GENERAL NOTES

A. PURPOSE

The intent of this standard plan is to promote public safety and welfare by reducing the risk of earthquake induced damage in existing wood frame residential buildings. The requirements represented here are minimum prescriptive standards which do not meet the requirements for new buildings. These standards are intended to improve the seismic performance of these existing buildings but will not necessarily prevent their damage in an earthquake. Their primary purpose is to reduce the likelihood that these buildings will fall off their foundations. (per Chapter 92 of the Los Angeles Building Code)

B. SCOPE

These standards apply to one, two and three story residential buildings with raised wood floors if they meet the following criteria:

1) cripple wall heights do not exceed 48 inches in one or two story buildings and do not exceed 14 inch stud height in three story buildings

2) the building is supported at its perimeter by a continuous concrete footing and stem wall

3) all of the floors in each story are at the same elevation.

4) the maximum number of dwelling units and/or guest rooms is four.

5) the cripple walls are sheathed with materials other than wood structural panels or diagonal sheathing.

6) no portion of the building is constructed over a slope steeper than 3 horizontal to 1 vertical.

C. GENERAL REQUIREMENTS

PERMIT REQUIREMENTS: All work shown on these plans requires a building permit.

PRE-INSPECTION REQUIREMENTS: None

INSPECTION REQUIREMENTS: All footing excavations and placement of reinforcing steel and anchor bolts in formwork shall be inspected prior to pouring of concrete for replacement footings and stem walls.

All cripple wall bracing, blocking, connectors and anchors in existing concrete shall be inspected after the work is completed but before the screens for the ventilation holes at the sill plate anchors are completely fastened.

DEPUTY INSPECTION: None

STRUCTURAL OBSERVATION: None

D. DEFINITIONS

ADHESIVE ANCHOR is a fastener placed in hardened concrete that derives its holding strength from a chemical adhesive compound placed between the wall of the hole and the embedded portion of the anchor. Chemical adhesive compounds are organic compounds, comprised of resin and hardener, that form adhesives when blended together. Examples of chemical adhesive compounds can include epoxies, polyurethanes, polyesters, methyl methacrylates and vinylesters.

ANCHOR SIDE PLATE is a metal plate or plates used to connect the sill plate or floor framing to the side of a concrete stem wall when conditions prevent anchor or bolt installation vertically through the sill plate.

APPROVAL is current product acceptance under a City of Los Angeles Research Report for all of the conditions of the intended use except continuous inspection of anchors.

BOLT RING is a metal or plastic piece of pipe placed around a bolt in a wood sill plate to fill in the annular space created by an oversized drilled hole.

EMBEDMENT DEPTH is the depth of the anchor into the concrete prior to setting of the anchor

EXPANSION ANCHOR is a mechanical fastener placed in hardened concrete designed to expand in a self-drilled or pre-drilled hole of a specified size and engage the sides of the hole in one or more locations to develop shear and/or tension resistance to applied loads without grout, adhesive or drypack.

INSTALLATION TORQUE is the minimum moment applied to a torque-set anchor that creates the degree of anchorage required for full load values.

MINIMUM CONCRETE EDGE DISTANCE is the measure between the free edge of the concrete and the centerline of the bolt at which the concrete will not break away when the anchor is set or loaded in service. Minimum edge distances for anchors are given in the product approval.

SNUG TIGHT is the condition when the full surface of the plate washer is in contact with the wood member and begins to slightly indent the wood surface.

TORQUE-SET ANCHOR is an expansion anchor whose wedge or sleeve engages the concrete base material in the drilled hole by the application of torque and where the amount of torque applied controls the degree of anchorage.

E. MATERIALS

ADHESIVE ANCHOR ROD MATERIALS: All adhesive anchors shall use all-thread rod manufactured from ASTM A193, grade B7, ASTM A36, or as specified in approved research report.
All thread rods shall be free of oil, scale and rust. The use of smooth or partially threaded rods or bolts is prohibited.

ADHESIVE PACKAGING: The packaging for each adhesive shall be marked with the manufacturer's name and address, lot number or date of packaging, shelf life or expiration date, name of the quality control agency, and instructions for installation. No adhesive shall be used after its expiration date.

ANCHORS: All adhesive or expansion anchors shall have a minimum normal load capacity of 635 lbs for 1/2 inch bolts and 980 lbs. for 5/8 inch bolts in 2000 psi concrete at the installed edge distance and depth of embedment. All proprietary anchors shall have current City of Los Angeles Research Report approval. Comply with all conditions of LARR for approval.

ANCHOR SIDE PLATE: All anchor side plates shall be of minimum 7 gauge steel (3/16 inch) unless otherwise approved (i.e. 12 gauge in a Research Report) and galvanized when exposed to weather. The minimum seismic adjusted load capacity for shear in the direction of the sill plate must meet or exceed a capacity of 1275 lbs. when substituted for 5/8 inch bolts and 840 lbs when substituted for 1/2 inch bolts. Other products with lower approved capacities may be used if their required spacing is reduced proportionately by the ratio of their strength to the strength requirement above. (i.e. [400 lbs /840 lbs] x 72 in. o.c. = use 34 in o.c. instead of 72 in o.c. for one story on anchor side plate with allowable value of 400 lbs instead of 840 lbs or greater). Anchor side plates shall be attached to the concrete stem wall with a minimum of 2 – 1/2 inch approved anchors. The number of expansion or adhesive anchors used must have a total shear capacity in concrete equa or greater to the value for the foundation anchor requirement above.l

BOLT RINGS: Bolt rings shall be of schedule 40 galvanized iron or PVC pipe

CONCRETE: All new concrete for replacement footings shall be of 2500 psi minimum compressive strength. No special inspection is required.

FASTENERS IN PRESERVATIVE TREATED WOOD: Fasteners in preservative-treated wood shall be of hot dipped zinc-coated galvanized steel, stainless steel,silicone bronze, or copper. The zinc coating weights shall be in accordance with ASTM A153

FRAMING ANCHORS: All framing anchors shall be of minimum 18 gauge galvanized steel, of 4-½ inch length and approved under a City of Los Angeles Research Report for wood frame construction. The seismic load capacity in the long direction must meet or exceed 450 lbs in dry lumber. The fasteners must be 12- 8d common x ½ inch nails unless otherwise approved. #6 x 1.5 inch flat head wood screws may be used at existing rim joist, blocking or top plate connections.

LUMBER: All new lumber installed for blocking shall be a minimum of nominal two inch Douglas Fir-Larch # 2 or better as graded under Western Wood Products Grading Rules. All lumber in contact with concrete shall be pressure treated douglas fir-larch for new stem walls and for sill plate replacements over 10% of the wall length. Replacement of sill plate less than 10% of the wall length may use the same lumber species as the existing material. All existing lumber shall be free of defects including dryrot, mildew, excessive wane, warping and insect infestation or damage. Damaged lumber must be replaced and the source of water or insect intrusion removed.

PLATE WASHERS: Square plate washers are required. Use 3/16 x 2 x 2 for 1/2 inch anchors and 1/4"x 2.5"x2.5"for 5/8 inch anchors. Standard circular cut washers shall not be used to connect sill plates to concrete stem walls. Washers furnished with the proprietary anchors shall not be used. Beveled washers shall be used on anchors drilled at an angle exceeding 6 degrees from vertical and shall be placed over the plate washers.

REINFORCING BAR: ASTM A615 Grade 40 or 60

SHEATHING: All wood structural panel sheathing shall be graded and conform to the requirements for their type in DOC PS 1-95 or DOC PS 2-92. All wood structural panel sheathing used for wall bracing shall be 15/32 inch APA rated sheathing, Exposure 1 with a span rating of 32/16. Plywood shall be minimum 5 ply construction.

SHEATHING FASTENERS: Nails shall be 8d common (.131 inch x2-1/2 inch) with full heads (.281 inch) on interior or covered sheathing. # 6 x 1-1/2 inch wood screws may be substituted on interior sheathing when plaster exists on the exterior side of the cripple wall. See requirements for fasteners in preservative treated wood.

F. REPLACEMENT OF EXISTING FOOTINGS & STEM WALLS

1. Deteriorated, cracked or unreinforded masonry footings may be replaced as shown on this plan provided proper shoring is provided. The method of shoring and sequence of its construction shall be the responsibility of the person performing the work and shall not weaken the structure so as to be a threat to the safety of its occupants or passers nearby.

2. When existing footings and stem walls are replaced in sections, the person performing the work shall take care to insure that all reinforcing steel shall be lapped a minimum of 24 inches and shall be dowelled into the exisitng concrete with adhesive or drypack a minimum of 8 inches.

3. The repair of damaged footings or stem walls or the continued use of archaic building materials such as unreinforced masonry, requires that plans and calculations be prepared by a licensed architect or engineer.

G. ANCHOR BOLT INSTALLATION

1. GENERAL REQUIREMENTS

A) CONDITION OF EXISTING CONCRETE: All concrete shall be fully cured and hardened, uncracked and in sound condition. Concrete with excessive cracking, deterioration or damage shall be replaced.

B) DRILLING OF THE HOLE IN CONCRETE: The drilled hole diameter and minimums for spacing, depth of hole and edge distance must comply with the Research Report approval and manufacturer's recommendations. All holes shall be drilled with carbide-tipped drill bits conforming to ANSI Specification B212.15-1994 tolerances. (1/2 = 0.520-0.530, 5/8 = 0.650-0.660 inch) Worn drill bits with reduced diameters below the ANSI tolerance limits shall not be used. All holes shall be driven as perpendicular as possible to the concrete surface. Right angle drill motors shall be used as needed to provide the proper hole orientation.

C) DRILLING OF THE HOLE IN WOOD: Drilled holes through existing sill plates shall normally be located in the middle third of the plate width. The minimum edge distance for the bolt from the wood edge shall be 1½ bolt diameters. Anchors or bolts shall be placed within 12 inches but not less than 9 inches from both ends of all sill plate members.

D) CHOICE OF USE OF ADHESIVE OR EXPANSION ANCHORS: Only products approved by the Department (refer to the attachment for the list of approved products and materials of construction) may be used for the retrofit of cripplewall works.
Both types of anchors may be used interchangeably in concrete of average or better quality. Concrete of weaker quality may be indicated by spalling during drilling or setting of expansion anchors or failure of anchors to reach the minimum torque required. Concrete of weaker quality must use adhesive anchors.
This requirement does not waive the need to replace existing concrete foundations when damaged, deteriorated, or of unsuitable quality.

2. REQUIREMENTS FOR ADHESIVE ANCHORS

A) CLEANING OF THE HOLE: The hole must be cleaned with a jet of compressed air and a nylon brush. Wire brushes shall not be used to clean the hole. No debris or dust shall remain in the hole.

B) PLACEMENT OF THE ADHESIVE: The resin, filler and hardener shall be thoroughly mixed before placement in the hole unless approved to be mixed in the hole. Compounds dispensed through a static mixing nozzle must be of uniform color. Ensure uniform color by extruding a small amount of adhesive until color by manual or pnuematic means from the bottom of the hole upward uniformity is achieved. Adhesive added to the hole shall be applied at a slow enough rate to prevent the formation of air voids. The amount of adhesive shall be sufficient to completely fill the threads and annular space about the threaded rod in both the concrete and any existing wood sill plate. Adhesives must be installed within the manufacturer's recommended temperature range for the air and concrete.

C) PLACEMENT OF THE THREADED ROD: The all thread rod, completely free of rust, scale or oil, shall be installed to the full depth of the hole. The rod shall be turned counter-clockwise sufficiently during installation for the adhesive to engage the threads. The length of the rod shall extend a minimum of one rod diameter above the nut after tightening.

D) ADHESIVE SETTING TIME: No torquing of the anchors shall occur until the adhesive has cured for the recommended time based on the temperature as shown in the manufacturer's instructions. Care must be used to insure that the anchor bond is not disturbed until the adhesive has sufficiently cured.

E) TORQUE REQUIREMENTS: A minimum torque setting of 30 ft lbs. for 1/2 inch anchors and 40 ft lbs. for 5/8 anchors is required for all adhesive anchors for the snug tight condition unless this value exceeds the maximum torque allowed by the approval. In those cases, the torque shall be set to its maximum allowable value.

3. REQUIREMENTS FOR EXPANSION ANCHORS

A) DRILLING OF THE HOLE: Care must be used to insure that the drilled hole carefully matches the depth and diameter requirements for the expansion anchor type. The depth of the hole cannot exceed 2/3 of the concrete thickness in the direction of the drilled hole. This is critical at the application of anchor side plates to full height concrete stem walls.

B) CLEANING OF THE HOLE: Unless otherwise required by the manufacturer's recommendations, the drilled hole may be deepened to allow the concrete debris to remain in the hole provided the hole does not exceed 2/3 of the concrete thickness in the direction of the drilled hole. The depth required for embedment must be free of debris. This rule does not apply to drop-in anchors that rely on the bottom of a clean drilled hole to set the expansion element.

C) USE OF THE BOLT RING: Bolt rings shall be required to be installed when the drilled hole in the wood member exceeds the bolt diameter by more than 1/8 inch. The length of the bolt ring shall be approximately equal to the thickness of the sill plate. Chemical compounds used in adhesive anchors may be substituted for bolt rings.

D) TORQUE REQUIREMENTS: A minimum torque setting equal to the installation torque or 30 ft lbs. for 1/2 inch anchors and 40 ft lbs. for 5/8 anchors, whichever is greater, is required for all expansion anchors unless this value exceeds the maximum torque allowed by the approval. In those cases, the torque shall be set to its maximum allowable value.

H. ANCHOR SIDE PLATE INSTALLATION

1. Anchor side plates may be substituted for vertically placed anchors or bolts only when conditions prevent anchor or bolt installation vertically through the sill plate even with a right angle drill motor.This condition commonly occurs when there is no cripple wall or one of greatly reduced height.

2. A minimum of two anchor side plates must be installed on each piece of sill plate 32 inches or longer. The nearest edge of the plate shall be installed a minimum of 8 inches but not more than 12 inches from the end of the sill plate.

3. Installation of the anchor bolts in the existing concrete shall follow the information in Section F except as noted herein. Care shall be used to insure the drilled hole depth does not exceed 2/3rds of the stem wall thickness when using expansion anchors. Cleaning of the hole may be required for these expansion anchors due to the limited stem wall thickness available to overdrill the hole.

4. Lag screws used to attach anchor side plates shall be installed as follows:

a) the lag screw shall be located at the center of the plate thickness and shall penetrate the sill plate a minimum of 2½ inches.

b) lead holes shall be pre-drilled for the threaded portion of the screw. The pre-drill diameter for the lead hole shall not exceed 70% of the shank diameter and shall be drilled to the full depth of penetration of the lag screw. Use a 1/4 inch diameter drill bit for 3/8 inch lag screws and 1/8 inch drill bit for 1/4 inch lag screws.

c) clearance holes shall also be drilled for the solid portion of the shank. The clearance hole shall be equal in depth and diameter to the solid portion of the shank.

d) the threaded portion of the lag screw shall be inserted in its lead hole by turning with a wrench and not by driving with a hammer or other blunt object.

e) soap or other lubricant shall be used on the lag screws or in the lead holes for ease of installation and to prevent damage to the lag screw.

5. Wood screws used to attach anchor side plates shall be installed as follows:

a) wood screws shall be located at the center of the plate thickness and shall penetrate the sill plate a minimum of 2½ inches.

b) lead holes shall be pre-drilled for the threaded portion of the screw. the pre-drill diameter for the lead hole shall be about 7/8th of the diameter of the screw at the root of the thread (mimimum solid diameter). Use 1/8 inch for #14 screws.)

c) clearence holes shall also be drilled for solid portion of the shank. The clearance hole shall be about 7/8ths of the diameter of the solid portion of the shank. Use a 3/16 inch drill bit for # 14 screws.

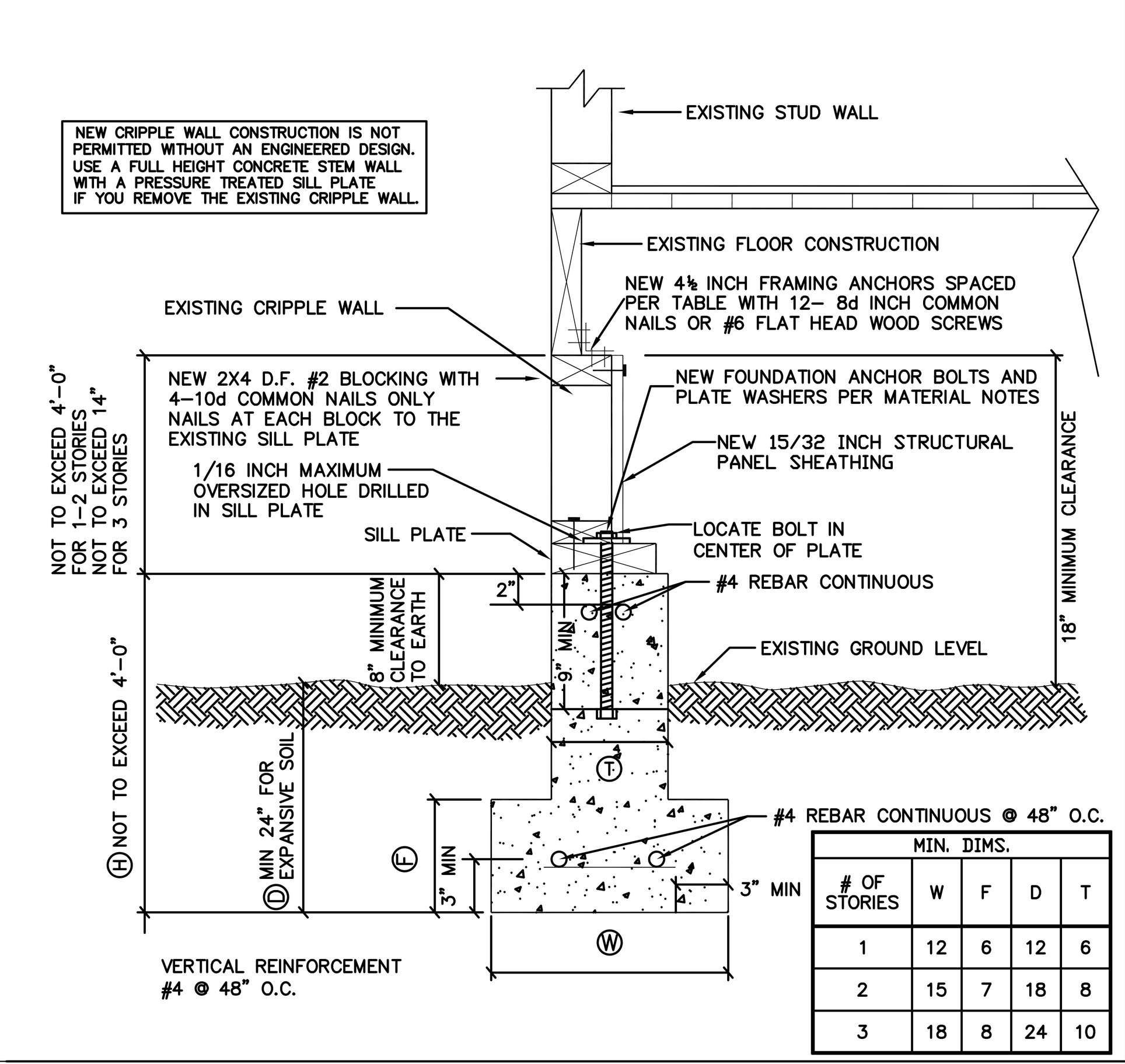
d) the threaded portion of the wood screw shall be inserted in its lead hole by turning with a wrench and not by driving with a hammer or other blunt object.

e) soap or other lubricant shall be used on the wood screws or in the lead holes for ease of installation and to prevent damage to the wood screw.

6. Shims may be used on sill plates for single plate anchors when the space exceed 3/16" and is less than 3/4". Shim requirements greater than 3/4 inch shall use two plate or curved plate connections unless otherwise approved.

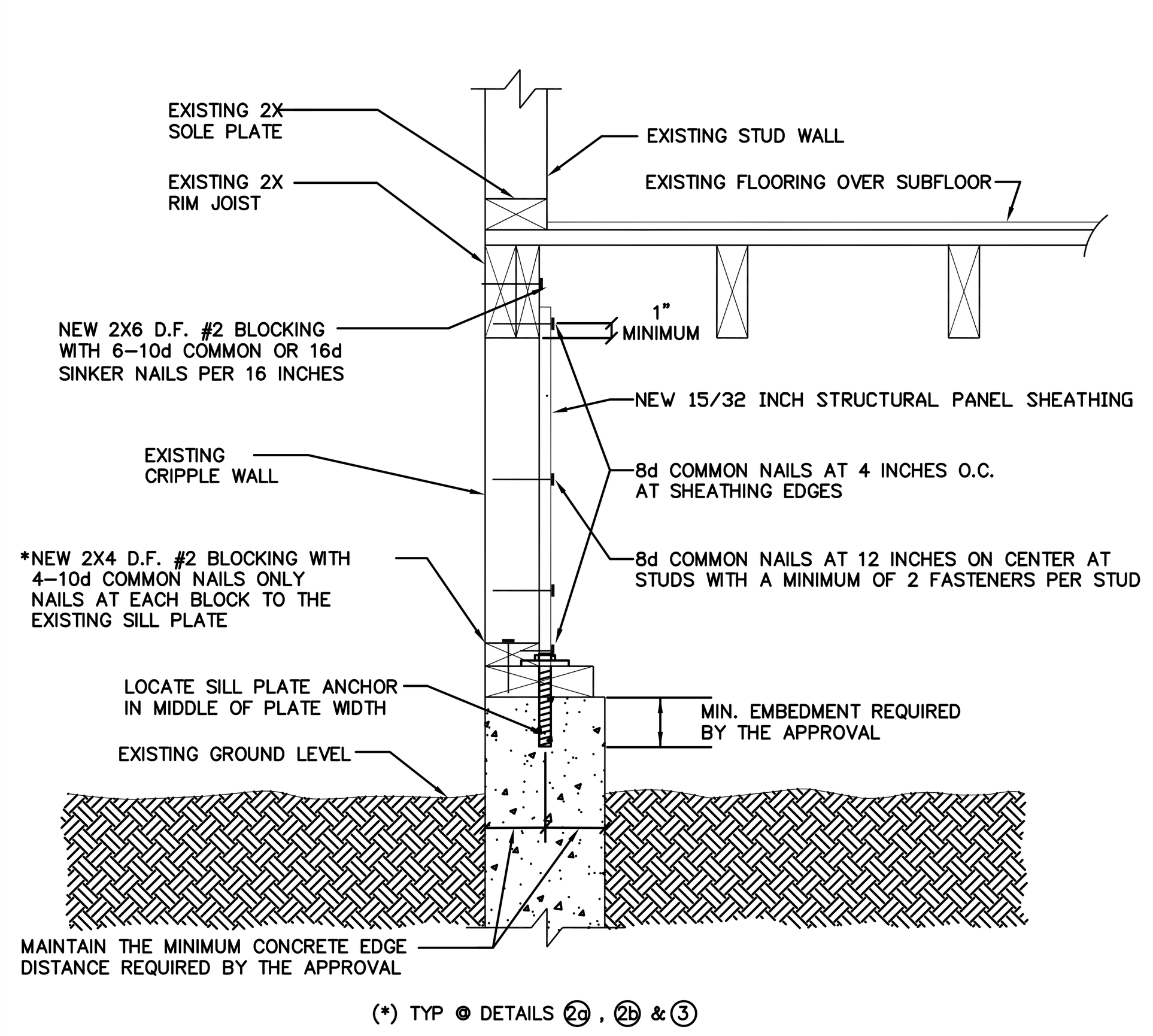
I. BRACING, FRAMING ANCHORS & VENTILATION

1. Framing members or 2X4 blocking shall be provided at the edge of all wood structural sheathing.
2. Nails or screws shall be centered in the framing member or blocking except at adjoining panel edges where a minimum 1/2 inch edge distance shall be maintained.
3. Panel joints shall normally occur on the centerline of studs but may occur on the joint of double studs when these studs are nailed with 16d common 8 inches on center.
4. Panel joints shall maintain a 1/8 inch separation between panels for expansion.
5. Panels may be oriented horizontally or vertically.
6. Nails shall be driven flush but shall not fracture the surface of the sheathing. When a nail fractures the sheathing it shall be left in place and not counted as part of the required nailing. A new nail shall be driven flush to the surface within 2 inches of the discounted nail.
7. Framing anchors shall be installed with their long dimension horizontal and with all of the nail holes filled with nails or approved wood screws. Drywall screws shall not be used.
8. Existing ventilation must be maintained and not covered by the wall bracing. Where obstructions such as vent holes or mechanical utilities cannot be avoided in the panel width, the required panel width shall be increased by the length of the obstruction or a minimum of one stud spacing, whichever is greater up to, but not exceeding the full length of the cripple wall.

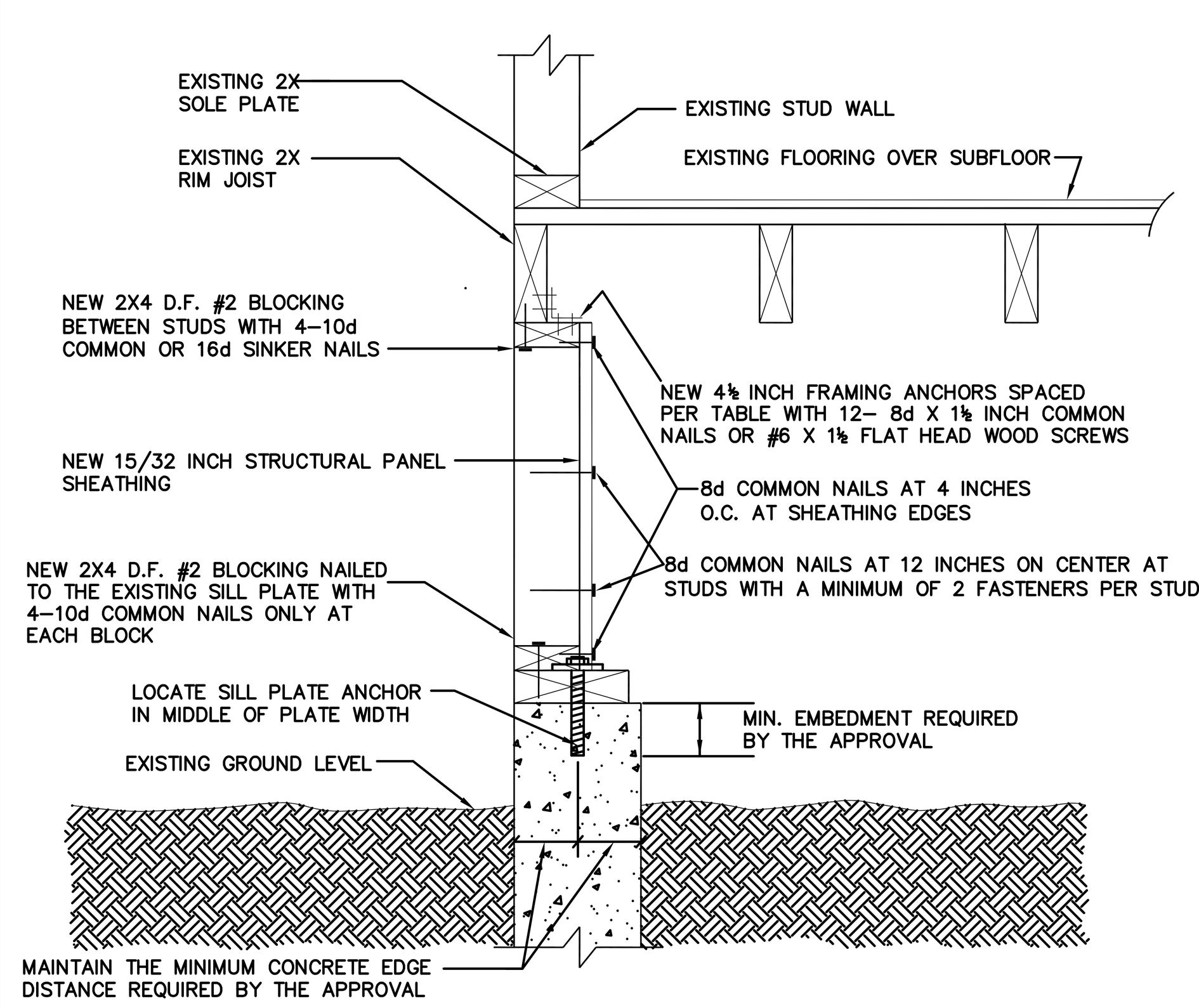


# OF STORIES	W	F	D	T
	MIN. DIMS.			
1	12	6	12	6
2	15	7	18	8
3	18	8	24	10

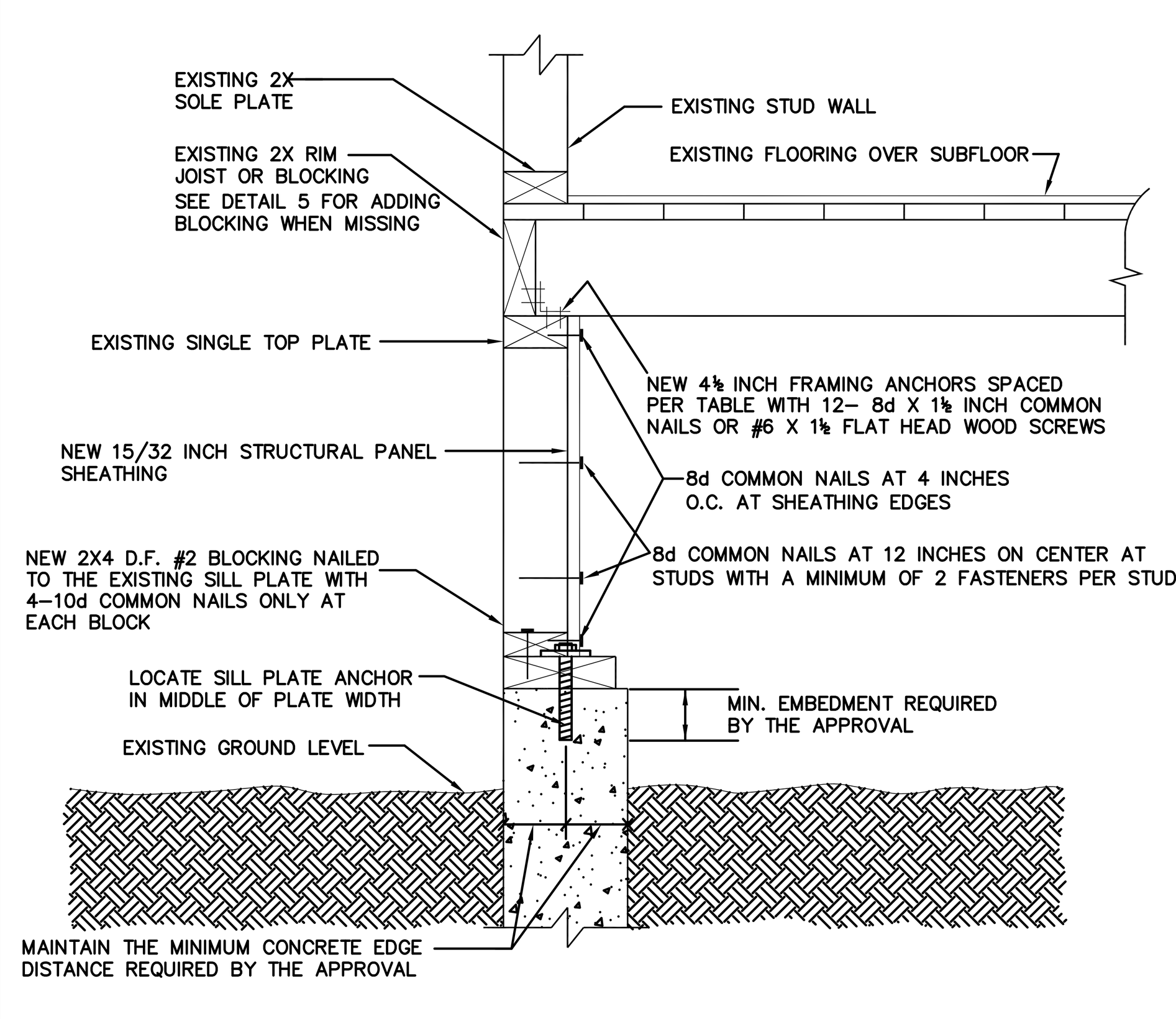
1 REPLACEMENT CONCRETE FOOTING AND STEM WALL



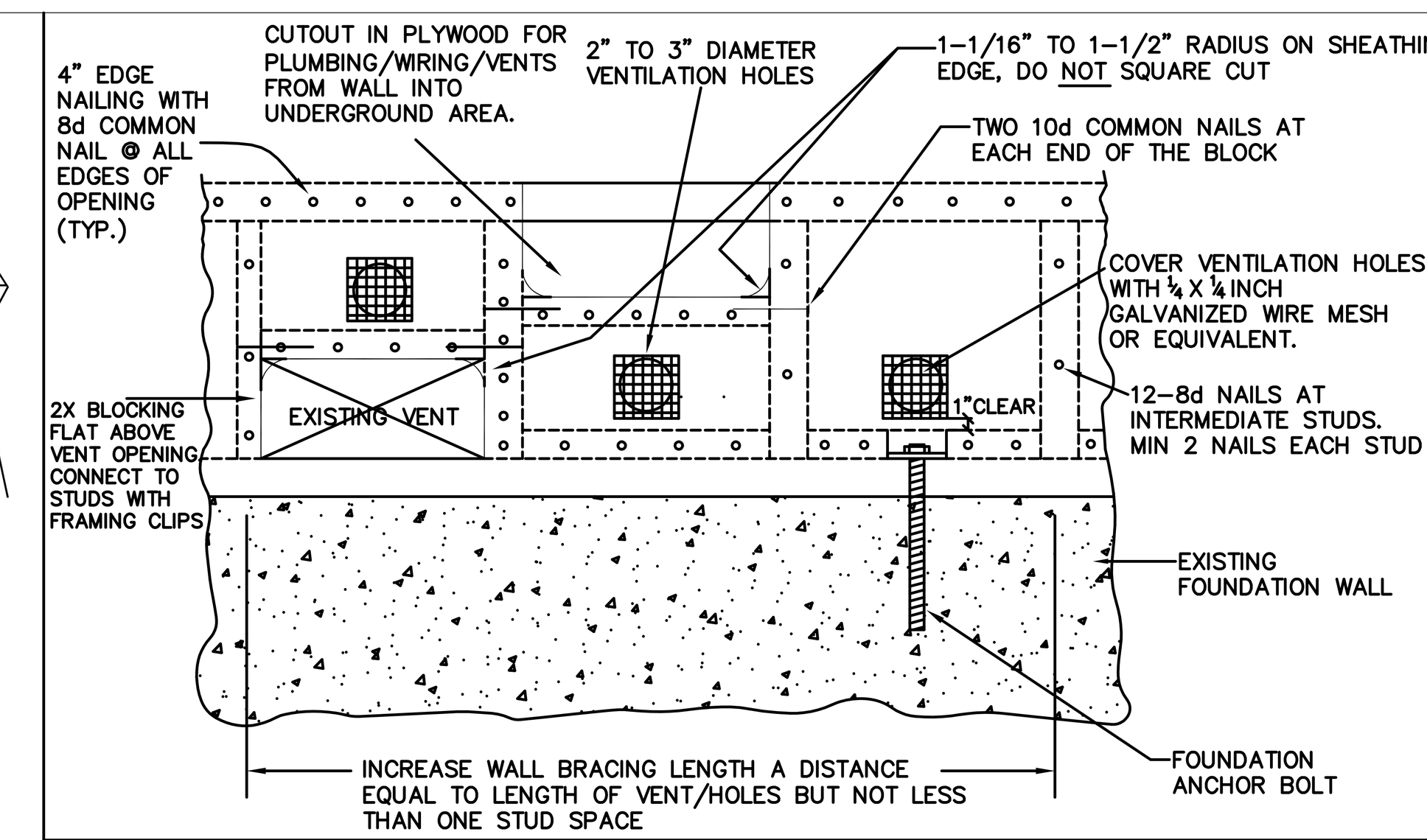
2a CRIPPLE WALL SECTION–PARALLEL JOISTS



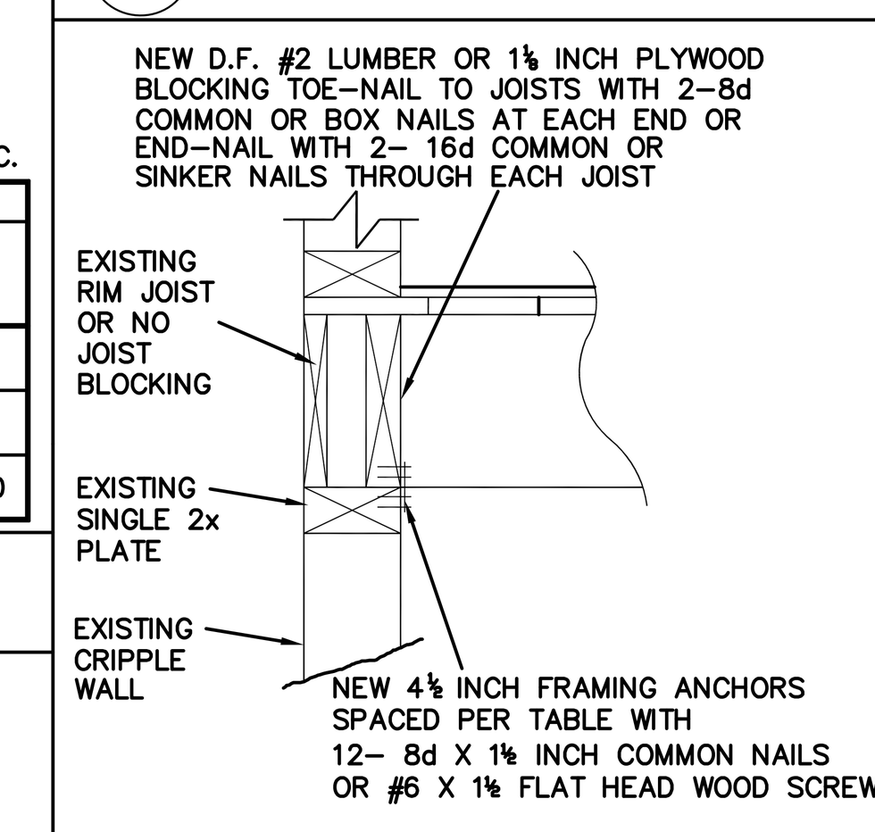
2b CRIPPLE WALL SECTION–PARALLEL JOISTS



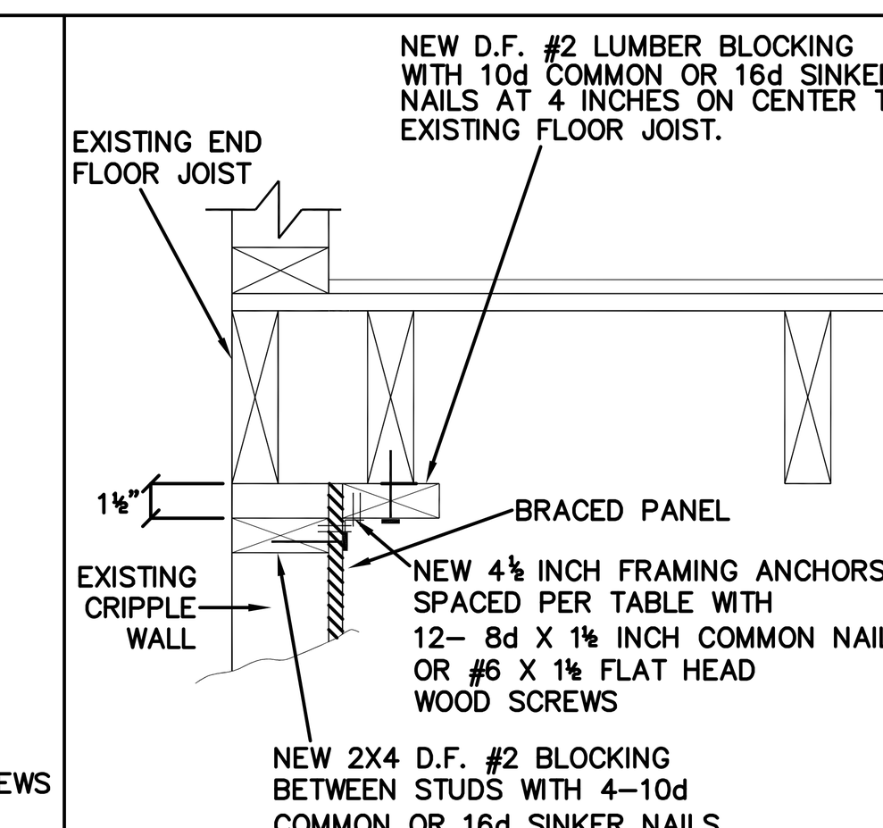
3 CRIPPLE WALL SECTION–PERPENDICULAR JOISTS



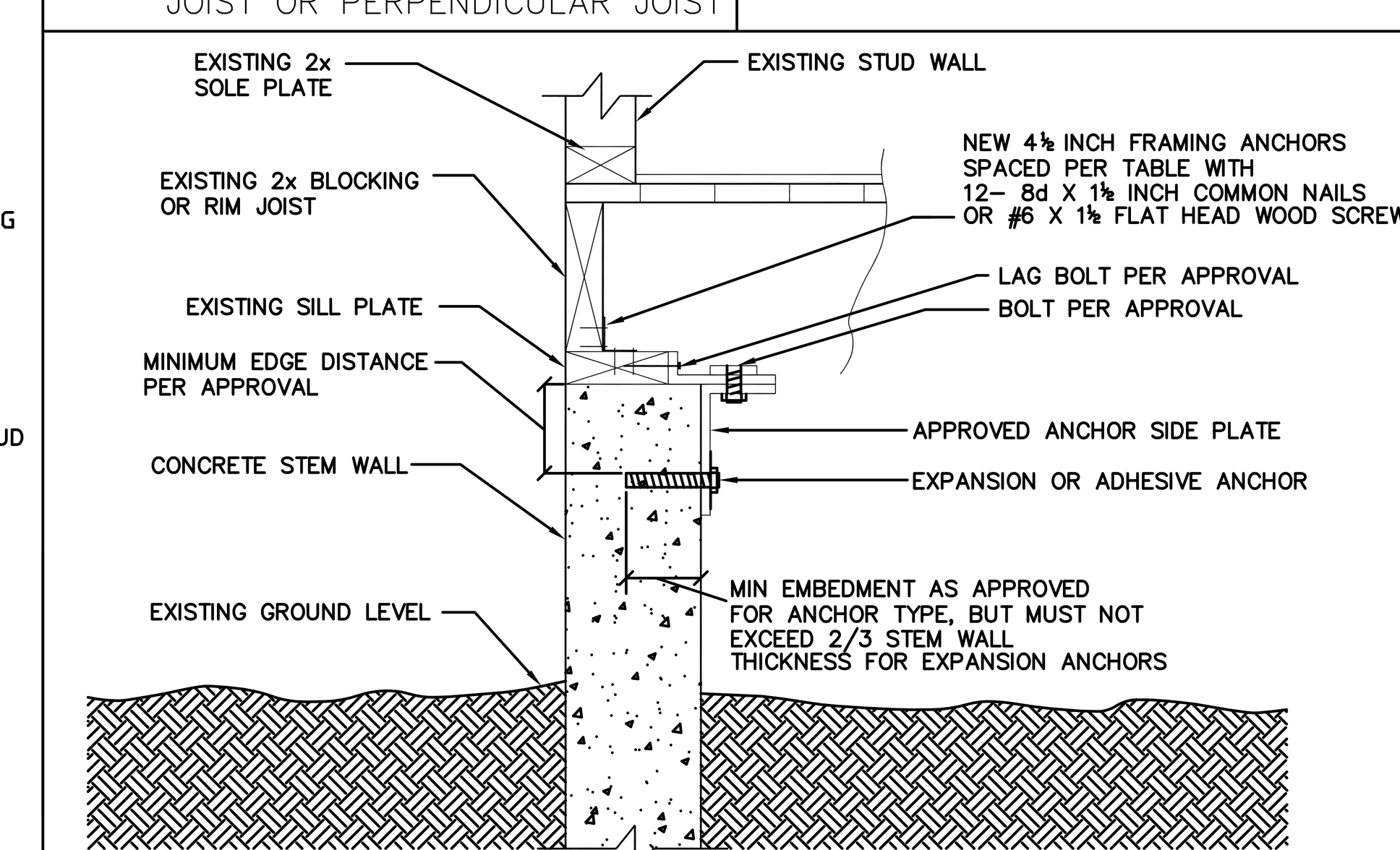
4 CRIPPLE WALL BRACING– OPENING REINFORCEMENT



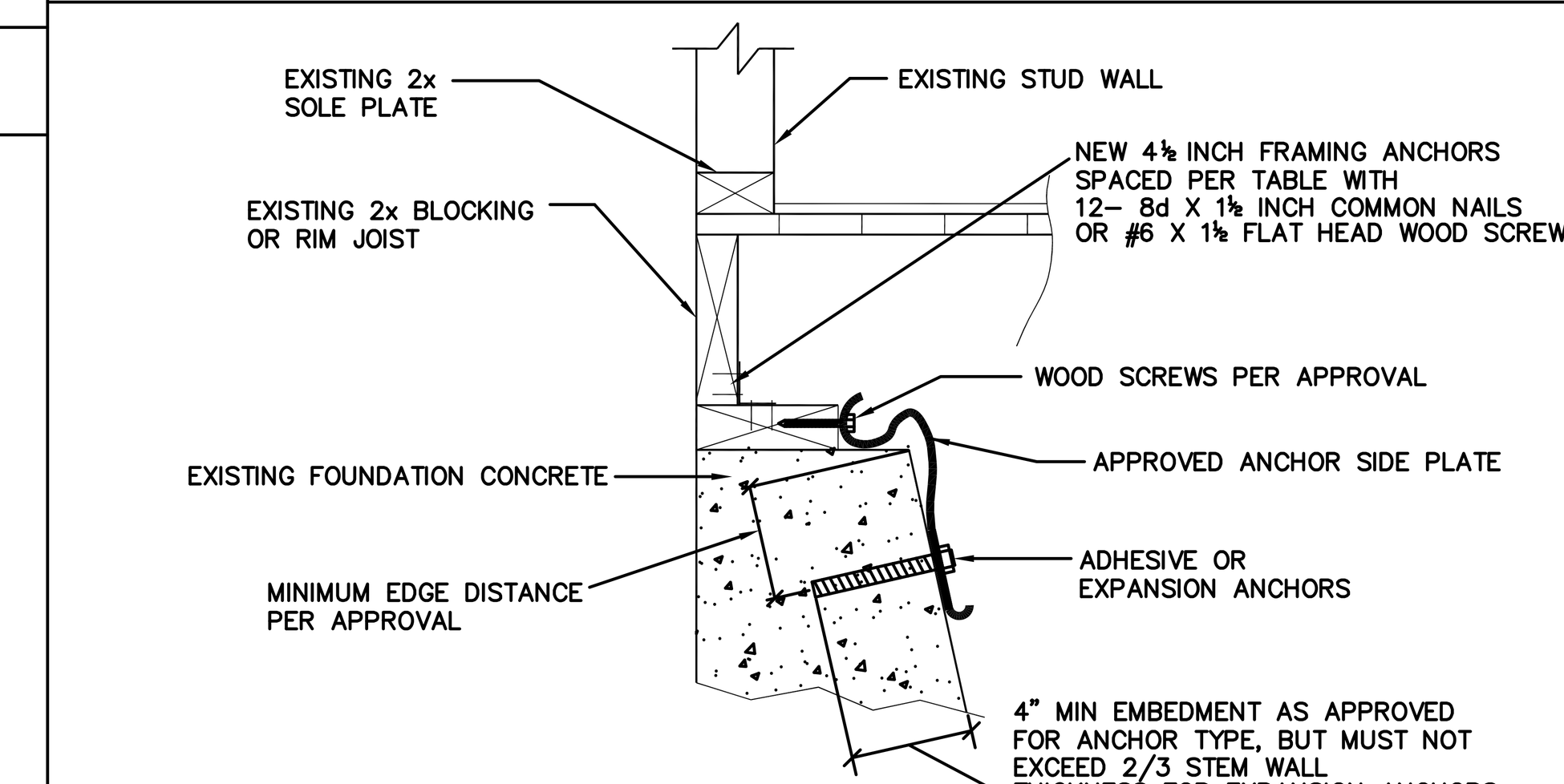
5a BLOCKING/FRAMING ANCHOR– MISSING 2X BLOCKING, RIM JOIST OR PERPENDICULAR JOIST



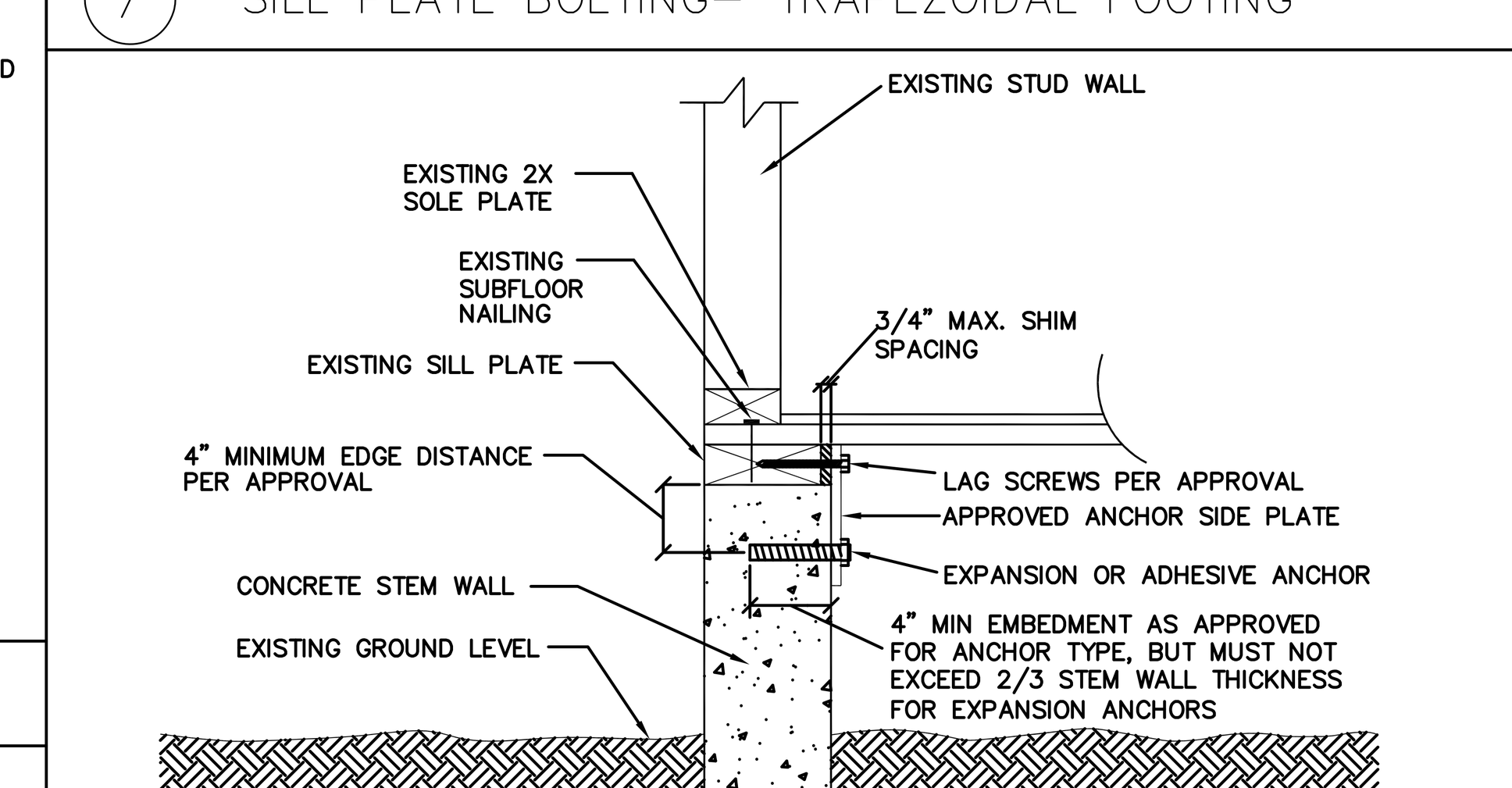
5b BLOCKING/FRAMING ANCHOR– PARALLEL JOIST OBSTRUCTION



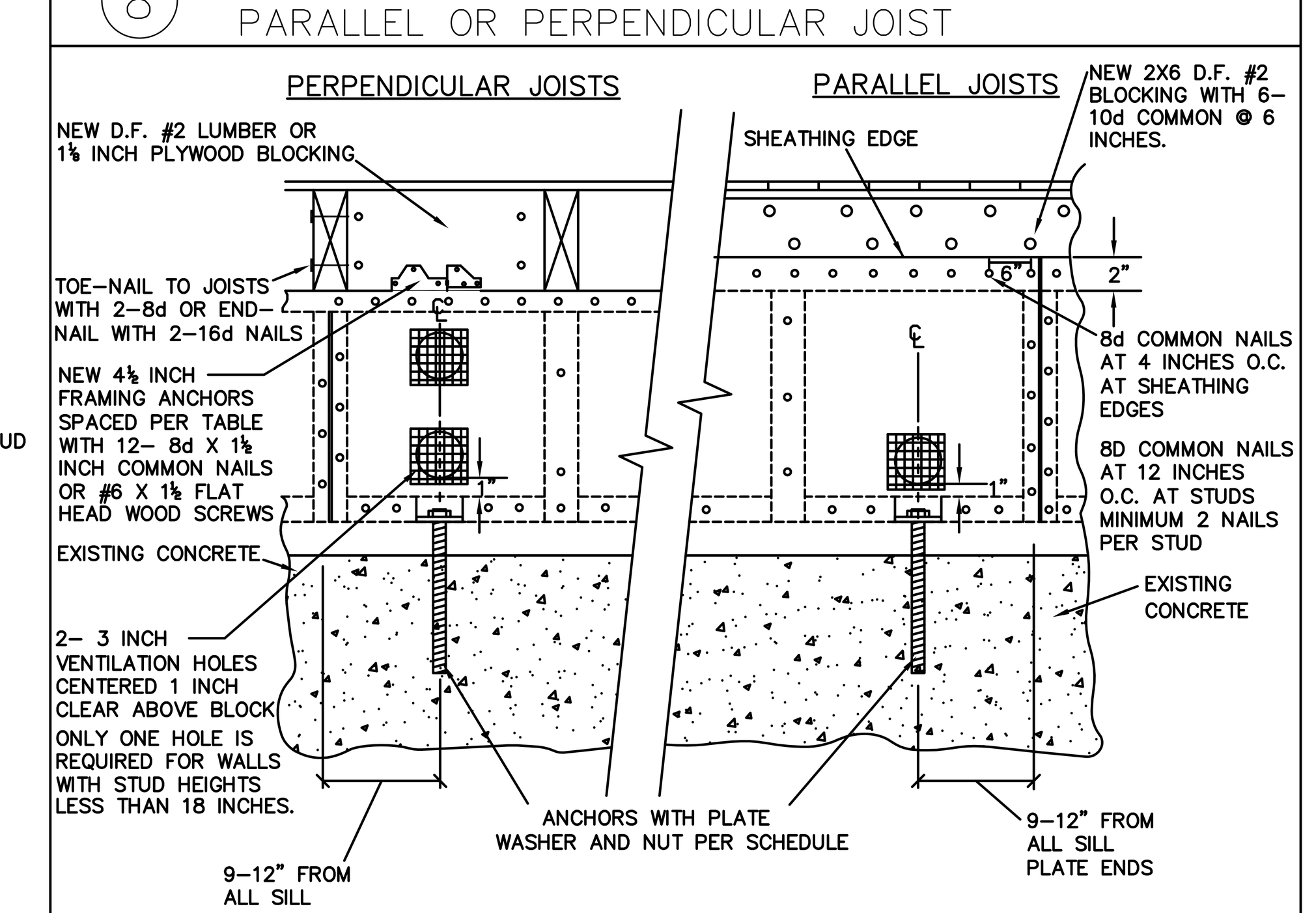
6 SILL PLATE BOLTING– NO CRIPPLE WALL PARALLEL OR PERPENDICULAR JOIST



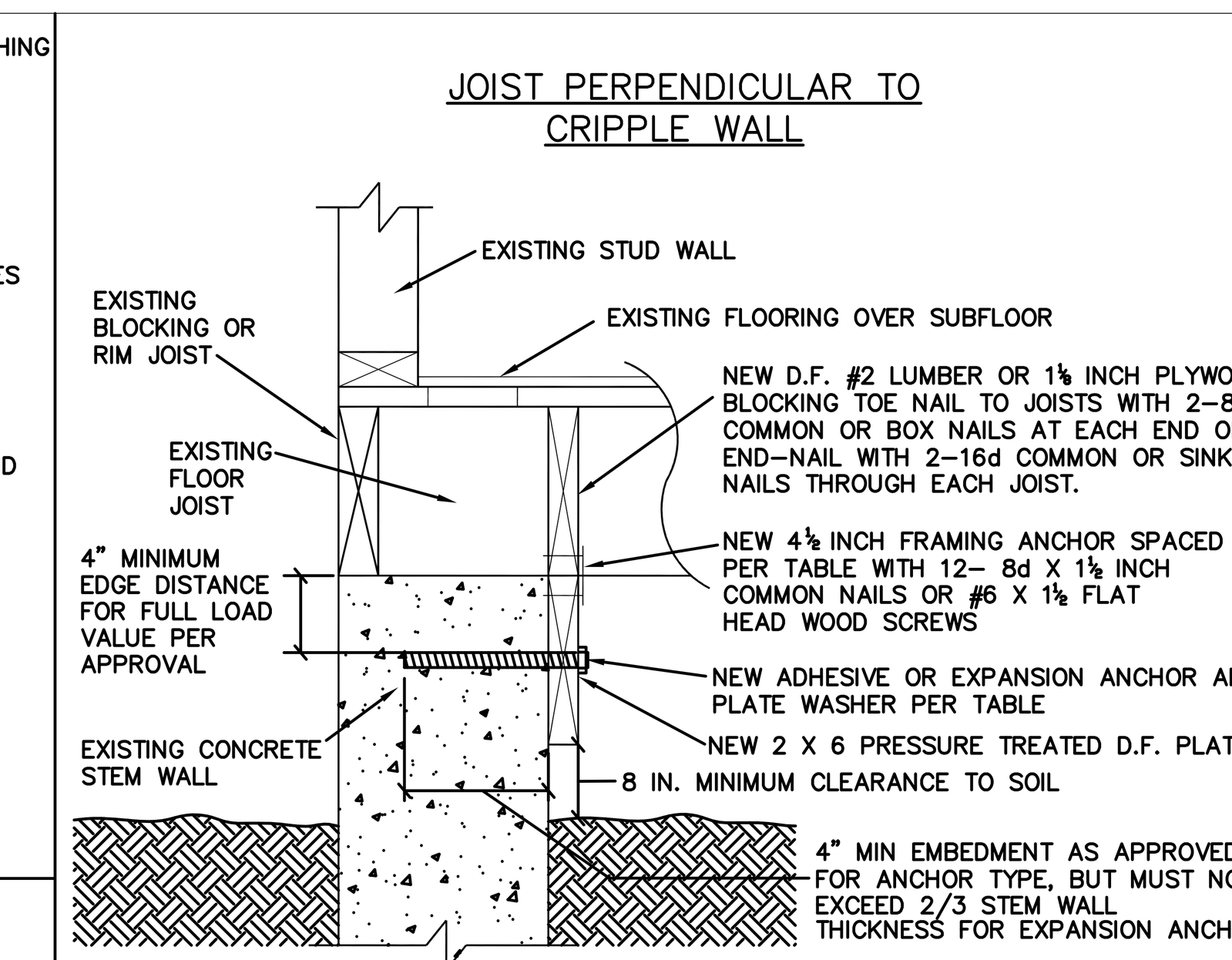
7 SILL PLATE BOLTING– TRAPEZOIDAL FOOTING



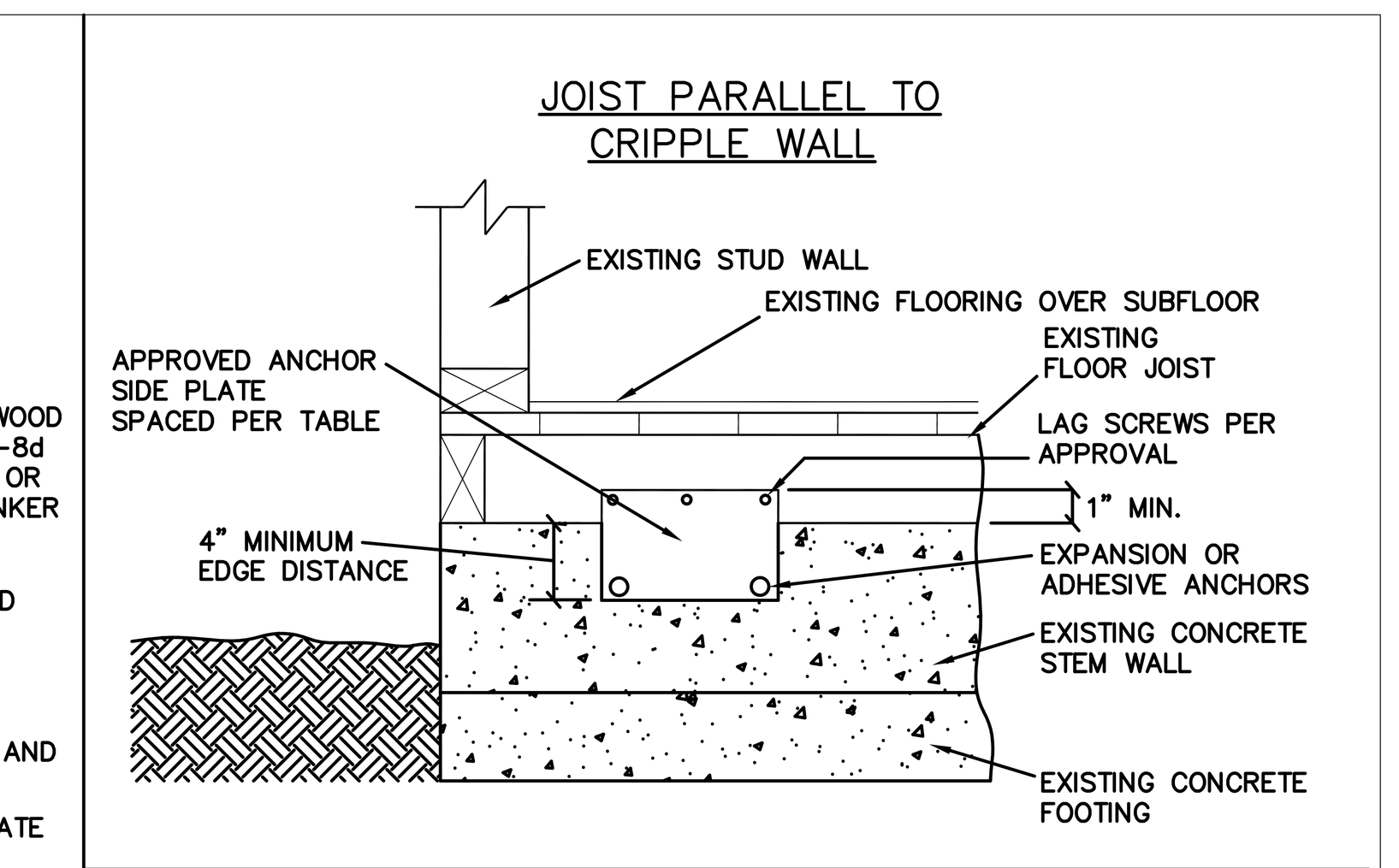
8 SILL PLATE BOLTING– NO FLOOR JOISTS PARALLEL OR PERPENDICULAR JOIST



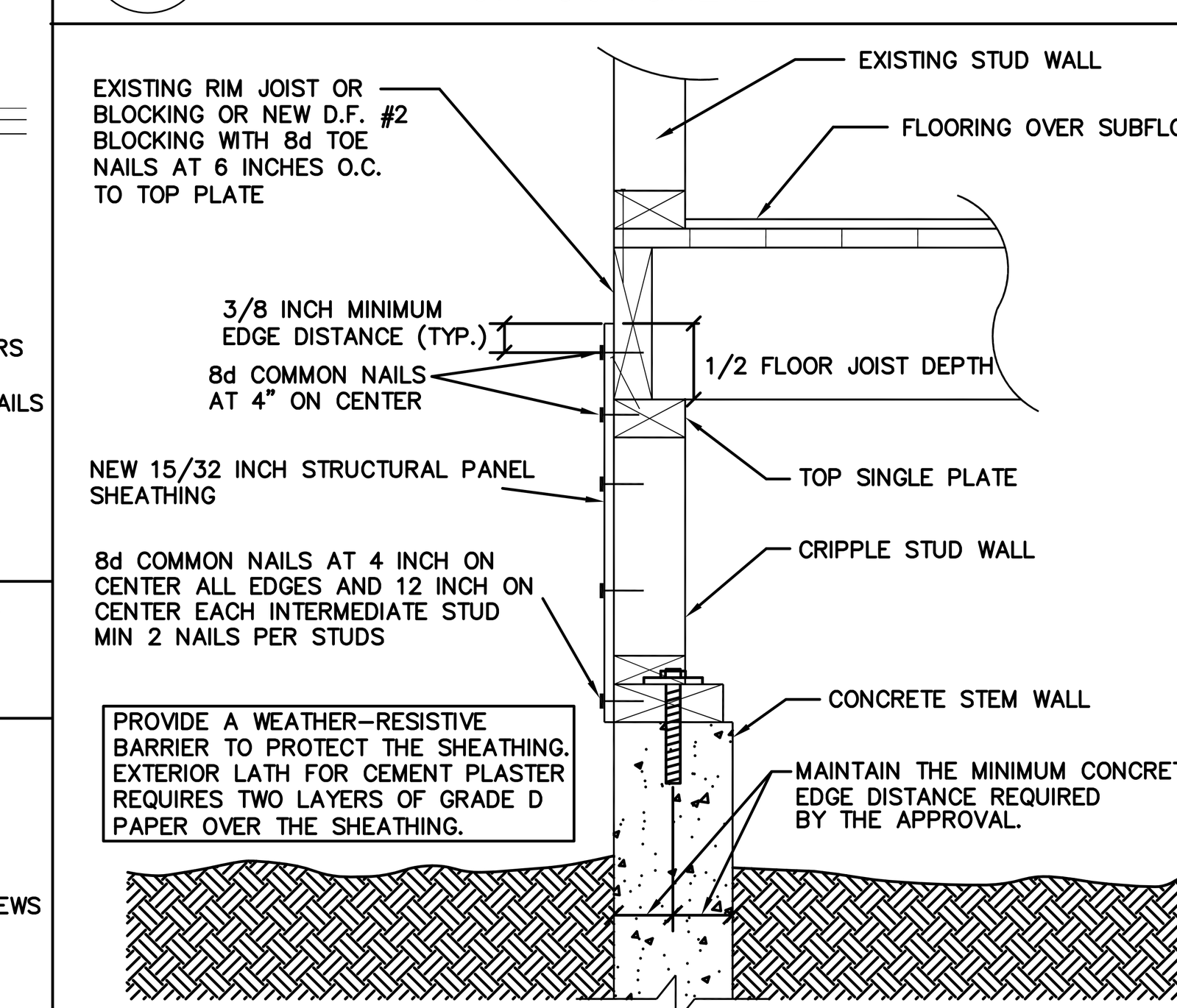
9 CRIPPLE WALL BRACING– INTERIOR ELEVATION



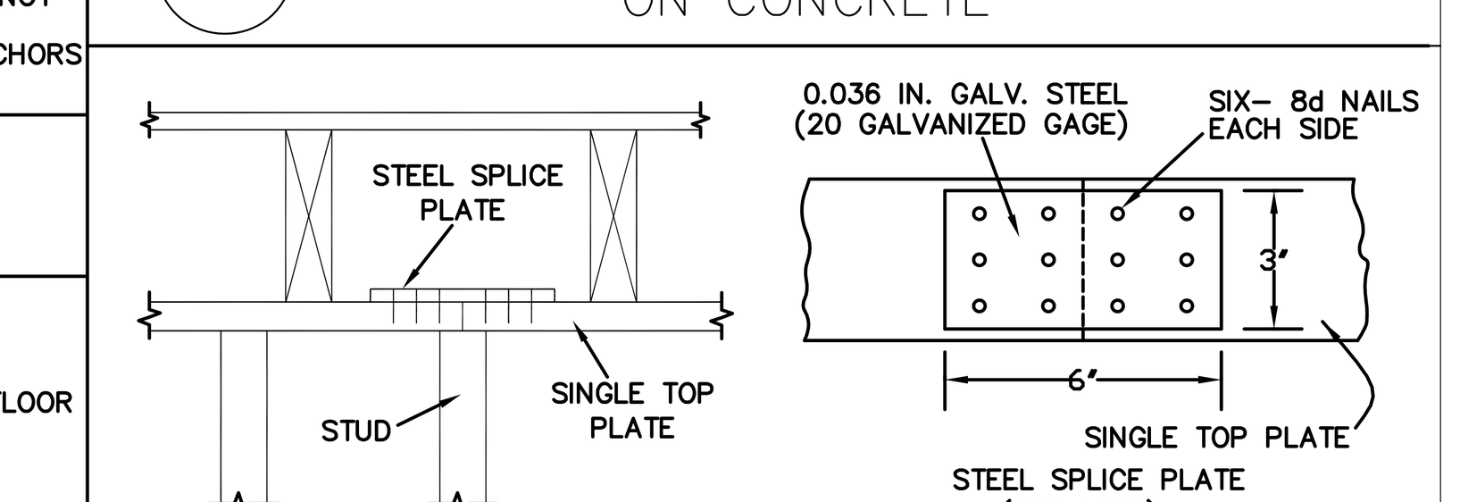
10a ANCHORAGE FOR JOISTS SUPPORTED ON CONCRETE



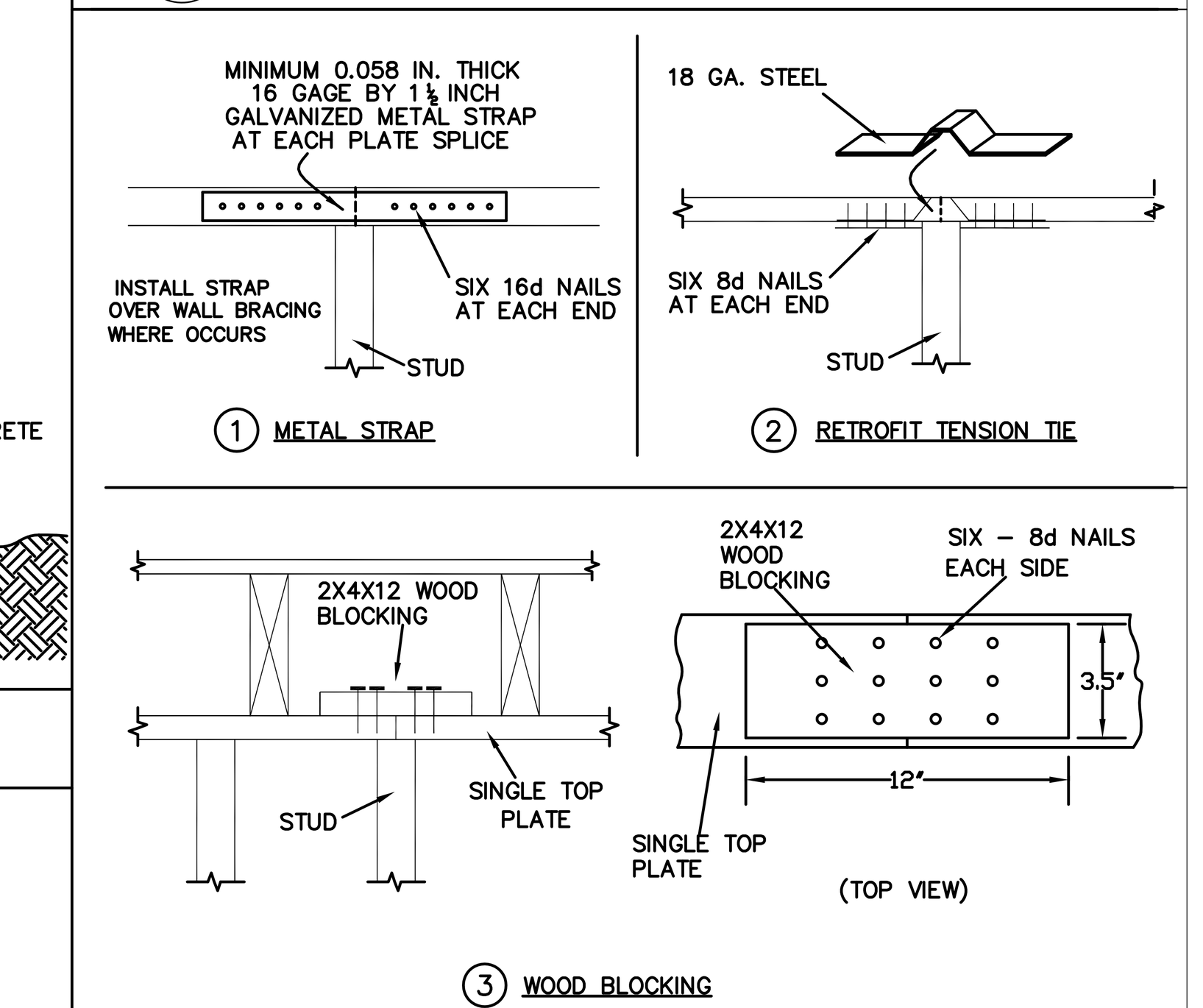
10b ANCHORAGE FOR JOISTS SUPPORTED ON CONCRETE



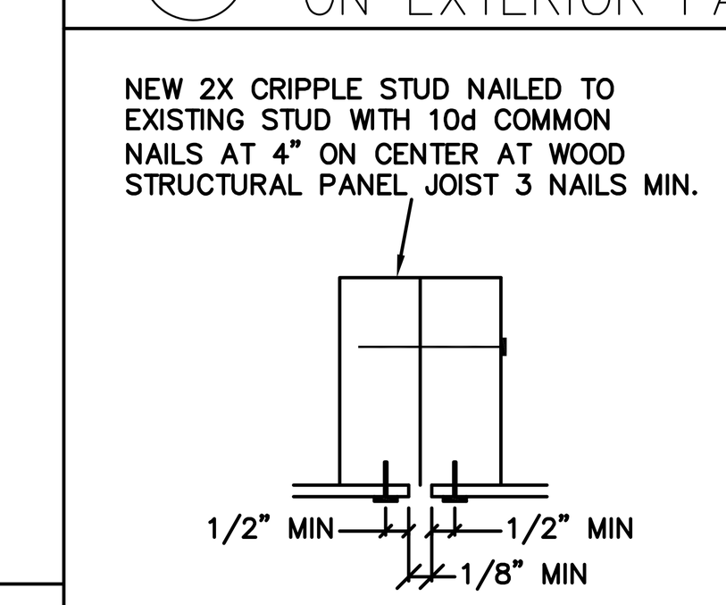
11 CRIPPLE WALL BRACING WITH PLYWOOD ON EXTERIOR FACE OF CRIPPLE STUDS



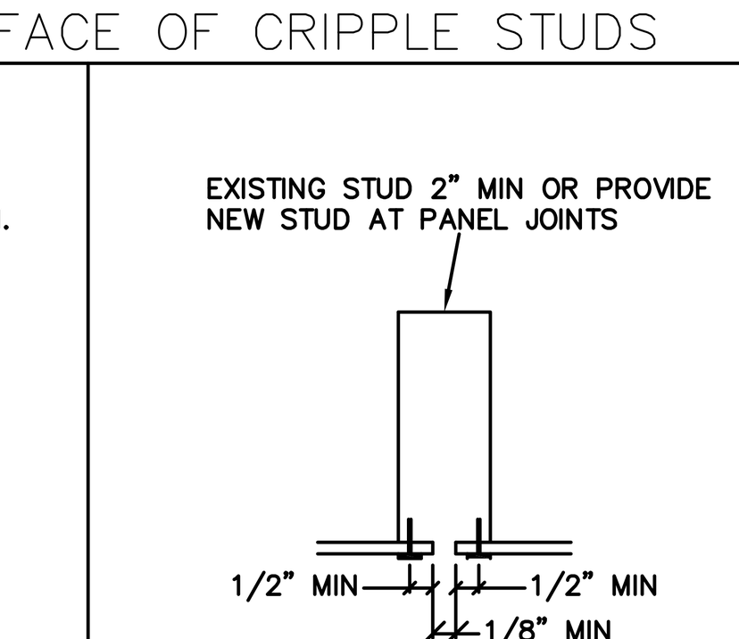
12 SINGLE TOP PLATE SPLICE



12a ALTERNATIVES TO SINGLE TOP PLATE SPLICE



13a VERTICAL SPLICE AT DOUBLE STUD

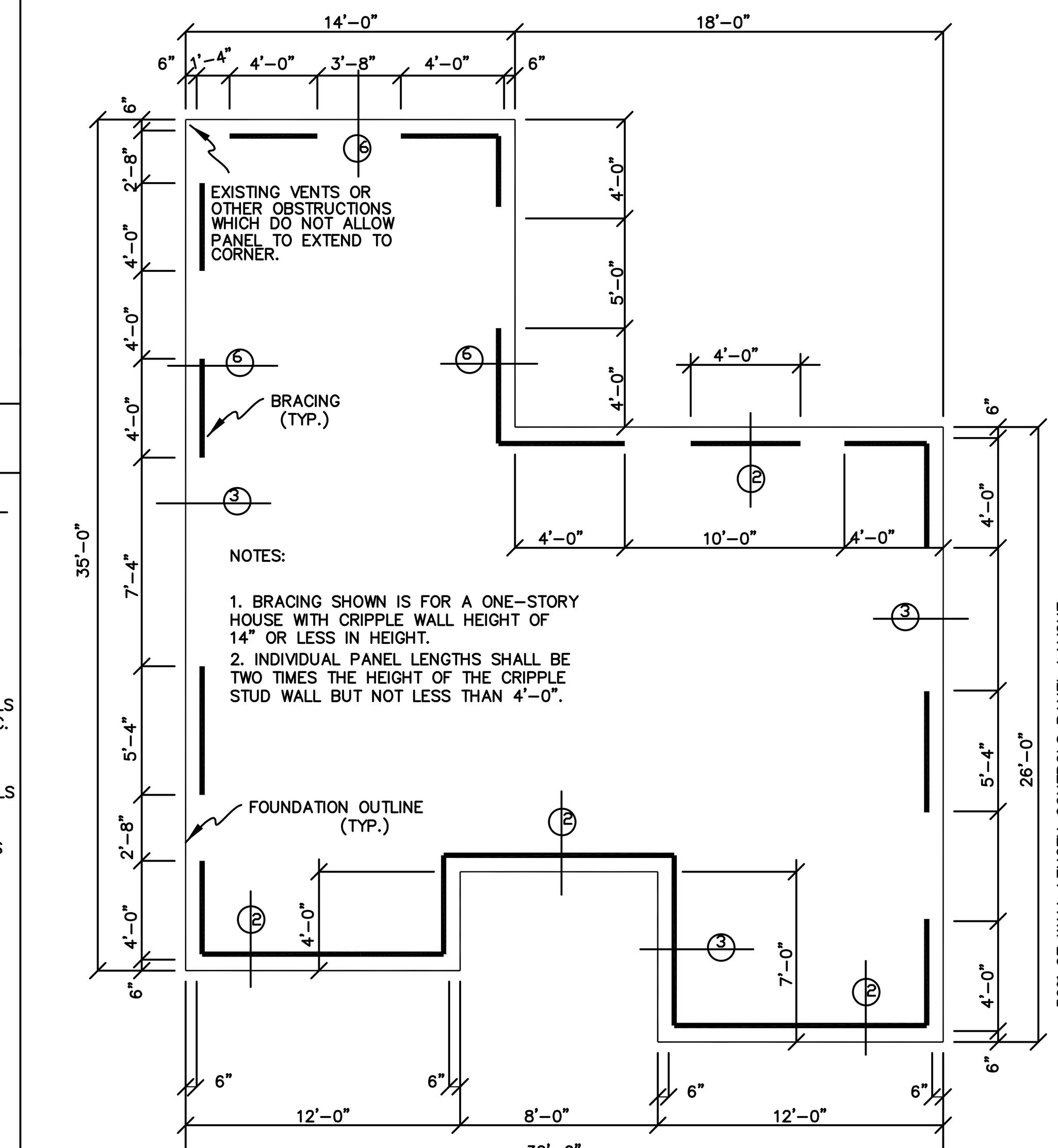


13b VERTICAL SPLICE AT SINGLE STUD

SUMMARY OF MINIMUM PRESCRIPTIVE REQUIREMENTS

NUMBER OF STORIES[1] ABOVE CRIPPLE WALL	STRUCTURAL WOOD PANEL CRIPPLE WALL BRACING REQUIREMENTS[2]	SILL PLATE ANCHOR SIZE AND SPACING[3,4,5]	FRAMING ANCHOR	JOIST BLOCKING[7]
ONE[1]	EACH END AND NOT LESS THAN 50% OF THE WALL LENGTH	1/2 INCH AT 6 FEET ON CENTER MAX	32 INCHES ON CENTER MAXIMUM	ALTERNATE JOISTS
TWO[1]	EACH END AND NOT LESS THAN 70% OF THE WALL LENGTH	1/2 INCH AT 4 FEET ON CENTER MAX[6]	24 INCHES ON CENTER MAXIMUM	ALTERNATE JOISTS AND EVERY JOIST ABOVE WALL BRACING
THREE[1]	100% OF THE WALL LENGTH	5/8 INCH AT 4 FEET ON CENTER MAX[6]	16 INCHES ON CENTER MAXIMUM	ALL JOISTS

1. THESE STANDARDS DO NOT APPLY TO ONE OR TWO STORY BUILDINGS WITH CRIPPLE WALLS GREATER THAN 48 INCHES IN HEIGHT OR TO THREE STORY BUILDINGS WITH CRIPPLE WALL STUDS GREATER THAN 14 INCHES.
2. THE WALL BRACING LENGTH SHALL BE AT LEAST 48 INCHES IN WIDTH OR TWO TIMES THE HEIGHT OF THE CRIPPLE WALL, WHICHEVER IS GREATER. WALL BRACING IS REQUIRED AT ALL EXTERIOR WALLS.
3. THE PLATE WASHERS FOR USE WITH ADHESIVE OR EXPANSION ANCHORS ON WOOD SHALL BE 3-INCH BY 3-INCH BY 0.229" MIN.
4. EXISTING SILL PLATE ANCHOR BOLTS CAST IN CONCRETE AND IS IN SOUND CONDITION SHALL BE PERMITTED TO PROVIDE ALL OR A PORTION OF THE SILL PLATE CONNECTION REQUIREMENT IF THE ANCHOR BOLT DIAMETER AND SPACING MEETS OR EXCEEDS THE TABLE REQUIREMENTS, A NEW PLATE WASHER CONFORMING TO FOOTNOTE 3 IS INSTALLED AND THE SILL PLATE IS CONNECTED TO A SNUG TIGHT CONDITION UNDER THE TORQUE TEST REQUIREMENT.
5. ANCHOR SIDE PLATES SHALL BE PERMITTED TO SUBSTITUTE FOR ADHESIVE OR EXPANSION ANCHORS WHEN CONDITIONS PREVENT ANCHOR INSTALLATION VERTICALLY THROUGH THE SILL PLATE. ANCHOR SIDE PLATES SHALL BE SPACED THE SAME AS ADHESIVE OR EXPANSION ANCHORS PER SECTION E REQUIREMENTS. ONLY ONE ANCHOR SIDE PLATE SHALL BE REQUIRED ON INDIVIDUAL PIECES OF SILL PLATE LESS THAN 32 INCHES IN LENGTH.
6. TWO STORY BUILDINGS MAY SUBSTITUTE 5/8 INCH ANCHORS AT A MAXIMUM OF 6 FEET ON CENTER AND THREE STORY BUILDINGS MAY SUBSTITUTE 1/2 INCH ANCHORS AT A MAXIMUM OF 2 FEET 8 INCHES ON CENTER.
7. EXISTING 2 INCH NOMINAL THICKNESS JOIST BLOCKING SHALL BE PERMITTED TO MEET THIS REQUIREMENT. NEW BLOCKING MAY BE EITHER 2 INCH NOMINAL DIMENSIONED LUMBER OR 1 PLYWOOD.



SAMPLE PLAN

NOTE:

THIS STANDARD PLAN DOES NOT APPLY TO THE BUILDINGS OR ELEMENTS THEREOF LISTED BELOW.

THESE BUILDINGS OR ELEMENTS REQUIRE ANALYSIS BY A LICENSED ENGINEER OR ARCHITECT.

1. BUILDINGS WITH A LATERAL-FORCE-RESISTING SYSTEM USING POLES OR COLUMNS EMBEDDED IN THE GROUND.
2. CRIPPLE WALLS THAT EXCEED 4 FEET IN HEIGHT.
3. BUILDINGS EXCEEDING THREE STORIES IN HEIGHT AND ANY THREE-STORY BUILDING WITH CRIPPLE WALL STUDS EXCEEDING 14 INCHES IN HEIGHT.
4. BUILDINGS WITH MORE THAN 4 DWELLING UNITS OR 4 GUEST ROOMS.
5. BUILDINGS, OR PORTIONS THEREOF, CONSTRUCTED ON A CONCRETE SLAB ON GRADE OR CONSTRUCTED ON OR INTO A SLOPE STEEPER THAN ONE UNIT VERTICAL IN 3 UNITS HORIZONTAL.
6. BUILDINGS WHERE THE SUPERINTENDENT OF BUILDING DETERMINES THAT CONDITIONS EXIST THAT ARE BEYOND THE SCOPE OF THE REQUIREMENTS OF THIS PLAN.
7. BUILDINGS THAT LACK CONTINUOUS FOOTINGS.
8. BUILDINGS WITH REINFORCED OR UNREINFORCED MASONRY OR STONE FOUNDATIONS.

REVISIONS: 05/03/2016

EARTHQUAKE HAZARD REDUCTION IN EXISTING WOOD FRAME RESIDENTIAL BUILDINGS WITH WEAK CRIPPLE WALLS AND UNBOLTED SILL PLATES

STANDARD PLAN NUMBER ONE

APPROVED BY:

IFA KASHEFI, CHIEF OF THE ENGINEERING BUREAU

KEN GILL, ASSISTANT CHIEF OF THE ENGINEERING BUREAU

LA DBS

DEPARTMENT OF BUILDING AND SAFETY