such that it is not susceptible to rational analysis, one load test shall be made for every 50 joists or fractional part thereof of every type of welded joist.

EXCEPTION: This requirement may be waived by the enforcement agency when a particular joist design has been previously verified. Verification of joist design and performance can be accomplished if a quality assurance control program and testing procedures acceptable to the enforcement agency are carried out by the manufacturer for each standard production joist series on a continuing basis.

[Return to Reminder List.](#)

[Endnote 101]:

Section 2231A.5 Inspection of Welding. Inspection of all shop and field welding operations, including the installation of automatic end-welded stud shear connectors shall be made by a qualified welding inspector approved by the enforcement agency. Such inspector shall be a person trained and thoroughly experienced in inspecting welding operations. The inspector's ability to distinguish between sound and unsound welding shall be reliably established. The minimum requirements for a qualified welding inspector shall be as those for an AWS certified welding inspector (CWI), as defined in

the provisions of the 1992 edition of AWS QCI, Standard and Guide for Qualification and Certification of Welding Inspectors published by the American Welding Society. All welding inspectors shall be as approved by the enforcement agency.

The ability of each welder to produce sound welds of all types required by the work shall be established by welder qualification satisfactory to the enforcement agency.

Welding inspection of structural welding shall conform to the requirements of AWS D1.1 Structural Welding Code-Steel, 1994 edition, published by the American Welding Society, except as modified by this section.

Welding inspection of cold-formed steel members shall conform to the requirements of AWS D1.3.

The welding inspector shall make a systematic record of all welds. This record shall include in addition to other required records:

- 1. Identification marks of welders.*
- 2. List of defective welds.*
- 3. Manner of correction of defects.*

The welding inspector shall check the material, equipment, details of construction and procedure, as well as the welds. The inspector shall also check the ability of the welder. The inspector shall verify that the installation procedure for automatic end-welded stud shear connectors is in accordance with the requirements of AWS D1.1, Structural Welding Code-Steel, 1994 edition, published by the American Welding Society and the approved plans and specifications. The inspector shall furnish the architect, structural engineer and the enforcement agency with a verified report that the welding is proper and has been done in conformity with AWS D1.1, Structural Welding Code-Steel, 1994 edition, published by the American Welding Society, and the approved plans and specifications. The inspector shall use all means necessary to determine the quality of the weld. The inspector may use gamma ray, magnaflux, trepanning, sonics or any other aid to visual inspection which the inspector may deem necessary to be assured of the adequacy of the welding.

EXCEPTION: *Plant welding inspection of open-web steel joists may be waived with the approval of the enforcement agency where welding inspection is provided at the jobsite.*

[Return to Reminder List.](#)

[Endnote 102]:

Section 2231A.6 Inspection of High-strength Bolt Installations. *Inspection of high-strength bolt installations shall be made in accordance with Division III by an inspector specially approved for that purpose by the enforcement agency. The inspector shall check the materials, equipment, details of construction and installation procedure. The*

inspector shall furnish the architect, structural engineer and the enforcement agency with a report that the work has been completed in every material respect in compliance with the approved plans and specifications.

[Return to Reminder List.](#)

[Endnote 103]:

EXCERPT FROM SECTION 2209A -- AMENDMENTS

4. Sec. J1, 10. *Delete entirely and replace with:*

Bolts in Combination with Welds. *In new work, A307 bolts or high-strength bolts used in bearing-type connections shall not be considered as sharing the stress in combinations with welds. The welds shall be made before the bolts are tensioned. Welds, if used, shall be provided to carry the entire stress in the connection. High-strength bolts proportioned for slip-critical connections may be considered as sharing the stress with the welds.*

In making welding alterations to structures, existing rivets and high-strength bolts tightened to the requirements for slip-critical connections are permitted for carrying stresses resulting from loads present at the time of alteration, and the welding need be adequate to carry only the additional stress.

[Return to Reminder List.](#)

[Endnote 104]:

Section 2205A.4.1 Steel Deck Diaphragms. *Steel deck diaphragms shall comply with the requirements of this section and Section 1613A. Materials for steel deck diaphragms shall conform to the requirements of Division VII and shall be identified in accordance with Section 2203A.3. Unidentified steel shall be tested in accordance with Section 2203A.1. The design of the diaphragm as well as the construction details may be based on test information acceptable to the enforcement agency.*

Diaphragm chord forces both compression and tension forces resulting from in-plane shear shall be resisted by flange members and not by the steel deck diaphragm.

The base material thickness of steel deck for diaphragms shall not be less than 0.0359 inch (0.9 mm) (20 gage), unless tests acceptable to the enforcement agency have been performed.

Weld washers shall be used for steel decks with a base metal thickness of material greater than 0.028 inch (0.7 mm) when the allowable shear values used in the diaphragm are obtained from the result of tests using weld washers.

Welding inspection shall conform to Section 2231A, Division XII.

[Return to Reminder List.](#)

[Endnote 105]:

Section 2205A.13 Welded Shear Connectors. *When welded shear connectors are used for applications other than composite construction, such as for transfer of shear loads to ledgers, drag ties and diaphragm chord members, the allowable shear loads shall be one third of the tabulated values. For installations where connectors are applied through formed steel decks and are used for transfer of shear loads other than for composite construction, the allowable shear loads shall be one third the tabulated value multiplied by the appropriate reduction factor given in Division IX*

[Return to Reminder List.](#)

[Endnote 106]:

Section 2308A -- WALL FRAMING.

The framing of exterior and interior walls shall be in accordance with provisions specified in Division IV unless a specific design is furnished.

Wood stud walls and bearing partitions shall not support more than two floors and a roof unless an analysis satisfactory to the *enforcement agency* shows that shrinkage of the wood framing will not have adverse effects on the structure or any plumbing, electrical or mechanical systems, or other equipment installed therein due to excessive shrinkage or differential movements caused by shrinkage. The analysis shall also show that the roof drainage system and the foregoing systems or equipment will not be adversely affected or, as an alternate, such systems shall be designed to accommodate the differential shrinkage or movements.

[Return to Reminder List.](#)

[Endnote 107]:

Section 1505.3 Ventilation. Where determined necessary by the building official [*for DSA/SS, OSHPD 1, 2 and 4*] *enforcement agency* due to atmospheric or climatic conditions, enclosed attics and enclosed rafter spaces formed where ceilings are applied directly to the underside of roof rafters shall have cross ventilation for each separate space by ventilating openings protected against the entrance of rain and snow. The net free ventilating area shall not be less than 1/150 of the area of the space ventilated.

EXCEPTIONS: 1. The opening area may be 1/300 of the area of the space ventilated provided 50 percent of the required opening area is provided by ventilators located in the upper portion of the space to be ventilated at least 3 feet (914 mm) above eave or cornice vents with the balance of the required ventilation provided by eave or cornice vents.

2. The opening area may be 1/300 of the area of the space ventilated provided a vapor barrier not exceeding 1 perm [5.7 10-11 kg/(Pa □ s □ m²)] is installed on the warm side of the attic insulation.

Where eave or cornice vents are installed, insulation shall not block the free flow of air. A minimum of 1 inch (25 mm) of air space shall be provided between the insulation and roof sheathing.

Openings for ventilation shall be covered with corrosion-resistant metal mesh with mesh openings of 1/4 inch (6.4 mm) in dimension.

Smoke and heat venting shall be in accordance with Section 906.

[Return to Reminder List.](#)

[Endnote 108]:

SECTION 2315A -- WOOD SHEAR WALLS AND DIAPHRAGMS

Excerpt from 2315A .1 General.

Connections and anchorages capable of resisting the design forces shall be provided between the diaphragms and the resisting elements. Openings in diaphragms that materially affect their strength shall be fully detailed on the plans and shall have their edges adequately reinforced to transfer all shearing stresses.

[Return to Reminder List.](#)

[Endnote 109]:

Section 2320A.8.4. Framing around openings. Trimmer and header joists shall be doubled, or of lumber of equivalent cross section, when the span of the header exceeds 4 feet (1219 mm). The ends of header joists more than 6 feet (1829 mm) long shall be supported by framing anchors or joist hangers unless bearing on a beam, partition or wall. Tail joists over 12 feet (3658 mm) long shall be supported at header by framing anchors or on ledger strips not less than 2 inches by 2 inches (51 mm by 51 mm).

[Return to Reminder List.](#)

[Endnote 110]:

Table 23A - II - I - 1, Footnote 4. *Shear walls more than one vertical panel in height shall have either vertical or horizontal staggered spliced joints. At continuous horizontal joints the blocking shall be 3-inch (76 mm) nominal or thicker.*

[Return to Reminder List.](#)

[Endnote 111]:

Table 23A - II - I - 1, Footnote 2. *Where plywood panels are applied on both faces of a wall, *** plywood panel joints shall occur at *** 3-inch (76 mm) nominal or thicker framing members, including blocking, and nails on each side shall be staggered.*

[Return to Reminder List.](#)

[Endnote 112]:

Table 23A - II - H - 1, Footnote 3. *Plywood joints shall occur at the center of framing members or blocking. The minimum edge distance for nails in the receiving members and the plywood shall be 3/8 inch (9.5 mm) for 2-inch (51 mm) nominal receiving*

members and 1/2-inch (13 mm) for 3-inch (76 mm) nominal receiving members. Flat blocking receiving 10d nails shall be 3-inch by 4-inch nominal (76 by 102 mm) or larger.

[Return to Reminder List.](#)

[Endnote 113]:

Table 23A - II - B - 1, Footnote 2. Nails spaced at 6 inches (152 mm) on center at edges, 12 inches (305 mm) at intermediate supports except 6 inches (152 mm) at all supports where spans are 48 inches (1219 mm) or more. For nailing of wood structural panel and particleboard diaphragms and shear walls, refer to Sections 2315A.3.3 and 2315A.4. Nails for wall sheathing may be common, box or casing.

[Return to Reminder List.](#)

[Endnote 114]:

Section 2315A.3.1 Conventional lumber diaphragm construction.

Such lumber diaphragms shall be made up of 1-inch (25 mm) nominal sheathing boards laid at an angle of approximately 45 degrees to supports. Sheathing boards shall be directly nailed to each intermediate bearing member with not less than two 8d nails for 1-inch-by-6-inch (25 mm by 152 mm) nominal boards and three 8d nails for boards 8 inches (203 mm) or wider; and three 8d nails and four 8d nails shall be used for 6-inch and 8-inch (152 mm and 203 mm) boards, respectively, at the *[for DSA/SS] ends of the board and diaphragm boundaries*. End joints in adjacent boards shall be separated by at least one joist or stud space, and there shall be at least two boards between joints on the same support. Boundary members at edges of diaphragms shall be designed to resist direct tensile or compressive chord stresses and adequately tied together at corners.

[Return to Reminder List.](#)

[Endnote 115]:

Excerpt from Section 2316A.2 Amendments.

22. Add a section as follows:

4.4.1.4 Bridging for Floor Joists and Roof Joists or Rafters. *Roof joists or rafters of more than 8-inch (203 mm) depth and floor joists of more than 4-inch (102 mm) depth which are spaced 32 inches (813 mm) on center or less shall be provided with bridging to distribute superimposed loads. Floor joists shall be bridged every 8 feet (2438 mm) and roof joists or rafters every 10 feet (3048 mm) by solid blocking 2 inches (51 mm) thick and the full depth of the joist or rafter, or by wood cross bridging of not less than 1 inch by 3 inches (25 mm by 76 mm) or nailed metal cross bridging of equal strength. Where cross bridging is used, the lower ends of such cross bridging shall be driven up and nailed after the floor, subfloor or roof has been nailed.*

[Return to Reminder List.](#)

[Endnote 116]:

Excerpt from Section 2320A.11.2 Framing details. Studs shall be placed with their wide dimension perpendicular to the wall. Not less than three studs shall be installed at each corner of an exterior wall.

Openings in stud walls or partitions shall have headers and a minimum of two studs at jambs, one stud of which may be cut to support the header in bearing.

[Return to Reminder List.](#)

[Endnote 117]:

Section 2320A.6 Foundation Plates or Sills. *Sills under bearing, exterior or shear walls shall be bolted to the masonry or concrete with not smaller than 5/8-inch by 12-inch (16 mm by 305 mm) bolts spaced not more than 4 feet (1219 mm) on center with a minimum of two bolts for each piece of sill plate. There shall be a bolt within 9 inches (229 mm) of each end of each piece of sill. The effective embedment length in concrete of bolts designed to resist overturning or uplift forces shall not include the embedment in 6-inch (152 mm) or narrower concrete curbs. Where sills are bored or notched exceeding one third the sill width, extra bolts shall be required as given for ends of sill pieces. All sills under bearing, exterior or shear walls shall be bedded on 1/2-inch-minimum (13 mm) dry pack or grout so as to obtain a continuous bearing.*

Sills under nonbearing interior partitions on concrete floor slabs shall be anchored at not more than 4 feet (1219 mm) on center to resist a shear of not less than 50 pounds per linear foot (0.7 kN/m) acting either parallel or normal to the wall.

The nominal thickness of the sills shall not be less than 3 inches (76 mm) when the wall is diagonally sheathed, and not less than 2 inches (51 mm) in any event.

Treated wood sills where cut, drilled or notched shall be treated with a preservative and approved by the architect and the enforcement agency on all exposed surfaces from which preservative treatment has been removed.

[Return to Reminder List.](#)

[Endnote 118]:

Excerpt from 2306A.4 Plates, Sills and Sleepers.

Bottoms of sills and plywood, unless the plywood is treated in accordance with Section 2306A.8 on exterior foundation walls shall not be less than 12 inches (305 mm) above outside finished earth grade. On exterior walls where the earth is paved with an asphalt or concrete slab at least 18 inches (457 mm) wide and draining away from the building, the bottom of sills may be 6 inches (152 mm) above the top of such slab. Other means of termite and decay protection may be accepted by the enforcement agency.

Stud walls or partitions around shower or toilet rooms with more than two fixtures, and stud walls adjacent to unroofed paved areas, shall rest on concrete curbs extending at least 6 inches (152 mm) above finished floor or paving level.

[Return to Reminder List.](#)

[Endnote 119]:

Section 2320A.11.9 Cutting and notching. *Any cutting and notching shall be detailed on the approved plans*

[Return to Reminder List.](#)

[Endnote 120]:

Section 2320A.11.10 Bored holes. *Holes exceeding one third of the width of the member being penetrated shall not be placed in studs unless fully detailed on the approved plans. Holes not exceeding one third of the stud width shall be neatly bored and shall be located in the center of the member being penetrated.*

[Return to Reminder List.](#)

[Endnote 121]:

Excerpt from Section 2304A.3 Timber Connectors and Fasteners.

The number and size of nails connecting wood members shall not be less than that set forth in Tables 23A-II-B-1 and 23A-II-B-2. Other connections shall be fastened to provide equivalent strength. End and edge distances and nail penetrations shall be in accordance with the applicable provisions of Division III, Part III.

[Return to Reminder List.](#)

[Endnote 122]:

Table 19A-D, Footnote 1. Values are *for* natural stone aggregate concrete and bolts of A 307 quality. Bolts shall have a standard head or an equal deformity in the embedded portion. *L or J bolts shall not be used to resist seismic forces. Bolts, except holdowns, anchoring light frame sills and having a minimum edge or end distance equal to or greater than 5 diameters, may use L or J bolts.*

[Return to Reminder List.](#)

[Endnote 123]:

Excerpt from Section 2318A.7 Metal Plate Connectors.

5. Complete truss drawings. *Complete drawings of truss configurations and all joint details, including the details for the support of the ends of the truss shall be shown on the drawings submitted for approval.*

[Return to Reminder List.](#)

[Endnote 124]:

Excerpt from Section 2304A.1 Quality and Identification. All lumber, *plywood*, structural glued-laminated timber, end-jointed lumber, piles and poles regulated by this chapter shall conform to the applicable standards and grading rules specified in this code and shall be so identified by the grade mark or certificate of inspection issued by an approved agency.

[Return to Reminder List.](#)

[Endnote 125]:

Excerpt from 2304A.1 Quality and Identification. All lumber, *plywood*, structural glued-laminated timber, end-jointed lumber, piles and poles regulated by this chapter shall conform to the applicable standards and grading rules specified in this code and shall be so identified by the grade mark or certificate of inspection issued by an approved agency

[Return to Reminder List.](#)

[Endnote 126]:

Excerpt from 2315A.3.3 Plywood diaphragms.

In horizontal plywood diaphragms, no panel less than 24 inches (610 mm) wide shall be used. In vertical plywood diaphragms, no panel less than 12 inches (305 mm) wide shall be used.

[Return to Reminder List.](#)

[Endnote 127]:

Excerpt from Section 2306A.4 Plates, Sills and Sleepers. All foundation plates or sills and sleepers on a concrete or masonry slab, which is in direct contact with earth, and sills that rest on concrete or masonry foundations, shall be treated wood or Foundation redwood, all marked or branded by an approved agency. Foundation cedar or No. 2 Foundation redwood marked or branded by an approved agency may be used for sills in territories subject to moderate hazard, where termite damage is not frequent and when specifically approved by the *enforcement agency*. In territories where hazard of termite damage is slight, any species of wood permitted by this code may be used for sills when specifically approved by the *enforcement agency*.

[Return to Reminder List.](#)

[Endnote 128]:

Excerpt from Section 2320A.6 Foundation Plates or Sills.

Treated wood sills where cut, drilled or notched shall be treated with a preservative and approved by the architect and the enforcement agency on all exposed surfaces from which preservative treatment has been removed

[Return to Reminder List.](#)

[Endnote 129]:

Excerpt from 2315A.3.3 Plywood diaphragms.

Use of machine nailing is subject to a satisfactory jobsite demonstration for each project and the approval of the project architect or structural engineer and the enforcement agency. The approval is subject to continued satisfactory performance. Machine nailing is not allowed for 5/16-inch (7.9 mm) plywood. If the nail heads penetrate the outer ply more than would be normal for a hand-held hammer, or if minimum allowable edge distances are not maintained, the performance will be deemed unsatisfactory and machine nailing shall be discontinued

[Return to Reminder List.](#)

[Endnote 130]:

Section 2337A.3 Manufactured Trusses. *The fabrication of trusses and other assemblages constructed using wood and metal members, or using light metal plate connectors, shall be continuously inspected by a qualified inspector approved by the enforcement agency. The inspector shall furnish the architect, structural engineer and the enforcement agency with a report that the lumber species, grades and moisture content; type of glue, temperature and gluing procedure; type of metal members and metal plate connectors; and the workmanship conform in every material respect with the duly approved plans and specifications. Each inspected truss shall be stamped by the inspector with an identifying mark.*

[Return to Reminder List.](#)

[Endnote 131]:

Excerpt from Section 2316A.2 Amendments.

28. Sec. 5.4.6. Add a new section as follows:

Manufacture and Fabrication. *The manufacture and fabrication of structural glued-laminated timber shall be in accordance with ANSI/AITC A 190.1 and the following requirements:*

1. **Joints.** *All portions of end joints in adjacent laminations shall be separated in accordance with ANSI/AITC A 190.1 and ASTM D 3737. The areas requiring 6-inch (152 mm) spacing shall be shown on the approved drawings or described in the specifications.*

Joints in adjacent laminations of arched members shall be separated as required for bending members.

2. **Adhesives.** *Dry-use adhesives shall not be used.*

3. **Moisture content at the time of gluing.** *The maximum moisture content of the wood at the time of gluing shall not exceed 16 percent for projects located in coastal areas, 12 percent for projects located in interior valleys or 10 percent for projects located in desert areas, with the geographical areas as determined by the enforcement agency. The moisture content of the wood for members that will be exposed to direct sunlight in the finished structure shall not exceed the following limits at time of gluing:*

1. 12 percent for Alaskan Yellow Cedar
2. 10 percent for all other species

The minimum moisture content shall not be less than 7 percent.

The range of moisture content of laminations assembled into a single member shall not exceed 5 percent at the time of gluing.

3. **Reinforcement for radial tension.** *Where mechanical reinforcement is required to resist radial tension, reinforcement shall be as described in 3rd Edition (1985) of the Timber Construction Manual or as otherwise approved. The maximum spacing of mechanical reinforcement shall not exceed one half the effective embedded thread*

length of the member at the location of reinforcement. The effective embedded thread length is the embedded thread length in the tension zone from the neutral axis of the member to the end of the reinforcement.

4. Inspection. See Section 2337A for inspection requirements.

29. Sec. 5.4.7. Add a new section as follows:

Specifications. For structural glued-laminated timber, the following shall be shown on the plans and in the specifications:

Whether for dry or wet conditions of use

Species and applicable standard

Stress requirements and combination symbol

If the temperature of the timber exceeds 150° F (66° C) in service

Tension zones for purposes of determining grades of laminations and location of spaced end joints for all members except simple beams supporting uniform loads.

Those portions of glued-laminated timbers which form the structural supports of a building or other structure and are exposed to weather and not properly protected by a roof, eave overhangs or similar covering shall be pressure treated with an approved preservative or be manufactured from wood of natural resistance to decay.

All weather-exposed surfaces of members shall be protected in an approved manner to prevent decay where they are located in a high-humidity environment such as in direct contact with soil or water and where portions extend beyond the walls and roof coverage in buildings. When the member is protected with an approved pressure treatment, the treatment process shall not impair the structural integrity of the member. When the member is protected by flashing or is encased, care must be taken to provide ventilation and prevent moisture entrapment on the member.

All members shall have appropriate weather protection during transit, storage and erection.

[Return to Reminder List.](#)

[Endnote 132]:

Excerpt from Section 2316A.2 Amendments.

3. Sec. 2.2. Delete first sentence and substitute the following:

Allowable stress design values for visually graded structural lumber, mechanically graded structural lumber and structural glued laminated timber shall be in accordance with NDS Supplement Tables 2A, 4A except for the Repetitive Member Factor, Cr, 4B except for the Repetitive Member Factor, Cr, 4C except for the Repetitive Member Factor, Cr, 4D, 5A, 5B and 5C. The Repetitive Member Factor, Cr, shall not be used to

adjust the allowable stresses set forth in Tables 4A, 4B, 4C and 4E. Values for species and grades not tabulated shall be submitted to the enforcement agency for approval.

[Return to Reminder List.](#)

[Endnote 133]:

Excerpt from Section 2316A.2 Amendments.

23. Sec. 5.2.2. Delete and substitute as follows:

[For DSA/SS] Reinforcement of radial tension. *Where mechanical reinforcement is required to resist radial tension, reinforcement shall be as described in the 3rd Edition (1985) of the Timber Construction Manual or as otherwise approved. The maximum spacing of mechanical reinforcement shall not exceed one half the effective embedded thread length of the member at the location of the reinforcement. The effective embedded thread length is the embedded thread length in the tension zone from the neutral axis of the member to the end of the reinforcement.*

[Return to Reminder List.](#)

[Endnote 134]:

Section 2304A.3 Timber Connectors and Fasteners. Safe loads and design practices for types of connectors and fasteners not mentioned or fully covered in Division III, Part III, may be determined in a manner approved by the building official.

The number and size of nails connecting wood members shall not be less than that set forth in Tables 23A-II-B-1 and 23A-II-B-2. Other connections shall be fastened to provide equivalent strength. End and edge distances and nail penetrations shall be in accordance with the applicable provisions of Division III, Part III.

Fasteners for pressure-preservative treated and fire-retardant treated wood shall be of hot-dipped zinc coated galvanized, stainless steel, silicon bronze or copper. Fasteners for wood foundations shall be as required in Chapter 18A, Division II. Fasteners required to be corrosion resistant shall be either zinc-coated fasteners, aluminum alloy wire fasteners or stainless steel fasteners.

Connections depending on joist hangers or framing anchors, ties, and other mechanical fastenings not otherwise covered may be used where approved.

[Return to Reminder List.](#)

[Endnote 135]:

Section 2318A.3 Nails and Spikes.

Excerpt from Section 2318A3.1 Allowable lateral loads.

Common wire nails or spikes driven parallel to the grain of the wood or installed as toenails shall not be subjected to more than one half of the lateral load allowed when driven perpendicular to the grain. When toenails are driven in subdrilled pilot holes, a value of two thirds of the allowable lateral load allowed for nails driven perpendicular to the grain may be used. Pilot holes shall have a diameter approximately 90 percent of the nail shank diameter.

Toenails shall not be used to transfer lateral forces in excess of 150 pounds per foot (2190 N/m) from diaphragms to shear walls, drag struts (collectors) or other elements, nor from shear walls to diaphragms or other elements of public elementary and secondary schools, community college buildings, and state-owned or state-leased essential services buildings.

[Return to Reminder List.](#)

[Endnote 136]:

Section 2318A.3.2 Allowable withdrawal loads. Allowable withdrawal design values, *W*, for wire nails driven perpendicular to the grain of the wood shall be as set forth in Table 23A-III-D.

The use of nails driven perpendicular to the grain to resist loads in withdrawal shall be limited to connections using not more than four nails in a single connection.

Nails driven parallel to the grain of the wood shall not be allowed for resisting withdrawal forces.

Toenails shall not be permitted to resist loads in withdrawal.

[Return to Reminder List.](#)

[Endnote 137]:

Section 2318A.6 Wood Screws and Lag Screws.

Section 2318A.6.1 *The use of wood screws and lag screws to resist continuously applied loads in withdrawal shall be limited to connections using not more than four screws in a single connection and at loads not exceeding 50 percent of the allowable values set forth in Division III.*

Washers shall be provided under heads of lag screws which bear on wood.

[Return to Reminder List.](#)

[Endnote 138]:

SECTION 2315A. WOOD SHEAR WALLS AND DIAPHRAGMS

Excerpt from Section 2315.1 General.

In buildings of wood-frame construction where rotation is provided for, the *dimension* of the diaphragm normal to the open side shall not exceed 25 feet (7620 mm) *nor* two thirds the diaphragm *dimension parallel to the open side*, whichever is the smaller *dimension*. Straight sheathing shall not be permitted to resist shears in diaphragms acting in rotation.

EXCEPTIONS: 1. One-story, wood-framed structures with the *dimension* normal to the open side not greater than 25 feet (7620 mm) may have a *dimension* equal to the *dimension parallel to the open side*.

2. Where calculations show that diaphragm deflections can be tolerated, the *dimension* normal to the open end may be increased to a ratio of *the dimensional normal to the open side to the dimension parallel to the open side* of not greater than 1.5:1 for diagonal sheathing or 2:1 for special diagonal sheathed or *plywood* diaphragms.

[Return to Reminder List.](#)

[Endnote 139]:

Section 1633A.2.8.1 Out-of-plane wall anchorage to flexible diaphragms. This section shall apply in Seismic Zones 3 and 4 where flexible diaphragms, as defined in Section 1630A.6, provide lateral support for walls.

1. Elements of the wall anchorage system shall be designed for the forces specified in Section 1632A where $R_p = 3.0$ and $a_p = 1.5$.

In Seismic Zone 4, the value of F_p used for the design of the elements of the wall anchorage system shall not be less than 420 pounds per lineal foot (6.1 kN per lineal meter) of wall substituted for E .

See Section 1611A.4 for minimum design forces in other seismic zones.

2. When elements of the wall anchorage system are not loaded concentrically or are not perpendicular to the wall, the system shall be designed to resist all components of the forces induced by the eccentricity.

3. When pilasters are present in the wall, the anchorage force at the pilasters shall be calculated considering the additional load transferred from the wall panels to the pilasters. However, the minimum anchorage force at a floor or roof shall be that specified in Section 1633A.2.8.1, Item 1.

4. The strength design forces for steel elements of the wall anchorage system shall be 1.4 times the forces otherwise required by this section.

5. The strength design forces for wood elements of the wall anchorage system shall be 0.85 times the force otherwise required by this section and these wood elements shall have a minimum actual net thickness of 2=1/2 inches (63.5 mm).

[Return to Reminder List.](#)

[Endnote 140]:

Section 2315A.2 Wood Members Resisting Horizontal Forces Contributed by Masonry and Concrete. *For buildings having masonry or concrete walls, wood construction shall not be used to resist continuously applied horizontal forces.*

NOTE: *See Table 16A-V for the use of horizontal diagonally sheathed wood or unblocked plywood diaphragms in buildings having masonry or reinforced concrete walls.*

The use of wood vertical resisting elements for buildings having masonry or reinforced concrete walls shall be limited to one-story buildings and to blocked plywood diaphragms with height-to-width ratios and shear stresses as set forth in Sections 2315A.1 and 2315A.3.3.

[Return to Reminder List.](#)

[Endnote 141]:

Excerpt from Section 2315A.3.3 Plywood diaphragms.

The allowable shear for vertical plywood shear walls used to resist horizontal forces in buildings with masonry or reinforced concrete walls shall be one half of the allowable values set forth in Table 23A-II-I-1.

[Return to Reminder List.](#)

[Endnote 142]:

Section 2315A.2 Wood Members Resisting Horizontal Forces Contributed by Masonry and Concrete. *For buildings having masonry or concrete walls, wood construction shall not be used to resist continuously applied horizontal forces.*

NOTE: *See Table 16A-V for the use of horizontal diagonally sheathed wood or unblocked plywood diaphragms in buildings having masonry or reinforced concrete walls.*

The use of wood vertical resisting elements for buildings having masonry or reinforced concrete walls shall be limited to one-story buildings and to blocked plywood diaphragms with height-to-width ratios and shear stresses as set forth in Sections 2315A.1 and 2315A.3.3.

[Return to Reminder List.](#)

[Endnote 143]:

Excerpt from Section 1633A.2.9 Diaphragms.

5. Where wood diaphragms are used to laterally support concrete or masonry walls, the anchorage shall conform to Section 1633A.2.8. In Seismic Zones * * * 3 and 4, anchorage shall not be accomplished by use of toenails or nails subject to withdrawal, wood ledgers or framing shall not be used in cross-grain bending or cross-grain tension, and the continuous ties required by Item 4 shall be in addition to the diaphragm sheathing.

[Return to Reminder List.](#)

[Endnote 144]:

Table 23A - II - I - 1, Excerpt from Footnote 1.

Allowable shear values for nails in framing members of other species set forth in Division III, Part III, shall be calculated for all other grades by multiplying the *tabulated* shear capacities for *common* nails * * * by the following factors: 0.82 for species with specific gravity greater than or equal to 0.42 but less than 0.49, and 0.65 for species with a specific gravity less than 0.42.

[Return to Reminder List.](#)