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.

B. SCOPE

These standards apply to one, two and three story one and two family residential buildings if they meet the following criteria:

1) cripple wall height 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 has a continuous concrete foundation around its entire perimeter

3) the building does not exceed 3 stories in height

4) the building foundation subgrade is not steeper than 3 horizontal to 1 vertical at any point.

C. GENERAL REQUIREMENTS

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

PRE-INSPECTION REQUIREMENTS: None

INSPECTION REQUIREMENTS:
All foundation anchors, cripple wall bracing, blocking, and connectors shall be inspected after the work is completed. Access shall be provided for inspection of foundation anchors, blocking, and connectors prior to being permanently concealed.

SPECIAL 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.

APPROVED is acceptable to the jurisdiction having authority. In the case of proprietary products such approval is based upon substantiating data prepared by a recognized independent third party

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 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 A36 or SAE 1018 material to meet the mechanical requirements of ASTM A307. 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 of 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 ½ 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 be approved based on substantiating data acceptable to the City of Portland, Bureau of Development Services .

ANCHOR SIDE PLATE: All anchor side plates shall be of minimum 7 gauge steel (3/16 inch) unless otherwise approved (i.e. 12gauge 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 ½ 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. (.e. [400 lbs / 840lbs] x 72 in. = use 34 in o.c. instead of 72 in o.c. for one story an 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 – ½ inch approved anchors. The number of expansion or adhesive anchors used must have a total shear capacity in concrete equal or greater to the value for the foundation anchor requirement above.

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,

FRAMING ANCHORS: All framing anchors shall be of minimum 18 gauge galvanized steel, of 4 ½ inch length. 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 1 ½ inch nails unless otherwise approved. #6 x 1 ½ 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 ½ inch anchors and ¼ x 2 ½ x 2 ½ 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.

SHEATHING: . All structural wood panel sheathing used for wall bracing shall be 15/32 inch APA rated Sheathing oriented strand board or C-D Exposure 1 plywood of minimum 5 ply panel construction with a span rating of 32/16.
All sheathing used for blocking and shear transfer shall be 1 1/8 inch APA Rated Sheathing Exposure 1.

SHEATHING FASTENERS: Nails shall be 8d common (.131 inch x 2 ½ inch) with full heads (.281 inch) on interior or covered sheathing. # 6 x 1 ½ inch wood screws may be substituted on interior sheathing when plaster exists on the exterior side of the cripple wall.

F. REPLACEMENT OF EXISTING FOOTINGS & STEM WALLS

1. The repair or replacement 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 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 B94-12-77 tolerances. (1/2 = 0.530, 5/8 = 0.650-0.0660 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 1 ½ 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 approved products may be used..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 pneumatic 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 of 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 ½ 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 ½ 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.

G. 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 2 ½ 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 lag screw. Use a ¼ inch diameter drill bit for 3/8 inch lag screws and 1/8 inch drill bit for ¼ 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 treaded 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 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 2 ½ 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 7/8yh of the diameter of the screw at the root of the thread (minimum solid diameter). Use 1/8 inch for #14 screws.)

c) clearance 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 ¾”. Shim requirements greater than ¾ inch shall use two plate or curved plate connections unless otherwise approved.

1. BRACING, FRAMING ANCHORS & VENTILATION

1. Framing members or 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 3/8 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 or sinker nails at 4 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 facture the surface of the sheathing. When a nail factures 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.