Vulnerability-Based Seismic Assessment and Retrofit of One- and Two-Family Dwellings

Volume 2B - Plan Set for Living-Space-Over-Garage Dwellings

FEMA P-1100-2B / October 2019

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Vulnerability-Based Seismic Assessment and Retrofit of One- and Two-Family Dwellings Volume 2B – Plan Set for Living-Space-Over-Garage Dwellings

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Notice

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Cover photograph – Photograph showing living-space-over-garage dwellings.

Overview

Purpose and Scope

This Plan Set is for retrofit of living-space-over-garage dwellings and is provided as a supplement to FEMA P-1100, *Vulnerability-Based Seismic Assessment and Retrofit of One-and Two-Family Dwellings, Volume 1 – Prestandard*. The Plan Set presents prescriptive, pre-engineered plans for a suggested minimum level of retrofit design for use by a general contractor or homeowner without necessarily having to involve a registered design professional. Use of this Plan Set is limited to dwellings that are compliant with eligibility statements presented in Table 1 on Sheet S0. The extent of the scope of this Plan Set is described on Sheet S0.

The Plan Set is intended to contain all of the necessary supplemental technical information and guidance for preparation of a complete set of plans for submittal to the local building department and for use during construction; however, supplemental information may be required by some building departments. Note that building permits are always required when performing the work described in this Plan Set.

The Plan Set does not attempt to address all potential deficiencies in a home and does not eliminate the risk of potential damage in future earthquakes.

Instructions for use are provided on Sheet 01.

Limitation of Liability

Earthquake strengthening constructed in accordance with this Plan Set is intended to reduce the risk of earthquake-related damage to existing residential wood-frame dwellings with living-space-over-garage configurations. The content of this Plan Set is based on the experience and judgment of practicing engineers and limited research. All circumstances, forms, or types of construction have not necessarily been contemplated in the preparation of this Plan Set, and it is not possible to control the quality of construction or predict or test all conditions that may occur during an earthquake. No party associated with the preparation of this Plan Set makes any representation, warranty, or covenant, expressed or implied, with respect to the design, condition, quality, durability, operation, fitness for use, or suitability of earthquake strengthening based on this Plan Set.

A. **Before you begin:**
1. This Plan Set is intended for use by a general contractor or homeowner without necessarily having to involve a Registered Design Professional.
2. Contact your local Building Official, often known as the Building Department, to understand the building permit application. Inquire about:
   a. Fees
   b. How many copies of the plans must be submitted
   c. Which inspections are required
3. The Building Official may also be able to assist with assessing the applicability of this Plan Set to a home, see Eligibility For Use, Sheet S0.
4. Complete the Eligibility For Use questionnaire on Sheet S0 (Table 1), to determine if this Plan Set is applicable. A "non-complaint" answer to any question disqualifies the home from using this Plan Set, unless a Registered Design Professional is involved.

B. Determine your Seismic Design Category (SDC), Building Retrofit Configuration Type and Weight Classification
1. Refer to Sheet S3.
2. Find Seismic Design Category (SDC) which will inform what S_{DS} value to use for the dwelling.
3. Determine building retrofit/ configuration type (see descriptions and the figures on Sheet S0 for guidance).
4. After you have obtained S_{DS} and configuration type, use Figure 1 on Sheet S3 to determine which retrofit schedules are applicable to use.
5. Determine weight classification for use in the selected schedules.

C. Prepare your plans:
1. Draw a scaled plan of the perimeter of the home in the graph layout area provided on Sheet S4, Foundation and Retrofit Layout Plan. Your plan should include the following:
   a. The location of any obstructions along the perimeter of the foundation that make the retrofitting work difficult or impossible such as fireplaces, water heaters, utilities. If the dwelling has a Ground Floor Residential Unit retrofit, this will apply to the perimeter line for the extent of the retrofit (See Figures 4 and 5 on Sheet S0). These areas should be avoided when laying out the required retrofitting work.
   b. An arrow to indicate the direction of the span of your second floor joists above plus the spacing such as “second floor joists at 16" on center.” This will be helpful when selecting the appropriate details shown on Sheets D1 - D8.1.
   c. Dimensions for each length of perimeter wall segment and interior groud floor walls in the area of work and overall dimensions of wall lines.
   d. An arrow pointing to North.
   e. Label the street side (front) of the home.
   f. See Sheet S4-ex for an example of a Plan Set submittal.
   g. See Sheet X1 for additional example and instructions for selecting and documenting the final retrofit. Note that the example shown is for the case with a Ground Floor Residential Unit, but the same process should be applied for dwellings with a Ground Floor without Residential Unit. Review Sheet S0 for clarity on extent/ location of the of the retrofit based on your building retrofit/ configuration type (i.e. with or without a Ground Floor Residential Unit).

D. Gather information to complete the plans:
1. Review General Notes on Sheets S1 and S2 for guidance on materials and installation for the required work.
2. Review the Detail Sheets included in this Plan Set (Sheets D1 - D8.1). Locate the details that most substantially match a home’s framing conditions. Not all details or Sheets will apply. As a minimum, you should have one detail each for:
   a. The foundation sill to concrete foundation connection (Sheet D1); and
   b. Upper floor framing to wood structural panel wall connection (Sheet D3).
3. Differences in existing conditions from those illustrated on the details that result in changes to these drawings will need to be reviewed by a Registered Design Professional. See "Purpose" on Sheet S0 for additional information.
4. Once you have selected the correct (applicable) Earthquake Retrofit Schedule Sheets (S3.1 thru S3.6), follow the Sheet instructions provided to determine the amount and type of earthquake retrofitting required along each wall line. Once Steps 1 through 7 of the Instruction Sheet are completed, document the results within the Retrofit Table as explained in Step 8.
5. Refer to Supplemental Technical Notes, on Sheet S2 where tie-downs are required.

E. Complete your plans:
1. Using information from the appropriate Earthquake Retrofit Schedule(s) Sheets S3.1 - S3.6, add the following to complete your Foundation and Retrofit Layout Plan on Sheet S4:
   a. Indicate and dimension the total length of shear wall required at each wall line where wood structural panel retrofits occur. Also indicate any steel column or proprietary wall retrofit systems if they occur at the front or back walls.
   b. Identify the details used for the connections as noted in D.2. Indicate the connection type and the minimum number of connectors for each wall line. Conform to Sections L and M of Sheet S1.
   c. Identify the details used for the wood structural panel (Sheets D4 or D5).
   d. If tie-downs are used, identify the details used (Sheet D5).
   e. Identify the details used for the top plate splice (Sheet D6).
   f. Identify the details used for notching and/or cutouts (Sheet D6).
   g. If steel column retrofits are to be applied at the front or back walls, identify the details used (Sheets D7 and D7.1).
   h. If Proprietary Shear Wall retrofits are to be applied at the front or back walls, identify the details used (Sheets D8 and D8.1).

F. Submit your plans:
1. Submit a permit application and the required number of completed sheets (Sheets S0 through D8.1) to the Building Official for review. Photographs of the foundation sill, the walls to be retrofitted, and second floor framing conditions may assist the review process.
2. Before starting work, the permit holder may be required to schedule a preconstruction inspection with the Building Official to verify that field conditions are consistent with the information provided on the approved plan.
3. Inspection(s) by the Building Official may be required for:
   a. Foundation anchor bolts / anchor plate installation,
   b. Blocking installation,
   c. Wood structural panel wall; sheathing and nailing,
   d. Steel column installation,
   e. Proprietary Shear Wall installation,
   f. Metal hardware "connectors" installation,
   g. Tie-downs, and
   h. Final inspection.

FEMA Package Sheet List

Note:
Retrofit schedules sheet #'s listed above (sheets S3.1-1.0 thru S3.6-1.0) are for S_{DS} = 1.0 only.
See Sheet S3, Figure 1 for sheet numbers for Earthquake Retrofit Schedules for S_{DS}=1.2 and S_{DS}=1.5

∗ Sheet for reference only. Do not submit to the Building Official.

This sheet is for instruction and reference only.

Do not submit to the Authority Having Jurisdiction.

Instructions for Use

Retrofit of Living-Space-Over-Garage Dwellings (Plan Set)
Vulnerability-Based Seismic Assessment and Retrofit of One- and Two-Family Dwellings
FEMA P-1100, Volume 2 - Plan Sets
Issued: SEPT 2019

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Date:

Sheet:
01

PURPOSE

The purpose of this Plan Set is to promote public safety and welfare by reducing earthquake-induced damage to existing Living-Space-Over-Garage Dwellings. The prescriptive designs provided in this Plan Set, which is being published as FEMA P-1100, Volume 2, are deemed to comply with Chapter 5 of the FEMA P-1100 Prestandard. The provisions of this Plan Set address a single vulnerability; see the FEMA P-1100 Prestandard for assessment and retrofit methodologies. Use of this Plan Set is anticipated to improve earthquake performance but is not intended to prevent earthquake damage. For additional information, see https://www.fema.gov/media-library/assets/documents/175158.

SCOPE

This Plan Set provides prescriptive provisions for retrofit of Ground Story Bracing in Living-Space-Over-Garage Dwellings.

ELIGIBILITY

Living-Space-Over-Garage Dwellings are permitted to use the prescriptive retrofit provisions of this Plan Set when all questions in Table 1 can be answered with "compliant". For dwellings not eligible to use this Plan Set, see the FEMA P-1100 Prestandard, section 5.5 for the Simplified Engineered Procedure.

DIFFERING CONDITIONS

Where a dwelling's actual conditions require modification of the vulnerability-based prescriptive retrofit solutions identified within this Plan Set, additional or modified details may be generated by a Registered Design Professional and used to supplement the prescriptive procedures of this Plan Set. These supplemental details shall be stamped and signed by a Registered Design Professional and approved by the Building Official in accordance with the FEMA P-1100 Prestandard, Section 5.5.

DESIGN BASIS

This set is deemed to comply with Chapter 5 of FEMA P-1100 Prestandard. Specific design assumptions are as follows:

R = 5.0; Ω_o = 1.5; S_{DS} = Varies (between 1 and 1.5) Site Class C

GENERAL

Living-Space-Over-Garage Dwellings include several types of dwellings in which living space occurs over a garage or a portion of the dwelling constructed as a garage. This term captures the dwellings in which all of the living space occurs at an upper level over a garage story, as seen in Figure 1. In this dwelling type the garage story may be unfinished and still used as a garage and utility area, or may have been partially or fully converted to a *ground story residential unit*. This term also captures dwellings where a portion of an upper level living space occurs over the garage, as seen in Figure 2.

Earthquake Retrofit Schedules in this plan set include a variety of options for retrofitting each of these configurations, including:

- Wood Structural Panel Shear Walls, with a single length of shear wall along a given wall line;
- Wood Structural Panel Shear Walls, with two sections of shear wall per wall line;
- Retrofits including Steel Columns or Proprietary Shear Walls options for front and back walls.

For Ground Story Bracing in *Living-Space-Over-Garage* Dwellings retrofit in accordance with this Plan Set, retrofit elements shall be provided as follows:

Configurations without a Ground Floor Residential Unit

- The retrofits shall include bracing elements at the dwelling front, back and side walls (See Figure 3). Bracing elements at the side walls are to be wood structural panel shear walls; bracing elements at the front and back walls are permitted to be of any of the bracing element types listed above

Configurations with a Ground Floor Residential Unit

- The retrofit shall include bracing elements at the garage front and side walls, and wall separating the garage use from the residential use (See Figures 4 and 5). Bracing elements at the front wall are permitted to be of any of the bracing element types in listed above. Bracing elements at the side walls and wall separating the garage use from the residential-use are to be wood structural panel shear walls.

ASSESSMENT

The retrofit provisions of this Plan Set are intended to apply to dwellings that have been assessed using the FEMA P-1100 methodology and found to have a Living-Space-Over-Garage Vulnerability.

Figure 1

Figure 2

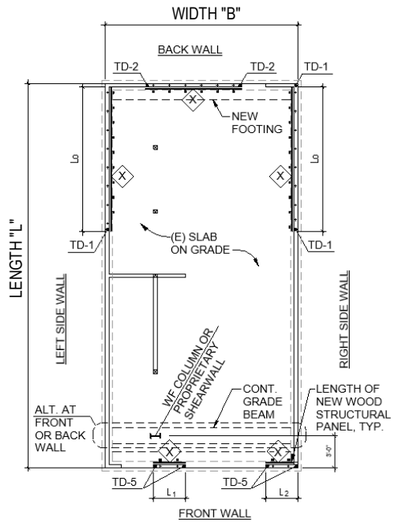

Figure 3
Example of dwelling configuration without Ground Floor Residential Unit

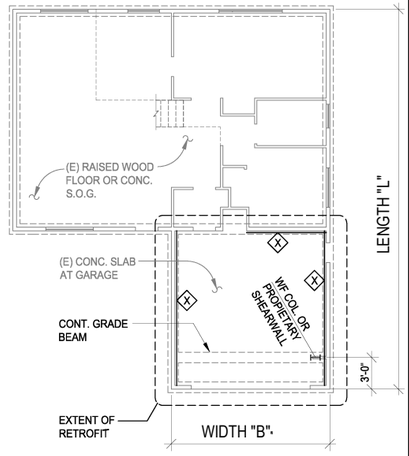

Figure 4
Example of dwelling configuration with Ground Floor Residential Unit

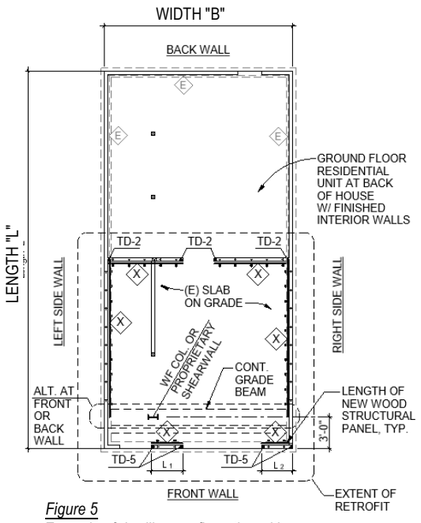

Figure 5
Example of dwelling configuration with Ground Floor Residential Unit

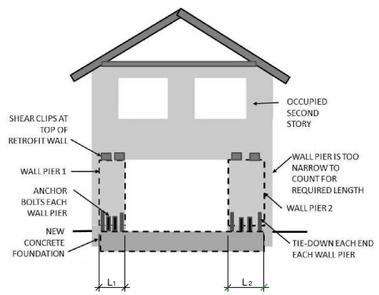

Figure 6
(2 sections of wall option shown)

TABLE 1: ELIGIBILITY FOR USE

To determine if a home qualifies, answer the following:	Compliant	Non-Compliant
1. The dwelling is a one or two-family detached structure or the dwelling is a unit in a townhouse and assesment and retrofit will occur for each attached townhouse.		
2. The dwelling is a wood light-frame dwelling and has a maximum of one story above the garage story.		
3. The dwelling is a living-space-over-garage dwelling as defined in Chapter 2 FEMA P-1100 prestandard.		
4. The dwelling perimeter (not including porches or other appurtenances) is supported on continuous concrete foundations, concrete stem walls or thickened slab edge footings.		
5. The lower (garage) level floor is constructed of a conventionally reinforced concrete slab on grade (or at least the portion of the floor that bounds the garage).		
6. Weight of roofing material shall not exceed 12 psf (measure on slope).		
7. Weight of exterior wall finish shall not exceed 10 psf, except that veneer wainscots supported on concrete or masonry foundations are permitted to extend up to four feet above the top of foundation.		
8. Weight of interior wall finish shall not exceed 8 psf, except that masonry fireplace surrounds of not more than 4 inches thick and up to 100 square feet are permitted to exceed this weight.		
9. Weight of upper floor finish shall not exceed 5 psf, except that heavier floor finishes of up to 10 psf are acceptable where limited to 25% of the total floor area of each level.		
10. Floors in each story are at the same level and not split level, excluding slab on grade portions.		
11. The home floor area, calculated as "B" times "L", as defined in figures 3, 4 or 5 shall not exceed 2,000 sqare feet.		
12. No part of the foundations is constructed of unreinforced masonry or stone.		
13. Clear floor to ceiling heights at any occupied level does not exceed 9'-0".		

If you answered "Compliant" to each of these questions, proceed to Sheet S3.
If you answered "Non-compliant" to any of these questions, the home is not eligible to apply this Plan Set, unless a Registered Design Professional has addressed non-compliant issues in accordance with P-1100 Prestandard, Section 5.5. See Differing Conditions section on this sheet.

Submittal Sheet Index

(*) Retrofit schedules sheet #'s listed above (sheets S3.1-1.0 thru S3.6-1.0) are for S_{DS} = 1.0 only. See sheet S3, Figure 1 for sheet numbers for Earthquake Retrofit Schedules for S_{DS}=1.2 and S_{DS}=1.5

APPLICANT INFORMATION

APPLICANT: _____

ADDRESS: _____

PHONE: _____

SIGNATURE: _____

Cover Sheet

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FEMA P-1100, Volume 2 - Plan Sets
Issued: SEPT 2019

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Date:

Sheet:

S0

A. **CODE**
1. All work not otherwise specified shall conform to the locally adopted version of the building code or residential code. Contractor shall comply with all locally adopted building codes and ordinances.

B. **GENERAL**
1. The contractor is responsible for maintaining a safe job site and complying with relevant state and/or federal OSHA standards. Contractor is responsible for the means and methods for accomplishing the work shown in this Plan Set, including any shoring and bracing of existing construction as required to safely install new work. Exercise caution working around existing utilities, locate underground utilities before excavating, and arrange for temporary disconnection of utilities if necessary.

C. **EXISTING CONDITIONS**
1. Contractor shall confirm that existing conditions match plans and details prior to start of work. Modify choice of detail as required prior to start of work.
2. Contractor shall verify that existing concrete, anchor bolts, wood framing, and other materials that will become part of the work or to which retrofit construction is attached is in reasonably sound condition and free of defects that would substantially reduce the capacity of the material. Where possible, damaged or deteriorated elements shall be repaired in place or supplemented with new elements. Otherwise damaged or deteriorated members shall be replaced. Repair or replacement shall be in accordance with the adopted building or residential code.
3. The Owner or Contractor shall verify that the existing concrete within all areas to receive new anchor bolts is in reasonably good condition. Examples of poor concrete quality would include excessive spalling, large rock pockets, cracks extending completely through the footing greater than 1/4" wide, or low strength concrete cement or mortar easily scrapable with a metal knife or trowel. Strengthening should be avoided in local areas of poor quality. Where these areas cannot be avoided, or where locations of poor quality are widespread, the new anchors are to be tested in accordance w/ Table C-1. Where torque tests continue to fail, the existing foundation system shall be replaced locally for a minimum of 30 inches on each side of the proposed anchor location.

Table C-1: Foundation Verification Requirements

	Screw Anchor	Adhesive Anchor
Diameter Ø	Torque (ft-lbs)	Torque (ft-lbs)
1/2"	35	15
5/8"	50	20

D. **NOTCHING, BORING AND CUTTING**
1. Do not cut, bore or notch structural members except as shown in these drawings or as specifically permitted by the building inspector. Exception: Notching and boring of framing shall be permitted as per Chapter 6 of the International Residential Code (IRC).
2. When drilling in concrete, do not drill through existing reinforcing steel. If reinforcing steel is hit during drilling, move a minimum of one inch and drill relocated hole. Fill original hole with non-shrink grout.

E. **CONCRETE**
1. Concrete shall have a strength of not less than 3000 psi at 28 days (design based upon 2500 psi). Concrete mixed on site shall be mixed and placed in accordance with the manufacturer's instructions using potable water.

F. **REINFORCING STEEL (REBAR)**
1. Reinforcing steel shall confirm to ASTM A615 Grade 40 or 60, ASTM A706, or ASTM A996 Type R.
2. Reinforcing steel bend radii and other rebar detailing shall be in accordance with Concrete Reinforcing Steel Institute.
3. Minimum concrete cover over reinforcing steel:
   a. Concrete cast against and permanently exposed to soil: 3 inches
   b. Formed concrete exposed to weather: 2 inches
   c. Concrete not exposed to weather or in contact with soil: 1-1/2 inch
   d. Reinforcing steel lap splice lengths: No. 4 / No. 5
      - Horizontal bars with more than 12 inches concrete below: 32 inches / 42 inches
      - Other bars: 24 inches / 32 inches

G. **STRUCTURAL STEEL**
1. Structural steel W-sections, plate, bar and miscellaneous steel shall be ASTM A992 or A572. Welding shall comply with AWS D1.1 requirements using prequalified welding procedures. All welding shall be conducted by welders certified for the materials and welding procedures used.
2. Bolts shall conform to ASTM A-307. Threaded rods shall conform to ASTM A-36.

H. **FASTENERS**
1. General
   a. All bolts, nails and other fasteners in contact with preservative treated wood or exposed to weather shall be hot dip galvanized or stainless steel.
2. Nails
   a. Unless otherwise noted, all nails specified are to be common nails.
   b. Special care is required when installing nails in existing framing. Where required to avoid splitting of framing, predrill to 75% of nail shank diameter.
   c. Fasteners for wood structural panel sheathing shall be full length 8d common nails (0.131" x 2.1/2"). Drive sheathing nail head flush with face of sheathing.
   d. Do not overdrive, countersink, or otherwise damage the outermost ply when installing nails. A nail is over-driven when it breaks the surface ply. Where nails are overdriven to the point that the plywood veneer is fractured, add one new nail for every (2) overdriven nails. Space new nails between existing.
3. Anchor Bolts
   a. Predrill bolt holes to not more than 1/16th inch larger than bolt or anchor bolt to be placed.
   b. At each perimeter wall line, proved a minimum quantity of Foundation Sill Anchors as required by the Earthquake Retrofit Schedule. Place new anchors between 8 and 12 inches from the end of each foundation sill plate and distribute the remaining anchors as evenly as practical along the wall line.
   c. Provide steel plate washers 0.229 x 3 x 3 inch minimum at all anchor bolts. Centerline of washer should be 1-1/2" to 2" from face of sheathing.
   d. Anchor bolts shall be a maximum spacing of 48" on center for the entire portion of all exterior walls, except as noted in Section J.
   e. For braced wall sections without tie-downs, provide one of the required anchor bolts within 8" of each end and one additional anchor bolt at each end as noted on Sheet D4.
   f. For braced wall sections with tie-downs, provide one additional anchor bolt within 8" minimum and 12" maximum from tie-down as noted on Sheet D5.

I. **WOOD STRUCTURAL PANEL SHEATHING**
1. Wood structural panels shall be 15/32" plywood sheathing, all veneer, conforming to US voluntary Product Standard PS-1, Exposure I or Exterior Exposure, manufactured with exterior glue, and minimum 4-ply.
2. Oriented Strand Board (OSB) shall be 15/32" thick and conform to US Voluntary Product Standard PS 2 with an exposure rating of Exposure 1 or Exterior Exposure, manufactured with exterior glue, and minimum 4-ply.
3. Provide 1/8-inch minimum gap at all sheathing panel ends and edges.
4. Maintain a minimum edge distance of 3/8" from center of nail to edges of sheathing, studs, or top and sill plates. See Sheet D4 for double stud at sheathing panel joints.

J. **WOOD FRAMING**
1. Framing shall be Douglas Fir-Larch, or an approved species having a greater or equal specific gravity.
2. Framing in contact with foundations or exposed to weather shall be preservative treated in accordance with AWPA U1 (Commodity Specification A, Use Category 4B). Field treat all cuts, bores and notches per AWPA M-4.

K. **CONNECTOR DEVICES**
1. Connectors shall be pre-engineered pre-manufactured devices, approved by the Building Official and installed in accordance with the manufacturer's instructions.
2. Connectors protected from weather shall be provided with a minimum of G90 zinc coating in accordance with ASTM A653. Connectors exposed to weather or in contact with preservative treated wood shall be provided with a minimum hot-dip galvanized coating or G185 coating in accordance with ASTM A653, and fasteners shall conform to ASTM A153.
3. Connector devices shall be of the type and size specified in these drawings.
4. Connectors required by the Earthquake Retrofit Schedule shall be distributed equally along the length of each wall line or within the length of the braced wall panel.
5. Connector spacing shall not be less than 8" on center.
6. Increase nail or screw length 1/2-inch minimum when installing connectors over wood structural panels.

L. **POST-INSTALLED ANCHORS**
1. Post-installed anchors shall be installed in accordance with the manufacturer's installation instructions.
2. Adhesive anchors shall be Simpson Strong-Tie SET-XP, HILTI RE 500 SD, CIA GEL 7000C, or approved equivalent.
3. Concrete screws shall be Simpson Strong-Tie Titen HD, KC Metals Kwik-HUS-EZ, or Powers Fasteners Wedge-Bolt, or approved equivalent.
4. See H.3 for additional anchor bolt requirements.

M. **PROPRIETARY SHEAR WALLS**
1. Proprietary shear walls shall be prefabricated wood shear panels or prefabricated cold-formed steel shear panels complying with the requirements of ICC-ES AC436, FEMA P-795, or shall have been tested in accordance with ASTM D7989, in a manner and with documentation acceptable to the building official.
2. Proprietary Shear Walls shall be installed in accordance with the manufacturer's installation requirements and the provisions of this Plan Set.

N. **PERMITS**
1. All work required by this Plan Set shall be permitted through the building department.

O. **INSPECTIONS**
1. Contractor shall coordinate with the building inspector to ensure that work is accessible for Building Department inspections, and shall correct non-compliant work as identified by the inspector.

P. **SPECIAL INSPECTIONS**
1. Special inspection by a third party inspector approved by the Building Official shall be provided for the following:
   a. Welding of structural steel
2. Special inspection by a third party inspector is not required for the following:
   a. Concrete or reinforcing steel for foundations. Design is based on an ultimate concrete strength of 2500 psi or less.
   b. Installation of cast-in-place or post-installed anchor bolts.
   c. Installation of adhesive anchors for tie-down devices, provided that each anchor is torque-tested in accordance with Table R-2, Sheet S2.
   d. Nailing of wood structural panel shear walls, provided a building department inspection is performed.

APPLICANT: _____

PROPERTY ADDRESS: _____

General Notes

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Date:

Sheet:

S1

Q. PURPOSE OF SUPPLEMENTAL TECHNICAL NOTES

1. These Supplemental Techical Notes provide guidance for the installation of wood structural panel shear walls that use tie-downs at existing foundation systems. Tie-downs shall be used where specified in the Earthquake Retrofit Schedules.
2. Where "New Fdn Req'd?" response is NO but a "Tie-down" TD1 is listed in the Earthquake Retrofit Schedules - Wood Structural Panel Shear Walls sheets, additional visual verification and testing of the existing foundation system is required to be completed by the owner or general contractor and approved by the Building Official, and documented in Table R-1 prior to commencing any work. Visual verification and testing shall be as noted in Section R.
3. Where these requirements are not met, a new foundation system will be required in accordance with Sheet D2.

R. EXISTING FOUNDATION REQUIREMENTS AND TESTING

1. The size of existing foundation systems at the location of new tie-down anchors shall be verified to be at least 15" deep ("D") and 8" wide ("W"). The dimension "D" shall be measured from the bottom of footing to the underside of the existing mudsill. The dimension "W" shall be measured from the top outside face of footing to the inside top face of footing. See Table R-1, item A.1.
2. Verification of the overall quality of concrete along any wall line requiring tie-downs shall be made and documented within Table R-1, item B.1. This verification shall be made by use of a minimum of two sacrificial torque tests along each wall line where tie-downs are used. These tests shall consist of installing 1/2" or 5/8" diameter screw-type bolts into the existing concrete and verifying that a value per Table R-2 can be achieved. Torque tests can be performed either by the owner, a general contractor, or a special inspection company or testing agency hired by the owner and as approved by the Building Official.
3. Where "Tie-downs" are used to determine the sheathed panel length required along a wall line, each adhesive anchor shall be torque tested in accordance with Table R-2.

S. TIE-DOWN REQUIREMENTS

1. Tie-downs shall be Simpson HDU2-SDS2.5, KC Metals ADST2, USP Structural Connectors PHD2A, or an equivalent with an allowable tensile load of 3075 lbs or more, installed per manufacturer's instructions.
2. End studs(s) to which tie-downs are installed, shall be 3x minimum or double 2x. For nailing at double studs, see Sheet D4.
3. All tie-downs shall use 5/8"ø (A36) threaded rod adhesive-type anchors with minimum embedment per Detail 1, Sheet D5.

T. MINIMUM INSTALLATION REQUIREMENTS FOR TIE-DOWN ANCHORS

1. All holes shall be drilled to the specified diameter and depth.
2. All holes shall be blown clean of dust with oil-free compressed air for a minimum of 4 seconds.
3. All holes shall be cleaned with a nylon brush for a minimum of 4 cycles.
4. Blow holes clean of dust with oil-free compressed air for a minimum of 4 seconds.
5. Check adhesive cartridge expiration date, open and install per the manufacturer's instructions.
6. Fill the holes 1/2 to 2/3 full, starting at the bottom of the hole to prevent air pockets and withdraw the nozzle as the hole fills up.
7. Insert a clean and oil-free anchor turning slowly until the anchor contacts the bottom of the hole.
8. Do not disturb the anchor until fully cured. See manufacturer's instructions.

Table R-1: Verification of Existing Foundation System

Requirement	Yes or N/A	Signature of Owner or Contractor (Owner performing work)
A.1 The size of the existing foundation is greater than or equal to that specified in Section R, item 1.		Signature
B.1 The existing foundation has generally been verified to be in good condition at planned tie-down locations as specified in Section R, item 2.		Signature
C.1 The capacity of each new tie-down anchor has been verified by passing the torque tests specified in Table R2.		Signature
D.1 All adhesive anchors were installed per the manufacturer's instructions per the minimum steps as noted in Section T.		Signature

Table R-2: Foundation Verification Requirements

	Screw Anchor	Adhesive Anchor
Diameter ø	Torque (ft-lbs)	Torque (ft-lbs)
1/2"	35	15
5/8"	50	20

APPLICANT: _____

PROPERTY ADDRESS: _____

Supplemental Technical Notes Where Tie-downs are Required at Existing Foundations

Retrofit of Living-Space-Over-Garage Dwellings (Plan Set)
Vulnerability-Based Seismic Assessment and Retrofit of One- and Two-Family Dwellings
FEMA P-1100, Volume 2 - Plan Sets
Issued: SEPT 2019

FEMA

Date:

Sheet:

S2

Seismic Design Category (SDC) and Building Retrofit/ Configuration Type

1. The first two factors taken into consideration for determining the appropriate amount of Earthquake Strengthening:
   a. Site seismicity or S_{DS} value
   b. Building retrofit/ configuration type
2. To find appropriate S_{DS} value, which is either 1.0, 1.2, or 1.5, you must first determine your Seismic Design Category (SDC) by clicking the link below.
   a. In your internet browser go to http://www.atcouncil.org/fema-p-1100
   b. Click on one of the five (5) geographic areas listed to find your location on the appropriate map.
   c. Locate your SDC (SDC A-SDC E) by the color contour shown on the map which corresponds to the % g values shown.
   d. For SDC A-D_1, use S_{DS} = 1.0.
   e. For SDC D_2, use S_{DS} = 1.2 unless the site class can be determined as A, B, or D, in which case use S_{DS} = 1.0.
   f. For SDC E, use S_{DS} = 1.5
   Note: where your location is on, or close to, the border of two SDC's, it is prudent to choose the higher value.
3. Determine building retrofit/configuration type: Does the dwelling have a ground floor residential unit? See Figures 3 thru 5 on Sheet S0 for guidance.
4. Find the corresponding S_{DS} value and building retrofit/configuration type in Figure 1. You will use one or more of the Earthquake Retrofit Schedules identified in Figure 1. Do not submit any of the unused sheets to the Building Official.

For S_{DS} - 1.0g:		*For S_{DS} - 1.2g:*		*For S_{DS} - 1.5g:*	
Without Ground Floor Residential Unit	**With Ground Floor Residential Unit**	**Without Ground Floor Residential Unit**	**With Ground Floor Residential Unit**	**Without Ground Floor Residential Unit**	**With Ground Floor Residential Unit**
See Retrofit Schedules on Sheets S3.1-1.0 and S3.2-1.0 for any wall. See Sheet S3.3-1.0 for alternates at front/ back wall.	See Retrofit Schedules on Sheets S3.1-1.0 thru S3.3-1.0 for side/back walls. See Retrofit Schedules on Sheets S3.4-1.0 thru S3.6-1.0 for front walls.	See Retrofit Schedules on Sheets S3.1-1.2 and S3.2-1.2 for any wall. See Sheet S3.3-1.2 for alternates at front/ back wall.	See Retrofit Schedules on Sheets S3.1-1.2 thru S3.3-1.2 for side/back walls. See Retrofit Schedules on Sheets S3.4-1.2 thru S3.6-1.2 for front walls.	See Retrofit Schedules on Sheets S3.1-1.5 and S3.2-1.5 for any wall. See Sheet S3.3-1.5 for alternates at front/ back wall.	See Retrofit Schedules on Sheets S3.1-1.5 thru S3.3-1.5 for side/back walls. See Retrofit Schedules on Sheets S3.4-1.5 thru S3.6-1.5 for front walls.

⇩

All S_{DS} Values
Construction Details See Sheets D1 thru D8.1

Figure 1. Earthquake Retrofit Schedules per S_{DS}

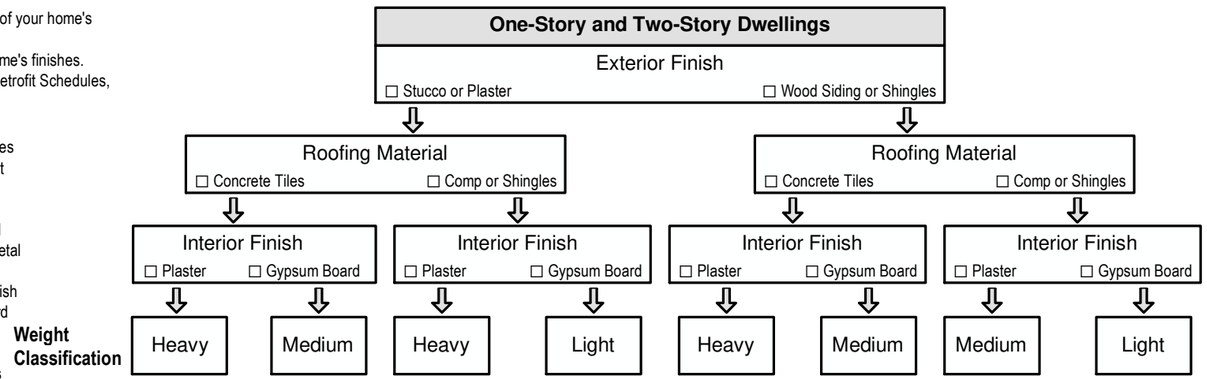
Weight Classification

This flowchart is used to determine the general weight classification of your home's construction.

1. Check the box of the material that most closely matches your home's finishes.
2. Note the Weight Classification result for use in the Earthquake Retrofit Schedules, Sheets S3.1-S3.6.

Specific notes for exterior, interior and roof coverings:

1. The "wood siding or shingles" exterior finish category also includes finishes of similar weight, including but not limited to fiber-cement and aluminum siding.
2. The "comp or shingles" roofing material category also includes roofing materials of similar weight, including but not limited to roll roofing, built-up felt roofing, single-ply membrane roofing, and metal roofing.
3. The "gypsum board" interior finish category also includes wall finish materials of similar weight, including but not limited to wood board or panel siding.
4. The exterior finish, roofing material and interior finish categories are intended to be identified based on the predominant materials used in construction. Where interior or exterior finishes vary, a heavier type finish shall be assumed where 25% or more of that heavier finish type exists within the dwelling.



Connectors

1. Manufacturer's model numbers and installation instructions are subject to change. Verify and follow manufacturer's written instructions.
2. Connector images are general in nature only. Individual manufacturer's connectors may vary.
3. Any of the connectors listed within a particular group (e.g. Type B) may be used for strengthening the particular condition.
4. This Plan Set was developed using the lowest listed manufacturer's capacity within a particular group.
5. Where connectors listed within the applicable Earthquake Retrofit Schedule will not fit within a particular wall line due to limitations in length, alternate connections may be substituted but shall be designed and selected by a Registered Design Professional and approved by the Building Official.

ANCHOR BOLTS

MANUFACTURER	MODEL	EMBEDMENT DEPTH	
		1/2"ø	5/8"ø
SCREW-TYPE			
Simpson Strong-Tie	Titen HD	3-1/2"	3-1/2"
KC Metals	Kwik-HUS-EZ	4-1/2"	n/a
Powers Fasteners	Wedge-Bolt	3-3/8"	3-3/8"
ADHESIVE	Threaded Rod with:		
Simpson Strong-Tie	SET Adhesive	4-1/4"	5"
Hilti	HIT-HY 200	2-3/4"	3-1/8"
USP Structural Connectors	CIA GEL 7000C	2-3/4"	3-1/8"

CONNECTORS

IMAGE	MANUFACTURER	MODEL	CAPACITY (lbs)
	TYPE A		
	Simpson Strong-Tie	URFP	1530
	USP Structural Connectors	SRC	1450
	TYPE B		
	Simpson Strong-Tie	FRFP	1065
	KC Metals	RFP	960
	USP Structural Connectors	SRCP	1570
	TYPE C		
	KC Metals	RFA86/88	725
	KC Metals	RFA136/138	1145
	USP Structural Connectors	SFA8	875
	Simpson	FRFP	1065
	TYPE D		
	Simpson Strong-Tie	L70	740
	KC Metals	CA70	565
	USP Structural Connectors	AC7	725
	TYPE E		
	Simpson Strong-Tie	L90	925
	KC Metals	CA90	740
	USP Structural Connectors	AC9	905
	TYPE F		
	Simpson Strong-Tie	H10A	590
	KC Metals	HT10A	590
	USP Structural Connectors	RT16A	800
	TYPE G		
	Simpson Strong-Tie	LTP4	600
	KC Metals	FAL	445
	USP Structural Connectors	MP4F	660
	TYPE S1		
	Simpson Strong-Tie	MSTA36	725
	KC Metals	TSA36	1145
	USP Structural Connectors	MSTA36	875
	TYPE S2		
	Simpson Strong-Tie	ST6236	2050
	KC Metals	TS36	2075
	USP Structural Connectors	KST234	2065

TIE-DOWNS

(Supplemental Technical Notes, Sheet S2, Section S)

MARK (kips)	IMAGE	MANUFACTURER	MODEL	CAPACITY (lbs)
TD1		Simpson Strong-Tie	HDU2	3075
		KC Metals	ADST2	4275
		USP Structural Connectors	PHD2A	3215
TD2		Simpson Strong-Tie	HDU4	4565
		KC Metals	ADST5	5895
		USP Structural Connectors	PHD5A	5215
TD3		Simpson Strong-Tie	HDU8	5645
		KC Metals	ADG8	5895
		USP Structural Connectors	PHD5A	6525
TD4		Simpson Strong-Tie	HDU8	7870
		KC Metals	ADG8	8820
		USP Structural Connectors	PHD8	8185
TD5		Simpson Strong-Tie	HDU11	11,175
		KC Metals	ADG12	13,200
		USP Structural Connectors	UPHD9	11,270

Note: Tie-down capacities listed above are ASD and based on manufacturer's data. Where tie-down TD1 is used at existing foundations, the allowable ASD capacity used for development of this Plan Set has been reduced to 3000# and TD1 must be installed per Detail 1, Sheet D5.

APPLICANT: _____

PROPERTY ADDRESS: _____

Earthquake Retrofit Schedule General Instructions, Weight Category, and Connectors

Retrofit of Living-Space-Over-Garage Dwellings (Plan Set)
Vulnerability-Based Seismic Assessment and Retrofit of One- and Two-Family Dwellings
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Date:

Sheet:

S3

EARTHQUAKE RETROFIT SCHEDULE (S_{DS} = 1.0) for Single Section of Wall

① WEIGHT CLASSIFICATION	② Floor Area in Square Feet	③ ☒ Mark row that applies	④ MINIMUM REQUIRED LENGTH OF A SINGLE SECTION OF WALL OF WOOD STRUCTURAL PANEL SHEAR WALLS (at each wall line)											⑤ FOUNDATION SILL ANCHORAGE Min. No. of Foundation Connectors or Anchors at Each Wall Panel					⑥ FLOOR FRAMING TO WALL CONNECTION Min. No. of Connectors at Each Wall Panel		
			No Tie-down		w/ Tie-downs in Existing or New Foundations																
					8d at 6" O.C.			8d at 4" O.C.			8d at 2" O.C.										
			8d Nail Spacing	Wall Length	Wall Length	Tie-down	New Fdn Req'd ?	Wall Length	Tie-down	New Fdn Req'd ?	Wall Length	Tie-down	New Fdn Req'd ?	Type "A"	Type "B"	Type "C"	1/2"ø Bolt	5/8"ø Bolt	Type "D"	Type "E" or "F"	Type "G"
Light Construction	800		6	16'-6"	12'-6"	TD1	No	8'-6"	TD2	Yes	5'-0"	TD5	Yes	4	6	7	6	4	9	9	11
	1000		6	19'-6"	15'-6"	TD1	No	10'-6"	TD2	Yes	6'-6"	TD5	Yes	4	7	9	7	5	11	11	14
	1200		6	22'-0"	18'-6"	TD1	No	13'-0"	TD2	Yes	7'-6"	TD4	Yes	5	8	11	9	6	13	13	17
	1500		6	25'-6"	23'-6"	TD1	No	16'-0"	TD2	Yes	9'-6"	TD4	Yes	6	10	13	11	8	17	16	21
	2000		4	31'-0"	31'-0"	None	No	21'-6"	TD2	Yes	12'-6"	TD4	Yes	8	13	17	14	10	22	21	28
Medium Construction	800		6	20'-6"	16'-0"	TD1	No	11'-0"	TD2	Yes	6'-6"	TD5	Yes	5	7	9	8	5	12	11	15
	1000		6	23'-6"	20'-0"	TD1	No	14'-0"	TD2	Yes	8'-0"	TD5	Yes	6	9	11	9	7	14	14	18
	1200		6	26'-6"	24'-0"	TD1	No	16'-6"	TD2	Yes	10'-0"	TD4	Yes	7	10	14	11	8	17	17	22
	1500		6	31'-0"	30'-6"	TD1	No	20'-6"	TD2	Yes	12'-6"	TD4	Yes	8	13	17	14	10	21	21	27
	2000		4	37'-6"	40'-6"	None	No	27'-6"	TD2	Yes	16'-6"	TD4	Yes	11	17	22	18	13	28	27	36
Heavy Construction	800		6	21'-6"	21'-0"	TD1	No	14'-6"	TD2	Yes	8'-6"	TD4	Yes	6	9	12	10	7	15	14	19
	1000		4	24'-6"	26'-6"	None	No	18'-0"	TD2	Yes	10'-6"	TD4	Yes	7	11	15	12	8	19	18	24
	1200		4	27'-6"	31'-6"	None	No	21'-6"	TD1	No	13'-0"	TD4	Yes	9	13	18	15	10	22	21	28
	1500		4	29'-6"	39'-6"	None	No	27'-0"	TD1	No	16'-0"	TD4	Yes	11	17	22	18	12	28	27	35
	2000		2	30'-0"	53'-0"	None	No	36'-0"	None	No	21'-6"	TD3	Yes	14	22	29	24	16	37	35	47

INSTRUCTIONS

① Locate the section that matches your home's construction. Use the chart on Sheet S3 to determine "Weight Category".

② Find the home's Floor Area "B" x "L" (See Figures D-3 thru D-5) in the schedule, this number should be at least as large as the number listed below. Do not use a smaller number, even if it is closer.

a. Approximate floor area _____

③ Check the box that matches your home's area per ②. You will use information in this row of the schedule to determine length of plywood bracing panels, nailing requirements, quantities of hardware, etc.

④ Determine the length of plywood bracing required. The columns contain the length of required bracing, including options for bracing without tie-downs, with tie-downs into existing foundations and tie-downs w/ new foundations, see schedule Note 3. Follow the row across from the total floor area that you checked for your home (in Step 3) to find the bracing length for each side of the house (front, back, left side, right side).

⑤ Determine the number of Foundation Sill Connectors or Anchors required. The columns show the number of anchors required, depending on whether you use Types A through C, or number of 1/2"ø or 5/8"ø anchor bolts. (ø = diameter of the bolts.) See Sheet S3.

⑥ Determine the number of Floor to Wall connectors. The columns indicate how many framing connectors are required, depending on whether you use Types D, E, F, or G. See Sheet S3.

⑦ Complete the Retrofit Summary for your project. Fill in the lengths found in ④ for each line. If no option is available, see Schedule notes 6 & 7. Check the boxes for the anchor and connector types you plan to use. If you intend to use tie-downs, check the box for tie-downs after each wall line you plan to use them for, check the box on line 4, and read the Supplemental Technical Notes for additional information.

⑧ Include Earthquake Retrofit Schedule Sheets S3.1-1.0 thru S3.6-1.0 where applicable. See sheet S3, Figure 2 and schedule notes 6 thru 8.

Notes:

1. Anchor bolts and Connectors shown in the Earthquake Retrofit Schedule are the minimum required per wall line, placed within the length of strengthening where possible. Additional anchors and connectors may be necessary to meet the requirements of specific details and General Notes.

2. Tie-downs: If your foundation meets the criteria, you may choose the tie-down option to decrease the required length of strengthening. This may be required where the length of the wall without tie downs specified in this schedule is longer than can be accommodated by existing conditions. However, there is a level of uncertainty when dealing with existing foundations, therefore, where possible, longer lengths of strengthening, without tie-downs, are preferred. (See Supplemental Technical Notes, Sheet S2 to verify the existing foundation is suitable and meets criteria.) Where "None" occurs, no tie-down is required.

3. Foundations: Where new foundations are required at front and back walls, see Sheet D2 for details. At side walls, select retrofit options that do not require new foundations whenever possible. Otherwise, provide foundations that extend the full depth of the garage in Figures 4 and 5 on Sheet S0 and for Figure 3 conditions (*living-space-over-garage* dwellings without *ground floor residential unit*), consult a Registered Design Professional for remedial direction.

4. Connector Type "F" should be used as an alternative only if joists are blocked on both sides and where accessibility makes the use of Types "D" or "E" impractical.

5. Any of the connectors listed within a particular group and as shown on Sheet S3 may be used for strengthening the particular condition.

6. This Plan Set was developed using the lowest listed manufacturer's capacity within a particular group. Cells marked "NG" on the applicable Earthquake Retrofit Schedule may be found to have an acceptable spacing where an alternate connector is used. Any such substitution can only be made by a Registered Design Professional.

7. Wall lengths are total length of a single wall section required on each side of the building. See Sheet S3.2-1.0 for 2 section of wall options.

8. See Sheet S3.3-1.0 for Alternate Earthquake Retrofit Options where sufficient length of wall does not occur or where wood structural panel shear wall retrofit installations are otherwise prohibited.

9. See Sheets S3.4-1.0 thru S3.6-1.0 for Earthquake Retrofit Schedules for the front wall only at dwellings with a ground story residential unit. See also Sheet S0, Figure 2.

⑦ RETROFIT SUMMARY

BRACING, ANCHORS, CONNECTORS, AND TIE-DOWNS

1. Retrofit requirements per wall line: (check box if tie-down and/or new footing will be used on that line)
   - ☐ Front Wall _____ft ☐ Nailing: 8d at ___ O.C. ☐ Tie-Down Type _____ ☐ New Ftg
   - ☐ Back Wall _____ft ☐ Nailing: 8d at ___ O.C. ☐ Tie-Down Type _____ ☐ New Ftg
   - ☐ Left Side Walls _____ft ☐ Nailing: 8d at ___ O.C. ☐ Tie-Down Type _____ ☐ New Ftg
   - ☐ Right Side Walls _____ft ☐ Nailing: 8d at ___ O.C. ☐ Tie-Down Type _____ ☐ New Ftg

2. New Foundation Sill Anchorage to be used: (check all that apply)
   Bolts: Diameter_____ ☐ Adhesive ☐ Screw
   ☐ Type "A" Connector ☐ Type "C" Connector
   ☐ Type "B" Connector
   Minimum required number of Sill Anchors per wall line _____

3. Floor Framing Connectors (to Top Plate) to be used: (check all that apply)
   ☐ Type "D" ☐ Type "F"
   ☐ Type "E" ☐ Type "G"
   Minimum required number of Floor Framing Connectors per wall line _____

4. ☐ Check this box if tie-downs and the SUPPLEMENTAL TECHNICAL NOTES will be used.

⑧ Supplemental Earthquake Retrofit Schedule

1. Check boxes if additional Earthquake Retrofit Schedues are included.
   ☐ S3.2-1.0 ☐ S3.4-1.0 ☐ S3.6-1.0
   ☐ S3.3-1.0 ☐ S3.5-1.0

APPLICANT: _____

PROPERTY ADDRESS: _____

Earthquake Retrofit Schedule - Wood Structural Panel with single section of wall

Retrofit of Living-Space-Over-Garage Dwellings (Plan Set)
Vulnerability-Based Seismic Assessment and Retrofit of One- and Two-Family Dwellings
FEMA P-1100, Volume 2 - Plan Sets
Issued: SEPT 2019

FEMA

Date:

Sheet:

S3.1-1.0

EARTHQUAKE RETROFIT SCHEDULE (S_{DS} = 1.0) Two Sections of Wall

① WEIGHT CLASSIFICATION	② Floor Area in Square Feet	③ ☒ Mark row that applies	④ MINIMUM TOTAL REQUIRED LENGTH OF EACH SECTION OF WOOD STRUCTURAL PANEL SHEAR WALL For a Two Section of Wall Option						⑤ FOUNDATION SILL ANCHORAGE Min. No. of Foundation Connectors or Anchors at Each Section of Wall					⑥ FLOOR FRAMING TO WALL CONNECTION Min. No. of Connectors at Each Section of Wall		
			Length per Section for a Two Section Option													
			8d at 6" O.C.			8d at 2" O.C.										
			Wall Length	Tie-down	New Fdn Req'd ?	Wall Length	Tie-down	New Fdn Req'd ?	Type "A"	Type "B"	Type "C"	1/2"ø Bolt	5/8"ø Bolt	Type "D"	Type "E" or "F"	Type "G"
Light Construction	800		6'-6"	TD1	No	3'-0"	TD4	Yes	2	3	4	3	2	5	5	6
	1000		8'-0"	TD1	No	3'-6"	TD4	Yes	2	4	5	4	3	6	6	7
	1200		9'-6"	TD1	No	4'-0"	TD4	Yes	3	4	6	5	3	7	7	9
	1500		12'-0"	TD1	No	5'-0"	TD4	Yes	3	5	7	6	4	9	8	11
	2000		15'-6"	None	No	6'-6"	TD4	Yes	4	7	9	7	5	11	11	14
Medium Construction	800		8'-0"	TD1	No	3'-6"'	TD5	Yes	3	4	5	4	3	6	6	8
	1000		10'-0"	TD1	No	4'-0"	TD5	Yes	3	5	6	5	4	7	7	9
	1200		12'-0"	TD1	No	5'-0"	TD5	Yes	4	5	7	6	4	9	9	11
	1500		15'-0"	TD1	No	6'-0"	TD4	Yes	4	7	9	7	5	11	11	14
	2000		20'-0"	None	No	8'-6"	TD4	Yes	6	9	11	9	7	14	14	18
Heavy Construction	800		10'-6"	TD1	No	4'-6"	TD4	Yes	3	5	6	5	4	8	7	10
	1000		13'-0"	None	No	5'-6"	TD4	Yes	4	6	8	6	4	10	9	12
	1200		16'-0"	None	No	6'-6"	TD4	Yes	5	7	9	8	5	11	11	14
	1500		20'-0"	None	No	8'-0"	TD4	Yes	6	9	11	9	6	14	14	18
	2000		26'-6"	None	No	11'-0"	TD3	Yes	7	11	15	12	8	19	18	24

Notes:

1. Anchor bolts and Connectors shown in the Earthquake Retrofit Schedule are the minimum required per section of wall, placed within the length of strengthening where possible. Total number of anchor bolts and connectors shall equal twice the number shown in the schedule. Additional anchors and connectors may be necessary to meet the requirements of specific details and General Notes.

2. Tie-downs: If your foundation meets the criteria, you may choose the tie-down option to decrease the required length of strengthening. This may be required where the length of the wall without tie downs specified in this schedule is longer than can be accommodated by existing conditions. However, there is a level of uncertainty when dealing with existing foundations, therefore, where possible, longer lengths of strengthening, without tie-downs, are preferred. (See Supplemental Technical Notes, Sheet S2 to verify the existing foundation is suitable and meets criteria.) Where "None" occurs, no tie-down is required.

3. Foundations: Where new foundations are required at front and back walls, see Sheet D2 for details. At side walls, select retrofit options that do not require new foundations whenever possible. Otherwise, provide foundations that extend the full depth of the garage in Figures 4 and 5 on Sheet S0 and for Figure 3 conditions (*living-space-over-garage* dwellings without *ground floor residential unit*), consult a Registered Design Professional for remedial direction.

4. Connector Type "F" should be used as an alternative only if joists are blocked on both sides and where accessibility makes the use of Types "D" or "E" impractical.

5. Any of the connectors listed within a particular group and as shown on Sheet S3 may be used for strengthening the particular condition.

6. This Plan Set was developed using the lowest listed manufacturer's capacity within a particular group. Cells marked "NG" on the applicable Earthquake Retrofit Schedule may be found to have an acceptable spacing where an alternate connector is used. Any such substitution can only be made by a Registered Design Professional.

7. Wall lengths are total length of wall required on each side of the building. You may use 2 sections of wall per line based on existing building conditions but each section must be at least 3 feel long and each individual section shall not be greater than 55% of the total require length. (See Figure D-6 on Sheets S0).

8. See Sheet S3.3-1.0 for Alternate Earthquake Retrofit Options where sufficient length of wall panel does not occur or where wood structural panel shear wall retrofit installations are otherwise prohibited.

9. See Sheets S3.4-1.0 thru S3.6-1.0 for Earthquake Retrofit Schedules for the front wall only at dwellings with a ground story residential unit. See also Sheet S0, Figure 2.

INSTRUCTIONS

① Locate the section that matches your home's construction. Use the chart on Sheet S3 to determine "Weight Category".

② Find the home's Floor Area "B" x "L" (See Figures D-3 thru D-5) in the schedule, this number should be at least as large as the number listed below. Do not use a smaller number, even if it is closer.

a. Approximate floor area _____

③ Check the box that matches your home's area per ②. You will use information in this row of the schedule to determine length of plywood bracing panels, nailing requirements, quantities of hardware, etc.

④ Determine the length of plywood bracing required. The columns contain the length of required bracing, including options for bracing without tie-downs, with tie-downs into existing foundations and tie-downs w/ new foundations, see schedule Note 3. Follow the row across from the total floor area that you checked for your home (in Step 3) to find the bracing length for each side of the house (front, back, left side, right side).

⑤ Determine the number of Foundation Sill Connectors or Anchors required. The columns show the number of anchors required, depending on whether you use Types A through C, or number of 1/2"ø or 5/8"ø anchor bolts. (ø = diameter of the bolts.) See Sheet S3.

⑥ Determine the number of Floor to Wall connectors. The columns indicate how many framing connectors are required, depending on whether you use Types D, E, F, or G. See Sheet S3.

⑦ Complete the Retrofit Summary for your project. Fill in the lengths found in ④ for each line. If no option is available, see Schedule notes 6 & 7. Check the boxes for the anchor and connector types you plan to use. If you intend to use tie-downs, check the box for tie-downs after each wall line you plan to use them for, check the box on line 4, and read the Supplemental Technical Notes for additional information.

⑧ Include Earthquake Retrofit Schedule Sheets S3.1-1.0 thru S3.6-1.0 where applicable. See sheet S3, Figure 2 and schedule notes 6 thru 8.

⑦ RETROFIT SUMMARY
BRACING, ANCHORS, CONNECTORS, AND TIE-DOWNS

1. Retrofit requirements at each section of wall, per wall line: (check box if tie-down and/or new footing will be used on that line)
   - ☐ Front Wall _____ft ☐ Nailing: 8d at ___ O.C. ☐ Tie-Down Type _____ ☐ New Ftg
   - ☐ Back Wall _____ft ☐ Nailing: 8d at ___ O.C. ☐ Tie-Down Type _____ ☐ New Ftg
   - ☐ Left Side Walls _____ft ☐ Nailing: 8d at ___ O.C. ☐ Tie-Down Type _____ ☐ New Ftg
   - ☐ Right Side Walls _____ft ☐ Nailing: 8d at ___ O.C. ☐ Tie-Down Type _____ ☐ New Ftg

2. New Foundation Sill Anchorage to be used: (check all that apply)
   Bolts: Diameter_____ ☐ Adhesive ☐ Screw
   ☐ Type "A" Connector ☐ Type "C" Connector
   ☐ Type "B" Connector
   Minimum required number of Sill Anchors at each section of wall, per wall line _____

3. Floor Framing Connectors (to Top Plate) to be used: (check all that apply)
   ☐ Type "D" ☐ Type "F"
   ☐ Type "E" ☐ Type "G"
   Minimum required number of Floor Framing Connectors at each section of wall, per wall line _____

4. ☐ Check this box if tie-downs and the SUPPLEMENTAL TECHNICAL NOTES will be used.

⑧ Supplemental Earthquake Retrofit Schedule

1. Check if this Sheet is supplemenatal to sheet S3.1, otherwise check if additional retrofit schedule are required.
   ☐ S3.2-1.0 ☐ S3.4-1.0 ☐ S3.6-1.0
   ☐ S3.3-1.0 ☐ S3.5-1.0

APPLICANT: _____

PROPERTY ADDRESS: _____

Earthquake Retrofit Schedule - Wood Structural Panel with two sections of wall

Retrofit of Living-Space-Over-Garage Dwellings (Plan Set)
Vulnerability-Based Seismic Assessment and Retrofit of One- and Two-Family Dwellings
FEMA P-1100, Volume 2 - Plan Sets
Issued: SEPT 2019

FEMA

Date:

Sheet:

S3.2-1.0

EARTHQUAKE RETROFIT SCHEDULE (S_{DS} = 1.0)

① WEIGHT CLASSIFICATION	② Floor Area in Square Feet	③ Mark row that applies ☒	④ STEEL COLUMN RETROFIT (2) (3)		⑤ PROPRIETARY SHEAR WALL RETROFIT (4) (5)	⑥ DIAPHRAGM NAILING (3) (5)
			Steel Column	Column Connection Type (per detail 2 on sheet D7) at Upper Floor	Minimum Required at Allowable Shear Capacity (Pounds)	Edge Nail Spacing
Light Construction	800		W8x21	C1	3250	6
	1000		W8x21	C1	4060	6
	1200		W8x28	C1	4870	6
	1500		W8x28	C1	6090	6
	2000		W10x30	C2	8120	6
Medium Construction	800		W8x21	C1	4200	6
	1000		W8x28	C1	5250	6
	1200		W8x28	C1	6300	6
	1500		W10x30	C2	7880	6
	2000		W12x35	C3	10,500	6
Heavy Construction	800		W8x28	C1	5400	6
	1000		W8x28	C1	6860	4
	1200		W10x30	C2	8230	4
	1500		W12x35	C3	10,300	4
	2000		W10x45	C3	13,700	4

Notes:
1. Steel column and Proprietary Shear Wall Options are provided for front of garage or back of garage or house only.
2. See detail 4 on Sheet D7 for footing detail at steel column retrofit.
3. See details 1 & 2 on Sheet D7 for steel column connections at upper floor.
4. See details 4 & 5 on Sheet D8 for footing details at proprietary shear wall.
5. See details 1 & 2 on Sheet D8 for upper floor connection at proprietary shear wall.

INSTRUCTIONS

1. Locate the section that matches your home's construction. Use the chart on Sheet S3 to determine "Weight Category".
2. Find the home's Floor Area "B" x "L" (See Figures D-3 thru D-5) in the schedule, this number should be at least as large as the number listed below. Do not use a smaller number, even if it is closer.

   a. Approximate floor area _____
3. Check the box that matches your home's area per ②. You will use information in this row of the schedule to select the steel column size and connection type or proprietary shear wall required.
4. Determine size of steel column and connection detail or see ⑤.
5. Determine minimum required allowable shear capacity to be used in selection of a proprietary shear wall. Note that more than one shear wall panel may be needed to obtain the required shear capacity. Consult manufacturer's load tables for final selection.
6. See details 1 & 2 on sheet D7 for steel column connections at upper floor.
   See details 1 & 2 on sheet D8 for upper floor connection at proprietary shear wall.
7. Complete retrofit summary below.

⑦ RETROFIT SUMMARY
check box if selected

Steel Column
- ☐ At front wall
  - Column Size _____
  - Connection _____
  - Diaphragm Nailing _____
- ☐ At back wall
  - Column Size _____
  - Connection _____
  - Diaphragm Nailing _____

Proprietary Shear Wall
- ☐ At front wall
  - Req'd Capacity _____
  - MFR/ Size _____
  - Diaphragm Nailing _____
- ☐ At back wall
  - Req'd Capacity _____
  - MFR/ Size _____
  - Diaphragm Nailing _____

⑧ Supplemental Earthquake Retrofit Schedule

1. Check boxes if additional Earthquake Retrofit Schedules are included.
   - ☐ S3.1-1.0
   - ☐ S3.2-1.0
   - ☐ S3.3-1.0
   - ☐ S3.4-1.0
   - ☐ S3.5-1.0

APPLICANT: _____

PROPERTY ADDRESS: _____

Alternate Earthquake Retrofit Schedule (Steel Column or Propriety Shear Wall)

Retrofit of Living-Space-Over-Garage Dwellings (Plan Set)
Vulnerability-Based Seismic Assessment and Retrofit of One- and Two-Family Dwellings
FEMA P-1100, Volume 2 - Plan Sets
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Date:

Sheet:

S3.3-1.0

EARTHQUAKE RETROFIT SCHEDULE (S_{DS} = 1.0) for Single Section of Wall at Front of Garage - Only

① WEIGHT CLASSIFICATION	② Floor Area in Square Feet	③ Mark row that applies ☒	④ MINIMUM REQUIRED LENGTH OF A SINGLE SECTION OF WALL OF WOOD STRUCTURAL PANEL SHEAR WALLS (at each wall line)										⑤ FOUNDATION SILL ANCHORAGE Min. No. of Foundation Connectors or Anchors at Each Wall Panel					⑥ FLOOR FRAMING TO WALL CONNECTION Min. No. of Connectors at Each Wall Panel		
			No Tie-down		w/ Tie-downs in Existing or New Foundations															
					8d at 6" O.C.			8d at 4" O.C.			8d at 2" O.C.										
			8d Nail Spacing	Wall Length	Wall Length	Tie-down	New Fdn Req'd ?	Wall Length	Tie-down	New Fdn Req'd ?	Wall Length	Tie-down	New Fdn Req'd ?	Type "A"	Type "B"	Type "C"	1/2"ø Bolt	5/8"ø Bolt	Type "D"	Type "E" or "F"	Type "G"
Light Construction	800		6	10'-0"	6'-0"	TD2	Yes	4'-6"	TD3	Yes	3'-0"	TD4	Yes	2	3	4	3	2	5	5	6
	1000		6	11'-6"	8'-0"	TD1	No	5'-6"	TD3	Yes	3'-6"	TD5	Yes	2	4	5	4	3	6	6	7
	1200		6	13'-6"	9'-6"	TD1	No	6'-6"	TD2	Yes	4'-0"	TD5	Yes	3	4	6	5	3	7	7	9
	1500		6	15'-6"	11'-6"	TD1	No	8'-0"	TD2	Yes	5'-0"	TD5	Yes	3	5	7	6	4	9	8	11
	2000		6	19'-6"	15'-6"	TD1	No	10'-6"	TD2	Yes	6'-6"	TD5	Yes	4	7	9	7	5	11	11	14
Medium Construction	800		6	12'-6"	8'-0"	TD1	No	5'-6"	TD3	Yes	3'-6"	TD5	Yes	3	4	5	4	3	6	6	8
	1000		6	14'-6"	10'-0"	TD1	No	7'-0"	TD3	Yes	4'-0"	TD5	Yes	3	5	6	5	4	7	7	9
	1200		6	16'-6"	12'-0"	TD1	No	8'-6"	TD2	Yes	5'-0"	TD5	Yes	4	5	7	6	4	9	9	11
	1500		6	19'-6"	15'-0"	TD1	No	10'-6"	TD2	Yes	6'-0"	TD5	Yes	4	7	9	7	5	11	11	14
	2000		6	24'-0"	20'-0"	TD1	No	14'-0"	TD2	Yes	8'-0"	TD5	Yes	6	9	11	9	7	14	14	18
Heavy Construction	800		6	13'-6"	10'-6"	TD1	No	7'-0"	TD2	Yes	4'-6"	TD5	Yes	3	5	6	5	4	8	7	10
	1000		6	15'-6"	13'-0"	TD1	No	9'-0"	TD2	Yes	5'-6"	TD5	Yes	4	6	8	6	4	10	9	12
	1200		6	17'-6"	16'-0"	TD1	No	11'-0"	TD2	Yes	6'-6"	TD4	Yes	5	7	9	8	5	11	11	14
	1500		4	19'-6"	20'-0"	None	No	13'-6"	TD2	Yes	8'-0"	TD4	Yes	6	9	11	9	6	14	14	18
	2000		4	20'-0"	26'-6"	None	No	18'-0"	TD1	No	10'-6"	TD4	Yes	7	11	15	12	8	19	18	24

INSTRUCTIONS

① Locate the section that matches your home's construction. Use the chart on Sheet S3 to determine "Weight Category".

② Find the home's Floor Area "B" x "L" (See Figures D-3 thru D-5) in the schedule, this number should be at least as large as the number listed below. Do not use a smaller number, even if it is closer.

a. Approximate floor area _____

③ Check the box that matches your home's area per ②. You will use information in this row of the schedule to determine length of plywood bracing panels, nailing requirements, quantities of hardware, etc.

④ Determine the length of plywood bracing required. The columns contain the length of required bracing, including options for bracing without tie-downs, with tie-downs into existing foundations and tie-downs w/ new foundations, see schedule Note 3. Follow the row across from the total floor area that you checked for your home (in Step 3) to find the bracing length for each side of the house (front, back, left side, right side).

⑤ Determine the number of Foundation Sill Connectors or Anchors required. The columns show the number of anchors required, depending on whether you use Types A through C, or number of 1/2"ø or 5/8"ø anchor bolts. (ø = diameter of the bolts.) See Sheet S3.

⑥ Determine the number of Floor to Wall connectors. The columns indicate how many framing connectors are required, depending on whether you use Types D, E, F, or G. See Sheet S3.

⑦ Complete the Retrofit Summary for your project. Fill in the lengths found in ④ for each line. If no option is available, see Schedule notes 6 & 7. Check the boxes for the anchor and connector types you plan to use. If you intend to use tie-downs, check the box for tie-downs after each wall line you plan to use them for, check the box on line 4, and read the Supplemental Technical Notes for additional information.

⑧ Include Earthquake Retrofit Schedule Sheets S3.1-1.0 thru S3.6-1.0 where applicable. See sheet S3, Figure 2 and schedule notes 6 and 7.

Notes:

1. Anchor bolts and Connectors shown in the Earthquake Retrofit Schedule are the minimum required per wall line, placed within the length of strengthening where possible. Additional anchors and connectors may be necessary to meet the requirements of specific details and General Notes.
2. Tie-downs: If your foundation meets the criteria, you may choose the tie-down option to decrease the required length of strengthening. This may be required where the length of the wall without tie downs specified in this schedule is longer than can be accommodated by existing conditions. However, there is a level of uncertainty when dealing with existing foundations, therefore, where possible, longer lengths of strengthening, without tie-downs, are preferred. (See Supplemental Technical Notes, Sheet S2 to verify the existing foundation is suitable and meets criteria.) Where "None" occurs, no tie-down is required.
3. Foundations: Where new foundations are required, see Sheet D2 for details.
4. Connector Type "F" should be used as an alternative only if joists are blocked on both sides and where accessibility makes the use of Types "D" or "E" impractical.
5. Any of the connectors listed within a particular group and as shown on Sheet S3 may be used for strengthening the particular condition.
6. This Plan Set was developed using the lowest listed manufacturer's capacity within a particular group. Cells marked "NG" on the applicable Earthquake Retrofit Schedule may be found to have an acceptable spacing where an alternate connector is used. Any such substitution can only be made by a Registered Design Professional.
7. Wall lengths are total length of a single wall section required. See Sheet S3.5-1.0 for 2 section of wall options.
8. See Sheet S3.6-1.0 for Alternate Earthquake Retrofit Options where sufficient length of wall does not occur or where wood structural panel shear wall retrofit installations are otherwise prohibited.

⑦ RETROFIT SUMMARY

BRACING, ANCHORS, CONNECTORS, AND TIE-DOWNS

1. Required length of strengthening at garage front wall line: (check box if tie-downs will be used on that line)
   Front Wall _____ft ☐ with Tie-Down Type _____
   Front Wall _____ft ☐ without Tie-Down
2. New Foundation Sill Anchorage to be used: (check all that apply)
   Bolts: Diameter_____ ☐ Adhesive ☐ Screw
   ☐ Type "A" Connector ☐ Type "C" Connector
   ☐ Type "B" Connector
   Minimum required number of Sill Anchors per wall line _____
3. Floor Framing Connectors (to Foundation Sill or to Top Plate) to be used: (check all that apply)
   ☐ Type "D" ☐ Type "F"
   ☐ Type "E" ☐ Type "G"
   Minimum required number of Floor Framing Connectors per wall line _____
4. ☐ Check this box if tie-downs and the SUPPLEMENTAL TECHNICAL NOTES will be used.

⑧ Supplemental Earthquake Retrofit Schedule

1. Check boxes if additional Earthquake Retrofit Schedules are included.
   ☐ S3.2-1.0 ☐ S3.4-1.0 ☐ S3.6-1.0
   ☐ S3.3-1.0 ☐ S3.5-1.0

APPLICANT: _____

PROPERTY ADDRESS: _____

Earthquake Retrofit Schedule at front of garage only in dwelling with Ground Floor Residential Unit

Retrofit of Living-Space-Over-Garage Dwellings (Plan Set)
Vulnerability-Based Seismic Assessment and Retrofit of One- and Two-Family Dwellings
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Sheet: **S3.4-1.0**

EARTHQUAKE RETROFIT SCHEDULE (S_{DS} = 1.0) Two Sections of Wall at Front of Garage - Only

① WEIGHT CLASSIFICATION	② Floor Area in Square Feet	③ ☒ Mark row that applies	④ MINIMUM TOTAL REQUIRED LENGTH OF EACH SECTION OF WOOD STRUCTURAL PANEL SHEAR WALLS For a Two Section of Wall Option						⑤ FOUNDATION SILL ANCHORAGE					⑥ FLOOR FRAMING TO WALL CONNECTION		
			Length per Section for a Two Section Option						Min. No. of Foundation Connectors or Anchors at Each Section of Wall					Min. No. of Connectors at Each Section of Wall		
			8d at 6" O.C.			8d at 2" O.C.										
			Wall Length	Tie-down	New Fdn Req'd ?	Wall Length	Tie-down	New Fdn Req'd ?	Type "A"	Type "B"	Type "C"	1/2"ø Bolt	5/8"ø Bolt	Type "D"	Type "E" or "F"	Type "G"
Light Construction	800		3'-6"	TD1	No	2'-8"	TD2	Yes	1	2	2	2	1	3	3	3
	1000		4'-0"	TD1	No	2'-8"	TD3	Yes	1	2	3	2	2	3	3	4
	1200		4'-6"	TD1	No	2'-8"	TD4	Yes	2	2	3	3	2	4	4	5
	1500		6'-0"	TD1	No	3'-0"	TD4	Yes	2	3	4	3	2	5	4	6
	2000		8'-0"	TD1	No	3'-6"	TD4	Yes	2	4	5	4	3	6	6	7
Medium Construction	800		4'-0"	TD2	Yes	2'-8'	TD4	Yes	2	2	3	2	2	3	3	4
	1000		5'-0"	TD1	No	2'-8"	TD4	Yes	2	3	3	3	2	4	4	5
	1200		6'-0"	TD1	No	3'-0"	TD4	Yes	2	3	4	3	2	5	5	6
	1500		7'-6"	TD1	No	3'-6"	TD5	Yes	2	4	5	4	3	6	6	7
	2000		10'-0"	TD1	No	4'-0"	TD5	Yes	3	5	6	5	4	7	7	9
Heavy Construction	800		5'-6"	TD1	No	2'-8"	TD4	Yes	2	3	3	3	2	4	4	5
	1000		6'-6"	TD1	No	3'-0"	TD4	Yes	2	3	4	3	2	5	5	6
	1200		8'-0"	TD1	No	3'-6"	TD4	Yes	3	4	5	4	3	6	6	7
	1500		10'-0"	None	No	4'-0"	TD4	Yes	3	5	6	5	3	7	7	9
	2000		13'-0"	None	No	5'-6"	TD4	Yes	4	6	8	6	4	10	9	12

Notes:

1. Anchor bolts and Connectors shown in the Earthquake Retrofit Schedule are the minimum required per section of wall, placed within the length of strengthening where possible.Total number of anchor bolts and connectors shall equal twice the number shown in the schedule. Additional anchors and connectors may be necessary to meet the requirements of specific details and General Notes.
2. Tie-downs: If your foundation meets the criteria, you may choose the tie-down option to decrease the required length of strengthening. This may be required where the length of the wall without tie downs specified in this schedule is longer than can be accommodated by existing conditions. However, there is a level of uncertainty when dealing with existing foundations, therefore, where possible, longer lengths of strengthening, without tie-downs, are preferred. (See Supplemental Technical Notes, Sheet S2 to verify the existing foundation is suitable and meets criteria.) Where "None" occurs, no tie-down is required.
3. Foundations: Where new foundations are required, see Sheet D2 for details.
4. Connector Type "F" should be used as an alternative only if joists are blocked on both sides and where accessibility makes the use of Types "D" or "E" impractical.
5. Any of the connectors listed within a particular group and as shown on Sheet S3 may be used for strengthening the particular condition.
6. This Plan Set was developed using the lowest listed manufacturer's capacity within a particular group. Cells marked "NG" on the applicable Earthquake Retrofit Schedule may be found to have an acceptable spacing where an alternate connector is used. Any such substitution can only be made by a Registered Design Professional.
7. Wall lengths are minimum length of each wall section required on the garage front wall line.
8. See Sheet S3.6-1.0 for Alternate Earthquake Retrofit Options where sufficient length of wall panel does not occur or where wood structural panel shear wall retrofit installations are otherwise prohibited.

INSTRUCTIONS

① Locate the section that matches your home's construction. Use the chart on Sheet S3 to determine "Weight Category".

② Find the home's Floor Area "B" x "L" (See Figures D-3 thru D-5) in the schedule, this number should be at least as large as the number listed below. Do not use a smaller number, even if it is closer.

a. Approximate floor area _____

③ Check the box that matches your home's area per ②. You will use information in this row of the schedule to determine length of plywood bracing panels, nailing requirements, quantities of hardware, etc.

④ Determine the length of plywood bracing required. The columns contain the length of required bracing, including options for bracing without tie-downs, with tie-downs into existing foundations and tie-downs w/ new foundations, see schedule Note 3. Follow the row across from the total floor area that you checked for your home (in Step 3) to find the bracing length for each side of the house (front, back, left side, right side).

⑤ Determine the number of Foundation Sill Connectors or Anchors required. The columns show the number of anchors required, depending on whether you use Types A through C, or number of 1/2"ø or 5/8"ø anchor bolts. (ø = diameter of the bolts.) See Sheet S3.

⑥ Determine the number of Floor to Wall connectors. The columns indicate how many framing connectors are required, depending on whether you use Types D, E, F, or G. See Sheet S3.

⑦ Complete the Retrofit Summary for your project. Fill in the lengths found in ④ for each line. If no option is available, see Schedule notes 6 & 7. Check the boxes for the anchor and connector types you plan to use. If you intend to use tie-downs, check the box for tie-downs after each wall line you plan to use them for, check the box on line 4, and read the Supplemental Technical Notes for additional information.

⑧ Include Earthquake Retrofit Schedule Sheets S3.1-1.0 thru S3.6-1.0 where applicable. See sheet S3, Figure 2 and schedule notes 6 and 7.

⑦ RETROFIT SUMMARY

BRACING, ANCHORS, CONNECTORS, AND TIE-DOWNS

1. Required length of each section of strengthening per wall line: (check box if tie-downs will be used on that line)
   Front Wall _____ft ☐ with Tie-Down Type _____
   Front Wall _____ft ☐ without Tie-Down
2. New Foundation Sill Anchorage to be used: (check all that apply)
   Bolts: Diameter_____ ☐ Adhesive ☐ Screw
   ☐ Type "A" Connector ☐ Type "C" Connector
   ☐ Type "B" Connector
   Minimum required number of Sill Anchors per wall line _____
3. Floor Framing Connectors (to Foundation Sill or to Top Plate) to be used: (check all that apply)
   ☐ Type "D" ☐ Type "F"
   ☐ Type "E" ☐ Type "G"
   Minimum required number of Floor Framing Connectors per wall line _____
4. ☐ Check this box if tie-downs and the SUPPLEMENTAL TECHNICAL NOTES will be used.

⑧ Supplemental Earthquake Retrofit Schedule

1. Check boxes if additional Earthquake Retrofit Schedules are included.
   ☐ S3.1-1.0 ☐ S3.3-1.0 ☐ S3.6-1.0
   ☐ S3.2-1.0 ☐ S3.4-1.0

APPLICANT: _____

PROPERTY ADDRESS: _____

Earthquake Retrofit Schedule at front of garage only in dwelling with Ground Floor Residential Unit

Retrofit of Living-Space-Over-Garage Dwellings (Plan Set)
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Sheet:

S3.5-1.0

EARTHQUAKE RETROFIT SCHEDULE (S_{DS} = 1.0) at front of Garage

① WEIGHT CLASSIFICATION	② Floor Area in Square Feet	③ Mark row that applies ☒	STEEL COLUMN RETROFIT (2) (3)		PROPRIETARY SHEAR WALL RETROFIT (4) (5)	DIAPHRAGM NAILING (3) (5)
			Steel Column	Column Connection Type (per detail 2 on sheet D7) at Upper Floor	Minimum Required at Allowable Shear Capacity (lbs)	Edge Nail Spacing
Light Construction	800		W8x21	C1	1620	6
	1000		W8x21	C1	2030	6
	1200		W8x21	C1	2440	6
	1500		W8x21	C1	3050	6
	2000		W8x21	C1	4060	6
Medium Construction	800		W8x21	C1	2100	6
	1000		W8x21	C1	2630	6
	1200		W8x21	C1	3150	6
	1500		W8x21	C1	3940	6
	2000		W8x28	C1	5250	6
Heavy Construction	800		W8x21	C1	2740	6
	1000		W8x21	C1	3430	6
	1200		W8x21	C1	4120	6
	1500		W8x28	C1	5150	6
	2000		W8x28	C1	6860	6

Notes:
1. Steel column and Proprietary Shear Wall Options are provided for front of garage or back of garage or house only.
2. See detail 4 on Sheet D7 for footing detail at steel column retrofit.
3. See details 1 & 2 on Sheet D7 for steel column connections at upper floor.
4. See details 4 & 5 on Sheet D8 for footing details at proprietary shear wall.
5. See details 1 & 2 on Sheet D8 for upper floor connection at proprietary shear wall.

INSTRUCTIONS

① Locate the section that matches your home's construction. Use the chart on Sheet S3 to determine "Weight Category".

② Find the home's Floor Area "B" x "L" (See Figures D-3 thru D-5) in the schedule, this number should be at least as large as the number listed below. Do not use a smaller number, even if it is closer.

a. Approximate floor area _____

③ Check the box that matches your home's area per ②. You will use information in this row of the schedule to steel column size and connection type or proprietary shear wall required.

④ Determine size of steel column and connection detail or see ⑤.

⑤ Determine minimum required allowable shear capacity to be used in selection of a proprietary shear wall. Consult manufacturer's load tables for final selection. Note that more than one shear wall panel may be needed to obtain the required shear capacity. Consult manufacturer's load tables for final selection.

⑥ See details 1 & 2 on sheet D7 for steel column connections at upper floor.
See details 1 & 2 on sheet D8 for upper floor connection at proprietary shear wall.

⑦ Complete retrofit it summary below.

⑦ RETROFIT SUMMARY
check box if selected

Steel Column
- ☐ At front wall
  - Column Size _____
  - Connection _____
  - Diaphragm Nailing _____
- ☐ At back wall
  - Column Size _____
  - Connection _____
  - Diaphragm Nailing _____

Proprietary Shear Wall
- ☐ At front wall
  - Req'd Capacity _____
  - MFR/ Size _____
  - Diaphragm Nailing _____
- ☐ At back wall
  - Req'd Capacity _____
  - MFR/ Size _____
  - Diaphragm Nailing _____

⑧ Supplemental Earthquake Retrofit Schedule

1. Check boxes if additional Earthquake Retrofit Schedules are included.
   - ☐ S3.1-1.0
   - ☐ S3.2-1.0
   - ☐ S3.3-1.0
   - ☐ S3.4-1.0
   - ☐ S3.5-1.0

APPLICANT: _____

PROPERTY ADDRESS: _____

Alternate Earthquake Retrofit Schedule at front of garage
in dwelling w/ Ground Floor Residential Unit

Retrofit of Living-Space-Over-Garage Dwellings (Plan Set)
Vulnerability-Based Seismic Assessment and Retrofit of One- and Two-Family Dwellings
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Date:

Sheet:

S3.6-1.0

EARTHQUAKE RETROFIT SCHEDULE (S_{DS} = 1.2) for Single Section of Wall

① WEIGHT CLASSIFICATION	② Floor Area in Square Feet	③ Mark row that applies ☒	④ MINIMUM REQUIRED LENGTH OF A SINGLE SECTION OF WALL OF WOOD STRUCTURAL PANEL SHEAR WALLS (at each wall line)											⑤ FOUNDATION SILL ANCHORAGE Min. No. of Foundation Connectors or Anchors at Each Wall Panel					⑥ FLOOR FRAMING TO WALL CONNECTION Min. No. of Connectors at Each Wall Panel		
			No Tie-down		w/ Tie-downs in Existing or New Foundations																
					8d at 6" O.C.			8d at 4" O.C.			8d at 2" O.C.										
			8d Nail Spacing	Wall Length	Wall Length	Tie-down	New Fdn Req'd ?	Wall Length	Tie-down	New Fdn Req'd ?	Wall Length	Tie-down	New Fdn Req'd ?	Type "A"	Type "B"	Type "C"	1/2"ø Bolt	5/8"ø Bolt	Type "D"	Type "E" or "F"	Type "G"
Light Construction	800		6	19'-0"	15'-0"	TD1	No	10'-6"	TD2	Yes	6'-0"	TD5	Yes	4	7	9	7	5	11	10	14
	1000		6	22'-6"	18'-6"	TD1	No	13'-0"	TD2	Yes	7'-6"	TD4	Yes	5	8	11	9	6	13	13	17
	1200		6	25'-6"	22'-6"	TD1	No	15'-6"	TD2	Yes	9'-0"	TD4	Yes	6	10	13	10	7	16	15	20
	1500		6	29'-6"	28'-0"	TD1	No	19'-0"	TD2	Yes	11'-6"	TD4	Yes	8	12	16	13	9	20	19	25
	2000		4	36'-0"	37'-6"	None	No	25'-6"	TD2	Yes	15'-0"	TD4	Yes	10	16	21	17	12	26	25	33
Medium Construction	800		6	23'-6"	19'-6"	TD1	No	13'-6"	TD2	Yes	8'-0"	TD5	Yes	5	8	11	9	6	14	13	17
	1000		6	27'-6"	24'-0"	TD1	No	16'-6"	TD2	Yes	10'-0"	TD4	Yes	7	10	14	11	8	17	17	22
	1200		6	31'-0"	29'-0"	TD1	No	20'-0"	TD2	Yes	12'-0"	TD4	Yes	8	12	16	13	9	21	20	26
	1500		4	35'-6"	36'-6"	None	No	25'-0"	TD2	Yes	15'-0"	TD4	Yes	10	15	20	17	11	26	25	32
	2000		4	43'-0"	48'-6"	None	No	33'-0"	TD2	Yes	19'-6"	TD4	Yes	13	20	27	22	15	34	33	43
Heavy Construction	800		4	24'-6"	25'-6"	None	No	17'-6"	TD2	Yes	10'-6"	TD4	Yes	7	11	14	12	8	18	17	23
	1000		4	28'-0"	31'-6"	None	No	21'-6"	TD2	Yes	13'-0"	TD4	Yes	9	13	18	15	10	22	21	28
	1200		4	31'-6"	38'-0"	None	No	26'-0"	TD1	No	15'-6"	TD4	Yes	10	16	21	17	12	27	26	34
	1500		4	34'-0"	47'-6"	None	No	32'-6"	TD1	No	19'-6"	TD4	Yes	13	20	26	22	15	33	32	42
	2000		2	34'-6"	"NG"	None	No	43'-6"	None	No	25'-6"	TD3	Yes	17	26	35	29	20	44	42	56

INSTRUCTIONS

① Locate the section that matches your home's construction. Use the chart on Sheet S3 to determine "Weight Category".

② Find the home's Floor Area "B" x "L" (See Figures D-3 thru D-5) in the schedule, this number should be at least as large as the number listed below. Do not use a smaller number, even if it is closer.

a. Approximate floor area _____

③ Check the box that matches your home's area per ②. You will use information in this row of the schedule to determine length of plywood bracing panels, nailing requirements, quantities of hardware, etc.

④ Determine the length of plywood bracing required. The columns contain the length of required bracing, including options for bracing without tie-downs, with tie-downs into existing foundations and tie-downs w/ new foundations, see schedule Note 3. Follow the row across from the total floor area that you checked for your home (in Step 3) to find the bracing length for each side of the house (front, back, left side, right side).

⑤ Determine the number of Foundation Sill Connectors or Anchors required. The columns show the number of anchors required, depending on whether you use Types A through C, or number of 1/2"ø or 5/8"ø anchor bolts. (ø = diameter of the bolts.) See Sheet S3.

⑥ Determine the number of Floor to Wall connectors. The columns indicate how many framing connectors are required, depending on whether you use Types D, E, F, or G. See Sheet S3.

⑦ Complete the Retrofit Summary for your project. Fill in the lengths found in ④ for each line. If no option is available, see Schedule notes 6 & 7. Check the boxes for the anchor and connector types you plan to use. If you intend to use tie-downs, check the box for tie-downs after each wall line you plan to use them for, check the box on line 4, and read the Supplemental Technical Notes for additional information.

⑧ Include Earthquake Retrofit Schedule Sheets S3.1-1.2 thru S3.6-1.2 where applicable. See sheet S3, Figure 2 and schedule notes 6 thru 8.

Notes:

1. Anchor bolts and Connectors shown in the Earthquake Retrofit Schedule are the minimum required per wall line, placed within the length of strengthening where possible. Additional anchors and connectors may be necessary to meet the requirements of specific details and General Notes.
2. Tie-downs: If your foundation meets the criteria, you may choose the tie-down option to decrease the required length of strengthening. This may be required where the length of the wall without tie downs specified in this schedule is longer than can be accommodated by existing conditions. However, there is a level of uncertainty when dealing with existing foundations, therefore, where possible, longer lengths of strengthening, without tie-downs, are preferred. (See Supplemental Technical Notes, Sheet S2 to verify the existing foundation is suitable and meets criteria.) Where "None" occurs, no tie-down is required.
3. Foundations: Where new foundations are required at front and back walls, see Sheet D2 for details. At side walls, select retrofit options that do not require new foundations whenever possible. Otherwise, provide foundations that extend the full depth of the garage in Figures 4 and 5 on Sheet S0 and for Figure 3 conditions (*living-space-over-garage* dwellings without *ground floor residential unit*), consult a Registered Design Professional for remedial direction.
4. Connector Type "F" should be used as an alternative only if joists are blocked on both sides and where accessibility makes the use of Types "D" or "E" impractical.
5. Any of the connectors listed within a particular group and as shown on Sheet S3 may be used for strengthening the particular condition.
6. This Plan Set was developed using the lowest listed manufacturer's capacity within a particular group. Cells marked "NG" on the applicable Earthquake Retrofit Schedule may be found to have an acceptable spacing where an alternate connector is used. Any such substitution can only be made by a Registered Design Professional.
7. Wall lengths are total length of a single wall section required on each side of the building. See Sheet S3.2-1.2 for 2 section of wall options.
8. See Sheet S3.3-1.2 for Alternate Earthquake Retrofit Options where sufficient length of wall does not occur or where wood structural panel shear wall retrofit installations are otherwise prohibited.
9. See Sheets S3.4-1.2 thru S3.6-1.2 for Earthquake Retrofit Schedules for the front wall only at dwellings with a ground story residential unit. See also Sheet S0, Figure 2.

⑦ RETROFIT SUMMARY

BRACING, ANCHORS, CONNECTORS, AND TIE-DOWNS

1. Retrofit requirements per wall line: (check box if tie-down and/or new footing will be used on that line)
   - ☐ Front Wall _____ft ☐ Nailing: 8d at ___ O.C. ☐ Tie-Down Type _____ ☐ New Ftg
   - ☐ Back Wall _____ft ☐ Nailing: 8d at ___ O.C. ☐ Tie-Down Type _____ ☐ New Ftg
   - ☐ Left Side Walls _____ft ☐ Nailing: 8d at ___ O.C. ☐ Tie-Down Type _____ ☐ New Ftg
   - ☐ Right Side Walls _____ft ☐ Nailing: 8d at ___ O.C. ☐ Tie-Down Type _____ ☐ New Ftg
2. New Foundation Sill Anchorage to be used: (check all that apply)
   Bolts: Diameter_____ ☐ Adhesive ☐ Screw
   ☐ Type "A" Connector ☐ Type "C" Connector
   ☐ Type "B" Connector
   Minimum required number of Sill Anchors per wall line _____
3. Floor Framing Connectors (to Top Plate) to be used: (check all that apply)
   ☐ Type "D" ☐ Type "F"
   ☐ Type "E" ☐ Type "G"
   Minimum required number of Floor Framing Connectors per wall line _____
4. ☐ Check this box if tie-downs and the SUPPLEMENTAL TECHNICAL NOTES will be used.

⑧ Supplemental Earthquake Retrofit Schedule

1. Check boxes if additional Earthquake Retrofit Schedues are included.
   ☐ S3.2-1.2 ☐ S3.4-1.2 ☐ S3.6-1.2
   ☐ S3.3-1.2 ☐ S3.5-1.2

APPLICANT: _____

PROPERTY ADDRESS: _____

Earthquake Retrofit Schedule - Wood Structural Panel with single section of wall

Retrofit of Living-Space-Over-Garage Dwellings (Plan Set)
Vulnerability-Based Seismic Assessment and Retrofit of One- and Two-Family Dwellings
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S3.1-1.2

EARTHQUAKE RETROFIT SCHEDULE (S_{DS} = 1.2) Two Sections of Wall

① WEIGHT CLASSIFICATION	② Floor Area in Square Feet	③ ☒ Mark row that applies	④ MINIMUM TOTAL REQUIRED LENGTH OF EACH SECTION OF WOOD STRUCTURAL PANEL SHEAR WALL For a Two Section of Wall Option — Length per Section for a Two Section Option						⑤ FOUNDATION SILL ANCHORAGE — Min. No. of Foundation Connectors or Anchors at Each Section of Wall					⑥ FLOOR FRAMING TO WALL CONNECTION — Min. No. of Connectors at Each Section of Wall		
			8d at 6" O.C.			8d at 2" O.C.										
			Wall Length	Tie-down	New Fdn Req'd ?	Wall Length	Tie-down	New Fdn Req'd ?	Type "A"	Type "B"	Type "C"	1/2"ø Bolt	5/8"ø Bolt	Type "D"	Type "E" or "F"	Type "G"
Light Construction	800		7'-6"	TD1	No	3'-6"	TD4	Yes	2	4	5	4	3	6	5	7
	1000		9'-6"	TD1	No	4'-0"	TD4	Yes	3	4	6	5	3	7	7	9
	1200		11'-6"	TD1	No	4'-6"	TD5	Yes	3	5	7	5	4	8	8	10
	1500		14'-0"	TD1	No	6'-0"	TD4	Yes	4	6	8	7	5	10	10	13
	2000		19'-0"	None	No	7'-6"	TD4	Yes	5	8	11	9	6	13	13	17
Medium Construction	800		9'-6"	TD1	No	4'-0"	TD5	Yes	3	4	6	5	3	7	7	9
	1000		12'-0"	TD1	No	5'-0"	TD5	Yes	4	5	7	6	4	9	9	11
	1200		14'-6"	TD1	No	6'-0"	TD4	Yes	4	6	8	7	5	11	10	13
	1500		18'-0"	None	No	7'-6"	TD4	Yes	5	8	10	9	6	13	13	16
	2000		24'-6"	None	No	10'-0"	TD4	Yes	7	10	14	11	8	17	17	22
Heavy Construction	800		12'-6"	None	No	5'-0"	TD4	Yes	4	6	7	6	4	9	9	12
	1000		16'-0"	None	No	6'-6"	TD4	Yes	5	7	9	8	5	11	11	14
	1200		19'-0"	None	No	8'-0"	TD4	Yes	5	8	11	9	6	14	13	17
	1500		24'-0"	None	No	9'-6"	TD4	Yes	7	10	13	11	8	17	16	21
	2000		"NG"	None	No	13'-0"	TD3	Yes	9	13	18	15	10	22	21	28

Notes:

1. Anchor bolts and Connectors shown in the Earthquake Retrofit Schedule are the minimum required per section of wall, placed within the length of strengthening where possible. Total number of anchor bolts and connectors shall equal twice the number shown in the schedule. Additional anchors and connectors may be necessary to meet the requirements of specific details and General Notes.

2. Tie-downs: If your foundation meets the criteria, you may choose the tie-down option to decrease the required length of strengthening. This may be required where the length of the wall without tie downs specified in this schedule is longer than can be accommodated by existing conditions. However, there is a level of uncertainty when dealing with existing foundations, therefore, where possible, longer lengths of strengthening, without tie-downs, are preferred. (See Supplemental Technical Notes, Sheet S2 to verify the existing foundation is suitable and meets criteria.) Where "None" occurs, no tie-down is required.

3. Foundations: Where new foundations are required at front and back walls, see Sheet D2 for details. At side walls, select retrofit options that do not require new foundations whenever possible. Otherwise, provide foundations that extend the full depth of the garage in Figures 4 and 5 on Sheet S0 and for Figure 3 conditions (*living-space-over-garage* dwellings without *ground floor residential unit*), consult a Registered Design Professional for remedial direction.

4. Connector Type "F" should be used as an alternative only if joists are blocked on both sides and where accessibility makes the use of Types "D" or "E" impractical.

5. Any of the connectors listed within a particular group and as shown on Sheet S3 may be used for strengthening the particular condition.

6. This Plan Set was developed using the lowest listed manufacturer's capacity within a particular group. Cells marked "NG" on the applicable Earthquake Retrofit Schedule may be found to have an acceptable spacing where an alternate connector is used. Any such substitution can only be made by a Registered Design Professional.

7. Wall lengths are total length of wall required on each side of the building. You may use 2 sections of wall per line based on existing building conditions but each section must be at least 3 feel long and each individual section shall not be greater than 55% of the total require length. (See Figure D-6 on Sheets S0).

8. See Sheet S3.3-1.2 for Alternate Earthquake Retrofit Options where sufficient length of wall panel does not occur or where wood structural panel shear wall retrofit installations are otherwise prohibited.

9. See Sheets S3.4-1.2 thru S3.6-1.2 for Earthquake Retrofit Schedules for the front wall only at dwellings with a ground story residential unit. See also Sheet S0, Figure 2.

INSTRUCTIONS

① Locate the section that matches your home's construction. Use the chart on Sheet S3 to determine "Weight Category".

② Find the home's Floor Area "B" x "L" (See Figures D-3 thru D-5) in the schedule, this number should be at least as large as the number listed below. Do not use a smaller number, even if it is closer.

a. Approximate floor area _____

③ Check the box that matches your home's area per ②. You will use information in this row of the schedule to determine length of plywood bracing panels, nailing requirements, quantities of hardware, etc.

④ Determine the length of plywood bracing required. The columns contain the length of required bracing, including options for bracing without tie-downs, with tie-downs into existing foundations and tie-downs w/ new foundations, see schedule Note 3. Follow the row across from the total floor area that you checked for your home (in Step 3) to find the bracing length for each side of the house (front, back, left side, right side).

⑤ Determine the number of Foundation Sill Connectors or Anchors required. The columns show the number of anchors required, depending on whether you use Types A through C, or number of 1/2"ø or 5/8"ø anchor bolts. (ø = diameter of the bolts.) See Sheet S3.

⑥ Determine the number of Floor to Wall connectors. The columns indicate how many framing connectors are required, depending on whether you use Types D, E, F, or G. See Sheet S3.

⑦ Complete the Retrofit Summary for your project. Fill in the lengths found in ④ for each line. If no option is available, see Schedule notes 6 & 7. Check the boxes for the anchor and connector types you plan to use. If you intend to use tie-downs, check the box for tie-downs after each wall line you plan to use them for, check the box on line 4, and read the Supplemental Technical Notes for additional information.

⑧ Include Earthquake Retrofit Schedule Sheets S3.1-1.2 thru S3.6-1.2 where applicable. See sheet S3, Figure 2 and schedule notes 6 thru 8.

⑦ RETROFIT SUMMARY

BRACING, ANCHORS, CONNECTORS, AND TIE-DOWNS

1. Retrofit requirements at each section of wall, per wall line: (check box if tie-down and/or new footing will be used on that line)
   - ☐ Front Wall _____ft ☐ Nailing: 8d at ___ O.C. ☐ Tie-Down Type _____ ☐ New Ftg
   - ☐ Back Wall _____ft ☐ Nailing: 8d at ___ O.C. ☐ Tie-Down Type _____ ☐ New Ftg
   - ☐ Left Side Walls _____ft ☐ Nailing: 8d at ___ O.C. ☐ Tie-Down Type _____ ☐ New Ftg
   - ☐ Right Side Walls _____ft ☐ Nailing: 8d at ___ O.C. ☐ Tie-Down Type _____ ☐ New Ftg

1. New Foundation Sill Anchorage to be used: (check all that apply)
   Bolts: Diameter_____ ☐ Adhesive ☐ Screw
   ☐ Type "A" Connector ☐ Type "C" Connector
   ☐ Type "B" Connector
   Minimum required number of Sill Anchors at each section of wall, per wall line _____

3. Floor Framing Connectors (to Top Plate) to be used: (check all that apply)
   ☐ Type "D" ☐ Type "F"
   ☐ Type "E" ☐ Type "G"
   Minimum required number of Floor Framing Connectors at each section of wall, per wall line _____

4. ☐ Check this box if tie-downs and the SUPPLEMENTAL TECHNICAL NOTES will be used.

⑧ Supplemental Earthquake Retrofit Schedule

1. Check if this Sheet is supplemenatal to sheet S3.1, otherwise check if additional retrofit schedule are required.
   ☐ S3.2-1.2 ☐ S3.4-1.2 ☐ S3.6-1.2
   ☐ S3.3-1.2 ☐ S3.5-1.2

APPLICANT: _____

PROPERTY ADDRESS: _____

Earthquake Retrofit Schedule - Wood Structural Panel with two sections of wall

Retrofit of Living-Space-Over-Garage Dwellings (Plan Set)
Vulnerability-Based Seismic Assessment and Retrofit of One- and Two-Family Dwellings
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Date:

Sheet:

S3.2-1.2

EARTHQUAKE RETROFIT SCHEDULE (S_{DS} = 1.2)

① WEIGHT CLASSSIFICATION	② Floor Area in Square Feet	③ Mark row that applies ☒	④ STEEL COLUMN RETROFIT (2) (3)		⑤ PROPRIETARY SHEAR WALL RETROFIT (4) (5)	⑥ DIAPHRAGM NAILING (3) (5)
			Steel Column	Column Connection Type (per detail 2 on sheet D7) at Upper Floor	Minimum Required at Allowable Shear Capacity (lbs)	Edge Nail Spacing
Light Construction	800		W8x21	C1	3900	6
	1000		W8x28	C1	4870	6
	1200		W8x28	C1	5850	6
	1500		W10x26	C2	7310	6
	2000		W12x35	C2	9740	6
Medium Construction	800		W8x28	C1	5040	6
	1000		W8x28	C1	6300	6
	1200		W10x30	C2	7560	4
	1500		W12x35	C2	9450	4
	2000		W10x45	C3	12,600	4
Heavy Construction	800		W8x28	C1	6590	4
	1000		W10x30	C2	8230	4
	1200		W12x35	C2	9880	3
	1500		W12x35	C3	12,400	3
	2000		"NG"	"NG"	16,500	3

Notes:
1. Steel column and Proprietary Shear Wall Options are provided for front of garage or back of garage or house only.
2. See detail 4 on Sheet D7 for footing detail at steel column retrofit.
3. See details 1 & 2 on Sheet D7 for steel column connections at upper floor.
4. See details 4 & 5 on Sheet D8 for footing details at proprietary shear wall.
5. See details 1 & 2 on Sheet D8 for upper floor connection at proprietary shear wall.

INSTRUCTIONS

① Locate the section that matches your home's construction. Use the chart on Sheet S3 to determine "Weight Category".

② Find the home's Floor Area "B" x "L" (See Figures D-3 thru D-5) in the schedule, this number should be at least as large as the number listed below. Do not use a smaller number, even if it is closer.

a. Approximate floor area _____

③ Check the box that matches your home's area per ②. You will use information in this row of the schedule to select the steel column size and connection type or proprietary shear wall required.

④ Determine size of steel column and connection detail or see ⑤.

⑤ Determine minimum required allowable shear capacity to be used in selection of a proprietary shear wall. Note that more than one shear wall panel may be needed to obtain the required shear capacity. Consult manufacturer's load tables for final selection.

⑥ See details 1 & 2 on sheet D7 for steel column connections at upper floor.
See details 1 & 2 on sheet D8 for upper floor connection at proprietary shear wall.

⑦ Complete retrofit summary below.

⑦ RETROFIT SUMMARY
check box if selected

Steel Column
- ☐ At front wall
  - Column Size _____
  - Connection _____
  - Diaphragm Nailing _____
- ☐ At back wall
  - Column Size _____
  - Connection _____
  - Diaphragm Nailing _____

Proprietary Shear Wall
- ☐ At front wall
  - Req'd Capacity _____
  - MFR/ Size _____
  - Diaphragm Nailing _____
- ☐ At back wall
  - Req'd Capacity _____
  - MFR/ Size _____
  - Diaphragm Nailing _____

⑧ Supplemental Earthquake Retrofit Schedule

1. Check boxes if additional Earthquake Retrofit Schedules are included.
   - ☐ S3.1-1.2
   - ☐ S3.2-1.2
   - ☐ S3.3-1.2
   - ☐ S3.4-1.2
   - ☐ S3.5-1.2

APPLICANT: _____

PROPERTY ADDRESS: _____

Alternate Earthquake Retrofit Schedule (Steel Column or Propriety Shear Wall)

Retrofit of Living-Space-Over-Garage Dwellings (Plan Set)
Vulnerability-Based Seismic Assessment and Retrofit of One- and Two-Family Dwellings
FEMA P-1100, Volume 2 - Plan Sets
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Date:

Sheet:

S3.3-1.2

EARTHQUAKE RETROFIT SCHEDULE (S_{DS} = 1.2) for Single Section of Wall at Front of Garage - Only

① WEIGHT CLASSIFICATION	② Floor Area in Square Feet	③ Mark row that applies ☒	④ MINIMUM REQUIRED LENGTH OF A SINGLE SECTION OF WALL OF WOOD STRUCTURAL PANEL SHEAR WALLS (at each wall line)											⑤ FOUNDATION SILL ANCHORAGE Min. No. of Foundation Connectors or Anchors at Each Wall Panel					⑥ FLOOR FRAMING TO WALL CONNECTION Min. No. of Connectors at Each Wall Panel		
			No Tie-down		w/ Tie-downs in Existing or New Foundations																
					8d at 6" O.C.			8d at 4" O.C.			8d at 2" O.C.										
			8d Nail Spacing	Wall Length	Wall Length	Tie-down	New Fdn Req'd ?	Wall Length	Tie-down	New Fdn Req'd ?	Wall Length	Tie-down	New Fdn Req'd ?	Type "A"	Type "B"	Type "C"	1/2"ø Bolt	5/8"ø Bolt	Type "D"	Type "E" or "F"	Type "G"
Light Construction	800		6	11'-6"	7'-6"	TD1	No	5'-0"	TD3	Yes	3'-6"	TD5	Yes	2	4	5	4	3	6	5	7
	1000		6	13'-6"	9'-6"	TD1	No	6'-6"	TD2	Yes	4'-0"	TD5	Yes	3	4	6	5	3	7	7	9
	1200		6	15'-6"	11'-0"	TD1	No	7'-6"	TD2	Yes	4'-6"	TD5	Yes	3	5	7	5	4	8	8	10
	1500		6	18'-0"	14'-0"	TD1	No	9'-6"	TD2	Yes	5'-6"	TD5	Yes	4	6	8	7	5	10	10	13
	2000		6	22'-6"	18'-6"	TD1	No	13'-0"	TD2	Yes	7'-6"	TD4	Yes	5	8	11	9	6	13	13	17
Medium Construction	800		6	14'-6"	9'-6"	TD1	No	6'-6"	TD3	Yes	4'-0"	TD5	Yes	3	4	6	5	3	7	7	9
	1000		6	17'-0"	12'-0"	TD1	No	8'-6"	TD2	Yes	5'-0"	TD5	Yes	4	5	7	6	4	9	9	11
	1200		6	19'-0"	14'-6"	TD1	No	10'-0"	TD2	Yes	6'-0"	TD5	Yes	4	6	8	7	5	11	10	13
	1500		6	22'-6"	18'-0"	TD1	No	12'-6"	TD2	Yes	7'-6"	TD5	Yes	5	8	10	9	6	13	13	16
	2000		6	27'-6"	24'-0"	TD1	No	16'-6"	TD2	Yes	10'-0"	TD5	Yes	7	10	14	11	8	17	17	22
Heavy Construction	800		6	15'-6"	12'-6"	TD1	No	8'-6"	TD2	Yes	5'-0"	TD5	Yes	4	6	7	6	4	9	9	12
	1000		6	18'-0"	16'-0"	TD1	No	11'-0"	TD2	Yes	6'-6"	TD5	Yes	5	7	9	8	5	11	11	14
	1200		6	20'-6"	19'-0"	TD1	No	13'-0"	TD2	Yes	7'-6"	TD4	Yes	5	8	11	9	6	14	13	17
	1500		4	22'-0"	23'-6"	None	No	16'-0"	TD2	Yes	9'-6"	TD4	Yes	7	10	13	11	8	17	16	21
	2000		4	23'-0"	31'-6"	None	No	21'-6"	TD1	No	13'-0"	TD4	Yes	9	13	18	15	10	22	21	28

Notes:

1. Anchor bolts and Connectors shown in the Earthquake Retrofit Schedule are the minimum required per wall line, placed within the length of strengthening where possible. Additional anchors and connectors may be necessary to meet the requirements of specific details and General Notes.
2. Tie-downs: If your foundation meets the criteria, you may choose the tie-down option to decrease the required length of strengthening. This may be required where the length of the wall without tie downs specified in this schedule is longer than can be accommodated by existing conditions. However, there is a level of uncertainty when dealing with existing foundations, therefore, where possible, longer lengths of strengthening, without tie-downs, are preferred. (See Supplemental Technical Notes, Sheet S2 to verify the existing foundation is suitable and meets criteria.) Where "None" occurs, no tie-down is required.
3. Foundations: Where new foundations are required, see Sheet D2 for details.
4. Connector Type "F" should be used as an alternative only if joists are blocked on both sides and where accessibility makes the use of Types "D" or "E" impractical.
5. Any of the connectors listed within a particular group and as shown on Sheet S3 may be used for strengthening the particular condition.
6. This Plan Set was developed using the lowest listed manufacturer's capacity within a particular group. Cells marked "NG" on the applicable Earthquake Retrofit Schedule may be found to have an acceptable spacing where an alternate connector is used. Any such substitution can only be made by a Registered Design Professional.
7. Wall lengths are total length of a single wall section required. See Sheet S3.5-1.2 for 2 section of wall options.
8. See Sheet S3.6-1.2 for Alternate Earthquake Retrofit Options where sufficient length of wall does not occur or where wood structural panel shear wall retrofit installations are otherwise prohibited.

INSTRUCTIONS

1. Locate the section that matches your home's construction. Use the chart on Sheet S3 to determine "Weight Category".
2. Find the home's Floor Area "B" x "L" (See Figures D-3 thru D-5) in the schedule, this number should be at least as large as the number listed below. Do not use a smaller number, even if it is closer.
   a. Approximate floor area _____
3. Check the box that matches your home's area per ②. You will use information in this row of the schedule to determine length of plywood bracing panels, nailing requirements, quantities of hardware, etc.
4. Determine the length of plywood bracing required. The columns contain the length of required bracing, including options for bracing without tie-downs, with tie-downs into existing foundations and tie-downs w/ new foundations, see schedule Note 3. Follow the row across from the total floor area that you checked for your home (in Step 3) to find the bracing length for each side of the house (front, back, left side, right side).
5. Determine the number of Foundation Sill Connectors or Anchors required. The columns show the number of anchors required, depending on whether you use Types A through C, or number of 1/2"ø or 5/8"ø anchor bolts. (ø = diameter of the bolts.) See Sheet S3.
6. Determine the number of Floor to Wall connectors. The columns indicate how many framing connectors are required, depending on whether you use Types D, E, F, or G. See Sheet S3.
7. Complete the Retrofit Summary for your project. Fill in the lengths found in ④ for each line. If no option is available, see Schedule notes 6 & 7. Check the boxes for the anchor and connector types you plan to use. If you intend to use tie-downs, check the box for tie-downs after each wall line you plan to use them for, check the box on line 4, and read the Supplemental Technical Notes for additional information.
8. Include Earthquake Retrofit Schedule Sheets S3.1-1.2 thru S3.6-1.2 where applicable. See sheet S3, Figure 2 and schedule notes 6 and 7.

⑦ RETROFIT SUMMARY

BRACING, ANCHORS, CONNECTORS, AND TIE-DOWNS

1. Required length of strengthening at garage front wall line: (check box if tie-downs will be used on that line)
   Front Wall _____ft ☐ with Tie-Down Type _____
   Front Wall _____ft ☐ without Tie-Down
2. New Foundation Sill Anchorage to be used: (check all that apply)
   Bolts: Diameter_____ ☐ Adhesive ☐ Screw
   ☐ Type "A" Connector ☐ Type "C" Connector
   ☐ Type "B" Connector
   Minimum required number of Sill Anchors per wall line _____
3. Floor Framing Connectors (to Foundation Sill or to Top Plate) to be used: (check all that apply)
   ☐ Type "D" ☐ Type "F"
   ☐ Type "E" ☐ Type "G"
   Minimum required number of Floor Framing Connectors per wall line _____
4. ☐ Check this box if tie-downs and the SUPPLEMENTAL TECHNICAL NOTES will be used.

⑧ Supplemental Earthquake Retrofit Schedule

1. Check boxes if additional Earthquake Retrofit Schedues are included.
   ☐ S3.2-1.2 ☐ S3.4-1.2 ☐ S3.6-1.2
   ☐ S3.3-1.2 ☐ S3.5-1.2

APPLICANT: _____

PROPERTY ADDRESS: _____

Earthquake Retrofit Schedule - at front of garage only in dwelling with ground story residential unit

Retrofit of Living-Space-Over-Garage Dwellings (Plan Set)
Vulnerability-Based Seismic Assessment and Retrofit of One- and Two-Family Dwellings
FEMA P-1100, Volume 2 - Plan Sets
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FEMA

Date:

Sheet: **S3.4-1.2**

EARTHQUAKE RETROFIT SCHEDULE (S_{DS} = 1.2) Two Sections of Wall at Front of Garage - Only

① WEIGHT CLASSIFICATION	② Floor Area in Square Feet	③ ☒ Mark row that applies	④ MINIMUM TOTAL REQUIRED LENGTH OF EACH SECTION OF WOOD STRUCTURAL PANEL SHEAR WALLS For a Two Section of Wall Option — Length per Section for a Two Section Option						⑤ FOUNDATION SILL ANCHORAGE — Min. No. of Foundation Connectors or Anchors at Each Section of Wall					⑥ FLOOR FRAMING TO WALL CONNECTION — Min. No. of Connectors at Each Section of Wall		
			8d at 6" O.C.			8d at 2" O.C.										
			Wall Length	Tie-down	New Fdn Req'd ?	Wall Length	Tie-down	New Fdn Req'd ?	Type "A"	Type "B"	Type "C"	1/2"ø Bolt	5/8"ø Bolt	Type "D"	Type "E" or "F"	Type "G"
Light Construction	800		4'-0"	TD1	No	2'-6"	TD3	Yes	1	2	3	2	2	3	3	4
	1000		4'-6"	TD1	No	2'-6"	TD4	Yes	2	2	3	3	2	4	4	5
	1200		5'-6"	TD1	No	3'-0"	TD4	Yes	2	3	4	3	2	4	4	5
	1500		7'-0"	TD1	No	3'-0"	TD4	Yes	2	3	4	4	3	5	5	7
	2000		9'-6"	TD1	No	4'-0"	TD5	Yes	3	4	6	5	3	7	7	9
Medium Construction	800		5'-0"	TD2	Yes	2'-6"	TD4	Yes	2	2	3	3	2	4	4	5
	1000		6'-0"	TD1	No	3'-0"	TD4	Yes	2	3	4	3	2	5	5	6
	1200		7'-6"	TD1	No	3'-6"	TD5	Yes	2	3	4	4	3	6	5	7
	1500		9'-0"	TD1	No	4'-0"	TD5	Yes	3	4	5	5	3	7	7	8
	2000		12'-0"	TD1	No	5'-0"	TD5	Yes	4	5	7	6	4	9	9	11
Heavy Construction	800		6'-6"	TD1	No	3'-0"	TD4	Yes	2	3	4	3	2	5	5	6
	1000		8'-0"	TD1	No	3'-6"	TD4	Yes	3	4	5	4	3	6	6	7
	1200		9'-6"	TD1	No	4'-0"	TD5	Yes	3	4	6	5	3	7	7	9
	1500		12'-0"	None	No	5'-0"	TD4	Yes	4	5	7	6	4	9	8	11
	2000		16'-0"	None	No	6'-6"	TD4	Yes	5	7	9	8	5	11	11	14

Notes:

1. Anchor bolts and Connectors shown in the Earthquake Retrofit Schedule are the minimum required per section of wall, placed within the length of strengthening where possible. Total number of anchor bolts and connectors shall equal twice the number shown in the schedule. Additional anchors and connectors may be necessary to meet the requirements of specific details and General Notes.
2. Tie-downs: If your foundation meets the criteria, you may choose the tie-down option to decrease the required length of strengthening. This may be required where the length of the wall without tie downs specified in this schedule is longer than can be accommodated by existing conditions. However, there is a level of uncertainty when dealing with existing foundations, therefore, where possible, longer lengths of strengthening, without tie-downs, are preferred. (See Supplemental Technical Notes, Sheet S2 to verify the existing foundation is suitable and meets criteria.) Where "None" occurs, no tie-down is required.
3. Foundations: Where new foundations are required, see Sheet D2 for details.
4. Connector Type "F" should be used as an alternative only if joists are blocked on both sides and where accessibility makes the use of Types "D" or "E" impractical.
5. Any of the connectors listed within a particular group and as shown on Sheet S3 may be used for strengthening the particular condition.
6. This Plan Set was developed using the lowest listed manufacturer's capacity within a particular group. Cells marked "NG" on the applicable Earthquake Retrofit Schedule may be found to have an acceptable spacing where an alternate connector is used. Any such substitution can only be made by a Registered Design Professional.
7. Wall lengths are minimum length of each wall section required on the garage front wall line.
8. See Sheet S3.6-1.2 for Alternate Earthquake Retrofit Options where sufficient length of wall panel does not occur or where wood structural panel shear wall retrofit installations are otherwise prohibited.

INSTRUCTIONS

① Locate the section that matches your home's construction. Use the chart on Sheet S3 to determine "Weight Category".

② Find the home's Floor Area "B" x "L" (See Figures D-3 thru D-5) in the schedule, this number should be at least as large as the number listed below. Do not use a smaller number, even if it is closer.

a. Approximate floor area _____

③ Check the box that matches your home's area per ②. You will use information in this row of the schedule to determine length of plywood bracing panels, nailing requirements, quantities of hardware, etc.

④ Determine the length of plywood bracing required. The columns contain the length of required bracing, including options for bracing without tie-downs, with tie-downs into existing foundations and tie-downs w/ new foundations, see schedule Note 3. Follow the row across from the total floor area that you checked for your home (in Step 3) to find the bracing length for each side of the house (front, back, left side, right side).

⑤ Determine the number of Foundation Sill Connectors or Anchors required. The columns show the number of anchors required, depending on whether you use Types A through C, or number of 1/2"ø or 5/8"ø anchor bolts. (ø = diameter of the bolts.) See Sheet S3.

⑥ Determine the number of Floor to Wall connectors. The columns indicate how many framing connectors are required, depending on whether you use Types D, E, F, or G. See Sheet S3.

⑦ Complete the Retrofit Summary for your project. Fill in the lengths found in ④ for each line. If no option is available, see Schedule notes 6 & 7. Check the boxes for the anchor and connector types you plan to use. If you intend to use tie-downs, check the box for tie-downs after each wall line you plan to use them for, check the box on line 4, and read the Supplemental Technical Notes for additional information.

⑧ Include Earthquake Retrofit Schedule Sheets S3.1-1.2 thru S3.6-1.2 where applicable. See sheet S3, Figure 2 and schedule notes 6 and 7.

⑦ RETROFIT SUMMARY

BRACING, ANCHORS, CONNECTORS, AND TIE-DOWNS

1. Required length of each section of strengthening per wall line: (check box if tie-downs will be used on that line)
   Front Wall _____ft ☐ with Tie-Down Type _____
   Front Wall _____ft ☐ without Tie-Down
2. New Foundation Sill Anchorage to be used: (check all that apply)
   Bolts: Diameter_____ ☐ Adhesive ☐ Screw
   ☐ Type "A" Connector ☐ Type "C" Connector
   ☐ Type "B" Connector
   Minimum required number of Sill Anchors per wall line _____
3. Floor Framing Connectors (to Foundation Sill or to Top Plate) to be used: (check all that apply)
   ☐ Type "D" ☐ Type "F"
   ☐ Type "E" ☐ Type "G"
   Minimum required number of Floor Framing Connectors per wall line _____
4. ☐ Check this box if tie-downs and the SUPPLEMENTAL TECHNICAL NOTES will be used.

⑧ Supplemental Earthquake Retrofit Schedule

1. Check boxes if additional Earthquake Retrofit Schedules are included.
   ☐ S3.1-1.2 ☐ S3.3-1.2 ☐ S3.6-1.2
   ☐ S3.2-1.2 ☐ S3.4-1.2

APPLICANT: _____

PROPERTY ADDRESS: _____

Earthquake Retrofit Schedule at front of garage only in dwelling with ground story residential unit

Retrofit of Living-Space-Over-Garage Dwellings (Plan Set)
Vulnerability-Based Seismic Assessment and Retrofit of One- and Two-Family Dwellings
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Sheet: **S3.5-1.2**

EARTHQUAKE RETROFIT SCHEDULE (S_{DS} = 1.2) at front of Garage

① WEIGHT CLASSIFICATION	② Floor Area in Square Feet	③ ☒ Mark row that applies	STEEL COLUMN RETROFIT (2) (3)		PROPRIETARY SHEAR WALL RETROFIT (4) (5)	DIAPHRAGM NAILING (3) (5)
			Steel Column	Column Connection Type (per detail 2 on sheet D7) at Upper Floor	Minimum Required at Allowable Shear Capacity (lbs)	Edge Nail Spacing (inches on center)
Light Construction	800		W8x21	C1	1950	6
	1000		W8x21	C1	2440	6
	1200		W8x21	C1	2920	6
	1500		W8x21	C1	3650	6
	2000		W8x28	C1	4870	6
Medium Construction	800		W8x21	C1	2520	6
	1000		W8x21	C1	3150	6
	1200		W8x21	C1	3780	6
	1500		W8x28	C1	4730	6
	2000		W8x28	C1	6300	6
Heavy Construction	800		W8x21	C1	3290	6
	1000		W8x21	C1	4120	6
	1200		W8x28	C1	4940	6
	1500		W8x28	C1	6170	6
	2000		W10x30	C2	8230	6

Notes:
1. Steel column and Proprietary Shear Wall Options are provided for front of garage or back of garage or house only.
2. See detail 4 on Sheet D7 for footing detail at steel column retrofit.
3. See details 1 & 2 on Sheet D7 for steel column connections at upper floor.
4. See details 4 & 5 on Sheet D8 for footing details at proprietary shear wall.
5. See details 1 & 2 on Sheet D8 for upper floor connection at proprietary shear wall.

INSTRUCTIONS

① Locate the section that matches your home's construction. Use the chart on Sheet S3 to determine "Weight Category".

② Find the home's Floor Area "B" x "L" (See Figures D-3 thru D-5) in the schedule, this number should be at least as large as the number listed below. Do not use a smaller number, even if it is closer.

a. Approximate floor area _____

③ Check the box that matches your home's area per ②. You will use information in this row of the schedule to steel column size and connection type or proprietary shear wall required.

④ Determine size of steel column and connection detail or see ⑤.

⑤ Determine minimum required allowable shear capacity to be used in selection of a proprietary shear wall. Consult manufacturer's load tables for final selection. Note that more than one shear wall panel may be needed to obtain the required shear capacity. Consult manufacturer's load tables for final selection.

⑥ See details 1 & 2 on sheet D7 for steel column connections at upper floor.
See details 1 & 2 on sheet D8 for upper floor connection at proprietary shear wall.

⑦ Complete retrofit it summary below.

⑦ RETROFIT SUMMARY
check box if selected

Steel Column
- ☐ At front wall
  - Column Size _____
  - Connection _____
  - Diaphragm Nailing _____
- ☐ At back wall
  - Column Size _____
  - Connection _____
  - Diaphragm Nailing _____

Proprietary Shear Wall
- ☐ At front wall
  - Req'd Capacity _____
  - MFR/ Size _____
  - Diaphragm Nailing _____
- ☐ At back wall
  - Req'd Capacity _____
  - MFR/ Size _____
  - Diaphragm Nailing _____

⑧ Supplemental Earthquake Retrofit Schedule

1. Check boxes if additional Earthquake Retrofit Schedules are included.
   - ☐ S3.1-1.2
   - ☐ S3.2-1.2
   - ☐ S3.3-1.2
   - ☐ S3.4-1.2
   - ☐ S3.5-1.2

APPLICANT: _____

PROPERTY ADDRESS: _____

Alternate Earthquake Retrofit Schedule at front of garage in dwelling w/ ground story residential unit

Retrofit of Living-Space-Over-Garage Dwellings (Plan Set)
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Sheet:

S3.6-1.2

EARTHQUAKE RETROFIT SCHEDULE (S_{DS} = 1.5) for Single Section of Wall

① WEIGHT CLASSIFICATION	② Floor Area in Square Feet	③ Mark row that applies ☒	④ MINIMUM REQUIRED LENGTH OF A SINGLE SECTION OF WALL OF WOOD STRUCTURAL PANEL SHEAR WALLS (at each wall line)											⑤ FOUNDATION SILL ANCHORAGE Min. No. of Foundation Connectors or Anchors at Each Wall Panel					⑥ FLOOR FRAMING TO WALL CONNECTION Min. No. of Connectors at Each Wall Panel		
			No Tie-down		w/ Tie-downs in Existing or New Foundations																
					8d at 6" O.C.			8d at 4" O.C.			8d at 2" O.C.											
			8d Nail Spacing	Wall Length	Wall Length	Tie-down	New Fdn Req'd ?	Wall Length	Tie-down	New Fdn Req'd ?	Wall Length	Tie-down	New Fdn Req'd ?	Type "A"	Type "B"	Type "C"	1/2"ø Bolt	5/8"ø Bolt	Type "D"	Type "E" or "F"	Type "G"
Light Construction	800		6	23'-0"	18'-6"	TD1	No	13'-0"	TD2	Yes	7'-6"	TD4	Yes	5	8	11	9	6	13	13	17
	1000		6	27'-0"	23'-6"	TD1	No	16'-0"	TD2	Yes	9'-6"	TD4	Yes	6	10	13	11	8	17	16	21
	1200		6	30'-6"	28'-0"	TD1	No	19'-0"	TD2	Yes	11'-6"	TD4	Yes	8	12	16	13	9	20	19	25
	1500		4	35'-0"	35'-0"	None	No	24'-0"	TD2	Yes	14'-6"	TD4	Yes	9	15	19	16	11	25	24	31
	2000		4	43'-0"	47'-0"	None	No	32'-0"	TD2	Yes	19'-0"	TD4	Yes	12	20	26	21	15	33	31	42
Medium Construction	800		6	28'-6"	24'-0"	TD1	No	16'-6"	TD2	Yes	10'-0"	TD5	Yes	7	10	14	11	8	17	17	22
	1000		6	33'-0"	30'-6"	TD1	No	20'-6"	TD2	Yes	12'-6"	TD4	Yes	8	13	17	14	10	21	21	27
	1200		6	37'-0"	36'-6"	TD1	No	25'-0"	TD2	Yes	15'-0"	TD4	Yes	10	15	20	17	11	26	25	32
	1500		4	42'-6"	45'-6"	None	No	31'-0"	TD2	Yes	18'-6"	TD4	Yes	12	19	25	21	14	32	31	40
	2000		4	51'-6"	"NG"	None	No	41'-6"	TD1	No	24'-6"	TD4	Yes	16	25	33	27	19	42	41	54
Heavy Construction	800		4	29'-6"	31'-6"	None	No	21'-6"	TD2	Yes	13'-0"	TD4	Yes	9	13	18	15	10	22	21	28
	1000		4	33'-6"	39'-6"	None	No	27'-0"	TD1	No	16'-0"	TD4	Yes	11	17	22	18	12	28	27	35
	1200		4	37'-6"	47'-6"	None	No	32'-6"	TD1	No	19'-6"	TD4	Yes	13	20	26	22	15	33	32	42
	1500		2	40'-6"	"NG"	None	No	40'-6"	None	No	24'-0"	TD4	Yes	16	25	32	27	18	41	40	53
	2000		2	41'-0"	"NG"	None	No	54'-0"	None	No	32'-0"	TD2	Yes	21	33	43	36	24	55	53	70

Notes:

1. Anchor bolts and Connectors shown in the Earthquake Retrofit Schedule are the minimum required per wall line, placed within the length of strengthening where possible. Additional anchors and connectors may be necessary to meet the requirements of specific details and General Notes.

2. Tie-downs: If your foundation meets the criteria, you may choose the tie-down option to decrease the required length of strengthening. This may be required where the length of the wall without tie downs specified in this schedule is longer than can be accommodated by existing conditions. However, there is a level of uncertainty when dealing with existing foundations, therefore, where possible, longer lengths of strengthening, without tie-downs, are preferred. (See Supplemental Technical Notes, Sheet S2 to verify the existing foundation is suitable and meets criteria.) Where "None" occurs, no tie-down is required.

3. Foundations: Where new foundations are required at front and back walls, see Sheet D2 for details. At side walls, select retrofit options that do not require new foundations whenever possible. Otherwise, provide foundations that extend the full depth of the garage in Figures 4 and 5 on Sheet S0 and for Figure 3 conditions (*living-space-over-garage* dwellings without *ground floor residential unit*), consult a Registered Design Professional for remedial direction.

4. Connector Type "F" should be used as an alternative only if joists are blocked on both sides and where accessibility makes the use of Types "D" or "E" impractical.

5. Any of the connectors listed within a particular group and as shown on Sheet S3 may be used for strengthening the particular condition.

6. This Plan Set was developed using the lowest listed manufacturer's capacity within a particular group. Cells marked "NG" on the applicable Earthquake Retrofit Schedule may be found to have an acceptable spacing where an alternate connector is used. Any such substitution can only be made by a Registered Design Professional.

7. Wall lengths are total length of a single wall section required on each side of the building. See Sheet S3.2-1.5 for 2 section of wall options.

8. See Sheet S3.3-1.5 for Alternate Earthquake Retrofit Options where sufficient length of wall does not occur or where wood structural panel shear wall retrofit installations are otherwise prohibited.

9. See Sheets S3.4-1.5 thru S3.6-1.5 for Earthquake Retrofit Schedules for the front wall only at dwellings with a ground story residential unit. See also Sheet S0, Figure 2.

INSTRUCTIONS

① Locate the section that matches your home's construction. Use the chart on Sheet S3 to determine "Weight Category".

② Find the home's Floor Area "B" x "L" (See Figures D-3 thru D-5) in the schedule, this number should be at least as large as the number listed below. Do not use a smaller number, even if it is closer.

a. Approximate floor area _____

③ Check the box that matches your home's area per ②. You will use information in this row of the schedule to determine length of plywood bracing panels, nailing requirements, quantities of hardware, etc.

④ Determine the length of plywood bracing required. The columns contain the length of required bracing, including options for bracing without tie-downs, with tie-downs into existing foundations and tie-downs w/ new foundations, see schedule Note 3. Follow the row across from the total floor area that you checked for your home (in Step 3) to find the bracing length for each side of the house (front, back, left side, right side).

⑤ Determine the number of Foundation Sill Connectors or Anchors required. The columns show the number of anchors required, depending on whether you use Types A through C, or number of 1/2"ø or 5/8"ø anchor bolts. (ø = diameter of the bolts.) See Sheet S3.

⑥ Determine the number of Floor to Wall connectors. The columns indicate how many framing connectors are required, depending on whether you use Types D, E, F, or G. See Sheet S3.

⑦ Complete the Retrofit Summary for your project. Fill in the lengths found in ④ for each line. If no option is available, see Schedule notes 6 & 7. Check the boxes for the anchor and connector types you plan to use. If you intend to use tie-downs, check the box for tie-downs after each wall line you plan to use them for, check the box on line 4, and read the Supplemental Technical Notes for additional information.

⑧ Include Earthquake Retrofit Schedule Sheets S3.1-1.5 thru S3.6-1.5 where applicable. See sheet S3, Figure 2 and schedule notes 6 thru 8.

⑦ RETROFIT SUMMARY

BRACING, ANCHORS, CONNECTORS, AND TIE-DOWNS

1. Retrofit requirements per wall line: (check box if tie-down and/or new footing will be used on that line)
   - ☐ Front Wall _____ft ☐ Nailing: 8d at ___ O.C. ☐ Tie-Down Type _____ ☐ New Ftg
   - ☐ Back Wall _____ft ☐ Nailing: 8d at ___ O.C. ☐ Tie-Down Type _____ ☐ New Ftg
   - ☐ Left Side Walls _____ft ☐ Nailing: 8d at ___ O.C. ☐ Tie-Down Type _____ ☐ New Ftg
   - ☐ Right Side Walls _____ft ☐ Nailing: 8d at ___ O.C. ☐ Tie-Down Type _____ ☐ New Ftg

2. New Foundation Sill Anchorage to be used: (check all that apply)
   Bolts: Diameter_____ ☐ Adhesive ☐ Screw
   ☐ Type "A" Connector ☐ Type "C" Connector
   ☐ Type "B" Connector
   Minimum required number of Sill Anchors per wall line _____

3. Floor Framing Connectors (to Top Plate) to be used: (check all that apply)
   ☐ Type "D" ☐ Type "F"
   ☐ Type "E" ☐ Type "G"
   Minimum required number of Floor Framing Connectors per wall line _____

4. ☐ Check this box if tie-downs and the SUPPLEMENTAL TECHNICAL NOTES will be used.

⑧ Supplemental Earthquake Retrofit Schedule

1. Check boxes if additional Earthquake Retrofit Schedues are included.
   ☐ S3.2-1.5 ☐ S3.4-1.5 ☐ S3.6-1.5
   ☐ S3.3-1.5 ☐ S3.5-1.5

APPLICANT: _____

PROPERTY ADDRESS: _____

Earthquake Retrofit Schedule - Wood Structural Panel with single section of wall

Retrofit of Living-Space-Over-Garage Dwellings (Plan Set)
Vulnerability-Based Seismic Assessment and Retrofit of One- and Two-Family Dwellings
FEMA P-1100, Volume 2 - Plan Sets
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Date:

Sheet:

S3.1-1.5

EARTHQUAKE RETROFIT SCHEDULE (S_{DS} = 1.5) Two Sections of Wall

① WEIGHT CLASSIFICATION	② Floor Area in Square Feet	③ Mark row that applies ☒	④ MINIMUM TOTAL REQUIRED LENGTH OF EACH SECTION OF WOOD STRUCTURAL PANEL SHEAR WALL For a Two Section of Wall Option — Length per Section for a Two Section Option						⑤ FOUNDATION SILL ANCHORAGE — Min. No. of Foundation Connectors or Anchors at Each Section of Wall					⑥ FLOOR FRAMING TO WALL CONNECTION — Min. No. of Connectors at Each Section of Wall		
			8d at 6" O.C.			8d at 2" O.C.										
			Wall Length	Tie-down	New Fdn Req'd ?	Wall Length	Tie-down	New Fdn Req'd ?	Type "A"	Type "B"	Type "C"	1/2"ø Bolt	5/8"ø Bolt	Type "D"	Type "E" or "F"	Type "G"
Light Construction	800		9'-6"	TD1	No	4'-0"	TD5	Yes	3	4	6	5	3	7	7	9
	1000		12'-0"	TD1	No	5'-0"	TD5	Yes	3	5	7	6	4	9	8	11
	1200		14'-0"	TD1	No	6'-0"	TD4	Yes	4	6	8	7	5	10	10	13
	1500		17'-6"	TD1	No	7'-0"	TD4	Yes	5	8	10	8	6	13	12	16
	2000		23'-6"	None	No	9'-6"	TD4	Yes	6	10	13	11	8	17	16	21
Medium Construction	800		12'-0"	TD1	No	5'-0"	TD5	Yes	4	5	7	6	4	9	9	11
	1000		15'-0"	TD1	No	6'-0"	TD5	Yes	4	7	9	7	5	11	11	14
	1200		18'-0"	TD1	No	7'-6"	TD4	Yes	5	8	10	9	6	13	13	16
	1500		23'-0"	None	No	9'-6"	TD4	Yes	6	10	13	11	7	16	16	20
	2000		"NG"	None	No	12'-6"	TD4	Yes	8	13	17	14	10	21	21	27
Heavy Construction	800		16'-0"	None	No	6'-6"	TD4	Yes	5	7	9	8	5	11	11	14
	1000		20'-0"	None	No	8'-0"	TD4	Yes	6	9	11	9	6	14	14	18
	1200		24'-0"	None	No	9'-6"	TD4	Yes	7	10	13	11	8	17	16	21
	1500		"NG"	None	No	12'-0"	TD4	Yes	8	13	16	14	9	21	20	27
	2000		"NG"	None	No	16'-0"	TD2	Yes	11	17	22	18	12	28	27	35

Notes:

1. Anchor bolts and Connectors shown in the Earthquake Retrofit Schedule are the minimum required per section of wall, placed within the length of strengthening where possible. Total number of anchor bolts and connectors shall equal twice the number shown in the schedule. Additional anchors and connectors may be necessary to meet the requirements of specific details and General Notes.

2. Tie-downs: If your foundation meets the criteria, you may choose the tie-down option to decrease the required length of strengthening. This may be required where the length of the wall without tie downs specified in this schedule is longer than can be accommodated by existing conditions. However, there is a level of uncertainty when dealing with existing foundations, therefore, where possible, longer lengths of strengthening, without tie-downs, are preferred. (See Supplemental Technical Notes, Sheet S2 to verify the existing foundation is suitable and meets criteria.) Where "None" occurs, no tie-down is required.

3. Foundations: Where new foundations are required at front and back walls, see Sheet D2 for details. At side walls, select retrofit options that do not require new foundations whenever possible. Otherwise, provide foundations that extend the full depth of the garage in Figures 4 and 5 on Sheet S0 and for Figure 3 conditions (*living-space-over-garage* dwellings without *ground floor residential unit*), consult a Registered Design Professional for remedial direction.

4. Connector Type "F" should be used as an alternative only if joists are blocked on both sides and where accessibility makes the use of Types "D" or "E" impractical.

5. Any of the connectors listed within a particular group and as shown on Sheet S3 may be used for strengthening the particular condition.

6. This Plan Set was developed using the lowest listed manufacturer's capacity within a particular group. Cells marked "NG" on the applicable Earthquake Retrofit Schedule may be found to have an acceptable spacing where an alternate connector is used. Any such substitution can only be made by a Registered Design Professional.

7. Wall lengths are total length of wall required on each side of the building. You may use 2 sections of wall per line based on existing building conditions but each section must be at least 3 feel long and each individual section shall not be greater than 55% of the total require length. (See Figure D-6 on Sheets S0).

8. See Sheet S3.3-1.5 for Alternate Earthquake Retrofit Options where sufficient length of wall panel does not occur or where wood structural panel shear wall retrofit installations are otherwise prohibited.

9. See Sheets S3.4-1.5 thru S3.6-1.5 for Earthquake Retrofit Schedules for the front wall only at dwellings with a ground story residential unit. See also Sheet S0, Figure 2.

INSTRUCTIONS

① Locate the section that matches your home's construction. Use the chart on Sheet S3 to determine "Weight Category".

② Find the home's Floor Area "B" x "L" (See Figures D-3 thru D-5) in the schedule, this number should be at least as large as the number listed below. Do not use a smaller number, even if it is closer.

a. Approximate floor area _____

③ Check the box that matches your home's area per ②. You will use information in this row of the schedule to determine length of plywood bracing panels, nailing requirements, quantities of hardware, etc.

④ Determine the length of plywood bracing required. The columns contain the length of required bracing, including options for bracing without tie-downs, with tie-downs into existing foundations and tie-downs w/ new foundations, see schedule Note 3. Follow the row across from the total floor area that you checked for your home (in Step 3) to find the bracing length for each side of the house (front, back, left side, right side).

⑤ Determine the number of Foundation Sill Connectors or Anchors required. The columns show the number of anchors required, depending on whether you use Types A through C, or number of 1/2"ø or 5/8"ø anchor bolts. (ø = diameter of the bolts.) See Sheet S3.

⑥ Determine the number of Floor to Wall connectors. The columns indicate how many framing connectors are required, depending on whether you use Types D, E, F, or G. See Sheet S3.

⑦ Complete the Retrofit Summary for your project. Fill in the lengths found in ④ for each line. If no option is available, see Schedule notes 6 & 7. Check the boxes for the anchor and connector types you plan to use. If you intend to use tie-downs, check the box for tie-downs after each wall line you plan to use them for, check the box on line 4, and read the Supplemental Technical Notes for additional information.

⑧ Include Earthquake Retrofit Schedule Sheets S3.1-1.5 thru S3.6-1.5 where applicable. See sheet S3, Figure 2 and schedule notes 6 thru 8.

⑦ RETROFIT SUMMARY

BRACING, ANCHORS, CONNECTORS, AND TIE-DOWNS

1. Retrofit requirements at each section of wall,per wall line: (check box if tie-down and/or new footing will be used on that line)
   - ☐ Front Wall _____ft ☐ Nailing: 8d at ___ O.C. ☐ Tie-Down Type _____ ☐ New Ftg
   - ☐ Back Wall _____ft ☐ Nailing: 8d at ___ O.C. ☐ Tie-Down Type _____ ☐ New Ftg
   - ☐ Left Side Walls _____ft ☐ Nailing: 8d at ___ O.C. ☐ Tie-Down Type _____ ☐ New Ftg
   - ☐ Right Side Walls _____ft ☐ Nailing: 8d at ___ O.C. ☐ Tie-Down Type _____ ☐ New Ftg

2. New Foundation Sill Anchorage to be used: (check all that apply)
   Bolts: Diameter_____ ☐ Adhesive ☐ Screw
   ☐ Type "A" Connector ☐ Type "C" Connector
   ☐ Type "B" Connector
   Minimum required number of Sill Anchors at each section of wall, per wall line _____

3. Floor Framing Connectors (to Foundation Sill or to Top Plate) to be used: (check all that apply)
   ☐ Type "D" ☐ Type "F"
   ☐ Type "E" ☐ Type "G"
   Minimum required number of Floor Framing Connectors at each section of wall, per wall line _____

4. ☐ Check this box if tie-downs and the SUPPLEMENTAL TECHNICAL NOTES will be used.

⑧ Supplemental Earthquake Retrofit Schedule

1. Check if this Sheet is supplemenatal to sheet S3.1, otherwise check if additional retrofit schedule are required.
   ☐ S3.2-1.5 ☐ S3.4-1.5 ☐ S3.6-1.5
   ☐ S3.3-1.5 ☐ S3.5-1.5

APPLICANT: _____

PROPERTY ADDRESS: _____

Earthquake Retrofit Schedule - Wood Structural Panel with two sections of wall

Retrofit of Living-Space-Over-Garage Dwellings (Plan Set)
Vulnerability-Based Seismic Assessment and Retrofit of One- and Two-Family Dwellings
FEMA P-1100, Volume 2 - Plan Sets
Issued: SEPT 2019

FEMA

Date:

Sheet:

S3.2-1.5

EARTHQUAKE RETROFIT SCHEDULE (S_{DS} = 1.5)

① WEIGHT CLASSIFICATION	② Floor Area in Square Feet	③ ☒ Mark row that applies	④ STEEL COLUMN RETROFIT (2) (3)		⑤ PROPRIETARY SHEAR WALL RETROFIT (4) (5)	⑥ DIAPHRAGM NAILING (3) (5)
			Steel Column	Column Connection Type (per detail 2 on sheet D7) at Upper Floor	Minimum Required at Allowable Shear Capacity (lbs)	Edge Nail Spacing
Light Construction	800		W8x28	C1	4870	6
	1000		W8x28	C1	6090	6
	1200		W10x26	C2	7310	4
	1500		W12x35	C2	9140	4
	2000		W12x35	C3	12,200	4
Medium Construction	800		W8x28	C1	6300	4
	1000		W10x30	C2	7880	4
	1200		W12x35	C2	9450	4
	1500		W12x35	C3	11,800	3
	2000		"NG"	"NG"	15,800	3
Heavy Construction	800		W10x30	C2	8230	3
	1000		W12x35	C3	10,300	3
	1200		W12x35	C3	12,300	3
	1500		"NG"	"NG"	15,400	3
	2000		"NG"	"NG"	20,600	3

Notes:
1. Steel column and Proprietary Shear Wall Options are provided for front of garage or back of garage or house only.
2. See detail 4 on Sheet D7 for footing detail at steel column retrofit.
3. See details 1 & 2 on Sheet D7 for steel column connections at upper floor.
4. See details 4 & 5 on Sheet D8 for footing details at proprietary shear wall.
5. See details 1 & 2 on Sheet D8 for upper floor connection at proprietary shear wall.

INSTRUCTIONS

① Locate the section that matches your home's construction. Use the chart on Sheet S3 to determine "Weight Category".

② Find the home's Floor Area "B" x "L" (See Figures D-3 thru D-5) in the schedule, this number should be at least as large as the number listed below. Do not use a smaller number, even if it is closer.

a. Approximate floor area _____

③ Check the box that matches your home's area per ②. You will use information in this row of the schedule to select the steel column size and connection type or proprietary shear wall required.

④ Determine size of steel column and connection detail or see ⑤.

⑤ Determine minimum required allowable shear capacity to be used in selection of a proprietary shear wall. Note that more than one shear wall panel may be needed to obtain the required shear capacity. Consult manufacturer's load tables for final selection.

⑥ See details 1 & 2 on sheet D7 for steel column connections at upper floor.
See details 1 & 2 on sheet D8 for upper floor connection at proprietary shear wall.

⑦ Complete retrofit summary below.

⑦ RETROFIT SUMMARY
check box if selected

Steel Column
- ☐ At front wall
  - Column Size _____
  - Connection _____
  - Diaphragm Nailing _____
- ☐ At back wall
  - Column Size _____
  - Connection _____
  - Diaphragm Nailing _____

Proprietary Shear Wall
- ☐ At front wall
  - Req'd Capacity _____
  - MFR/ Size _____
  - Diaphragm Nailing _____
- ☐ At back wall
  - Req'd Capacity _____
  - MFR/ Size _____
  - Diaphragm Nailing _____

⑧ Supplemental Earthquake Retrofit Schedule

1. Check boxes if additional Earthquake Retrofit Schedules are included.
   - ☐ S3.1-1.5
   - ☐ S3.2-1.5
   - ☐ S3.3-1.5
   - ☐ S3.4-1.5
   - ☐ S3.5-1.5

APPLICANT: _____

PROPERTY ADDRESS: _____

Alternate Earthquake Retrofit Schedule (Steel Column or Propriety Shear Wall)

Retrofit of Living-Space-Over-Garage Dwellings (Plan Set)
Vulnerability-Based Seismic Assessment and Retrofit of One- and Two-Family Dwellings
FEMA P-1100, Volume 2 - Plan Sets
Issued: SEPT 2019

FEMA

Date:

Sheet:

S3.3-1.5

EARTHQUAKE RETROFIT SCHEDULE (S_{DS} = 1.5) for Single Section of Wall at Front of Garage - Only

① WEIGHT CLASSIFICATION	② Floor Area in Square Feet	③ Mark row that applies ☒	④ MINIMUM REQUIRED LENGTH OF A SINGLE SECTION OF WALL OF WOOD STRUCTURAL PANEL SHEAR WALLS (at each wall line)											⑤ FOUNDATION SILL ANCHORAGE Min. No. of Foundation Connectors or Anchors at Each Wall Panel					⑥ FLOOR FRAMING TO WALL CONNECTION Min. No. of Connectors at Each Wall Panel		
			No Tie-down		w/ Tie-downs in Existing or New Foundations															
					8d at 6" O.C.			8d at 4" O.C.			8d at 2" O.C.										
			8d Nail Spacing	Wall Length	Wall Length	Tie-down	New Fdn Req'd ?	Wall Length	Tie-down	New Fdn Req'd ?	Wall Length	Tie-down	New Fdn Req'd ?	Type "A"	Type "B"	Type "C"	1/2"ø Bolt	5/8"ø Bolt	Type "D"	Type "E" or "F"	Type "G"
Light Construction	800		6	14'-0"	9'-6"	TD1	No	6'-6"	TD3	Yes	4'-0"	TD5	Yes	3	4	6	5	3	7	7	9
	1000		6	16'-6"	11'-6"	TD1	No	8'-0"	TD2	Yes	5'-0"	TD5	Yes	3	5	7	6	4	9	8	11
	1200		6	18'-6"	14'-0"	TD1	No	9'-6"	TD2	Yes	5'-6"	TD5	Yes	4	6	8	7	5	10	10	13
	1500		6	22'-0"	17'-6"	TD1	No	12'-0"	TD2	Yes	7'-0"	TD4	Yes	5	8	10	8	6	13	12	16
	2000		6	27'-0"	23'-6"	TD1	No	16'-0"	TD2	Yes	9'-6"	TD4	Yes	6	10	13	11	8	17	16	21
Medium Construction	800		6	17'-6"	12'-0"	TD1	No	8'-6"	TD3	Yes	5'-0"	TD5	Yes	4	5	7	6	4	9	9	11
	1000		6	20'-6"	15'-0"	TD1	No	10'-6"	TD2	Yes	6'-0"	TD5	Yes	4	7	9	7	5	11	11	14
	1200		6	23'-0"	18'-0"	TD1	No	12'-6"	TD2	Yes	7'-6"	TD5	Yes	5	8	10	9	6	13	13	16
	1500		6	27'-0"	22'-6"	TD1	No	15'-6"	TD2	Yes	9'-0"	TD4	Yes	6	10	13	11	7	16	16	20
	2000		6	33'-0"	30'-6"	TD1	No	20'-6"	TD2	Yes	12'-6"	TD4	Yes	8	13	17	14	10	21	21	27
Heavy Construction	800		6	18'-6"	16'-0"	TD1	No	11'-0"	TD2	Yes	6'-6"	TD5	Yes	5	7	9	8	5	11	11	14
	1000		6	21'-6"	20'-0"	TD1	No	13'-6"	TD2	Yes	8'-0"	TD4	Yes	6	9	11	9	6	14	14	18
	1200		6	24'-6"	23'-6"	TD1	No	16'-0"	TD2	Yes	9'-6"	TD4	Yes	7	10	13	11	8	17	16	21
	1500		4	26'-6"	29'-6"	None	No	20'-6"	TD2	Yes	12'-0"	TD4	Yes	8	13	16	14	9	21	20	27
	2000		4	27'-6"	39'-6"	None	No	27'-0"	TD1	No	16'-0"	TD4	Yes	11	17	22	18	12	28	27	35

INSTRUCTIONS

1. Locate the section that matches your home's construction. Use the chart on Sheet S3 to determine "Weight Category".
2. Find the home's Floor Area "B" x "L" (See Figures D-3 thru D-5) in the schedule, this number should be at least as large as the number listed below. Do not use a smaller number, even if it is closer.
   a. Approximate floor area _____
3. Check the box that matches your home's area per ②. You will use information in this row of the schedule to determine length of plywood bracing panels, nailing requirements, quantities of hardware, etc.
4. Determine the length of plywood bracing required. The columns contain the length of required bracing, including options for bracing without tie-downs, with tie-downs into existing foundations and tie-downs w/ new foundations, see schedule Note 3. Follow the row across from the total floor area that you checked for your home (in Step 3) to find the bracing length for each side of the house (front, back, left side, right side).
5. Determine the number of Foundation Sill Connectors or Anchors required. The columns show the number of anchors required, depending on whether you use Types A through C, or number of 1/2"ø or 5/8"ø anchor bolts. (ø = diameter of the bolts.) See Sheet S3.
6. Determine the number of Floor to Wall connectors. The columns indicate how many framing connectors are required, depending on whether you use Types D, E, F, or G. See Sheet S3.
7. Complete the Retrofit Summary for your project. Fill in the lengths found in ④ for each line. If no option is available, see Schedule notes 6 & 7. Check the boxes for the anchor and connector types you plan to use. If you intend to use tie-downs, check the box for tie-downs after each wall line you plan to use them for, check the box on line 4, and read the Supplemental Technical Notes for additional information.
8. Include Earthquake Retrofit Schedule Sheets S3.1-1.5 thru S3.6-1.5 where applicable. See sheet S3, Figure 2 and schedule notes 6 and 7.

Notes:

1. Anchor bolts and Connectors shown in the Earthquake Retrofit Schedule are the minimum required per wall line, placed within the length of strengthening where possible. Additional anchors and connectors may be necessary to meet the requirements of specific details and General Notes.
2. Tie-downs: If your foundation meets the criteria, you may choose the tie-down option to decrease the required length of strengthening. This may be required where the length of the wall without tie downs specified in this schedule is longer than can be accommodated by existing conditions. However, there is a level of uncertainty when dealing with existing foundations, therefore, where possible, longer lengths of strengthening, without tie-downs, are preferred. (See Supplemental Technical Notes, Sheet S2 to verify the existing foundation is suitable and meets criteria.) Where "None" occurs, no tie-down is required.
3. Foundations: Where new foundations are required, see Sheet D2 for details.
4. Connector Type "F" should be used as an alternative only if joists are blocked on both sides and where accessibility makes the use of Types "D" or "E" impractical.
5. Any of the connectors listed within a particular group and as shown on Sheet S3 may be used for strengthening the particular condition.
6. This Plan Set was developed using the lowest listed manufacturer's capacity within a particular group. Cells marked "NG" on the applicable Earthquake Retrofit Schedule may be found to have an acceptable spacing where an alternate connector is used. Any such substitution can only be made by a Registered Design Professional.
7. Wall lengths are total length of a single wall section required. See Sheet S3.5-1.5 for 2 section of wall options.
8. See Sheet S3.6-1.5 for Alternate Earthquake Retrofit Options where sufficient length of wall does not occur or where wood structural panel shear wall retrofit installations are otherwise prohibited.

⑦ RETROFIT SUMMARY

BRACING, ANCHORS, CONNECTORS, AND TIE-DOWNS

1. Required length of strengthening at garage front wall line: (check box if tie-downs will be used on that line)
   Front Wall _____ft ☐ with Tie-Down Type _____
   Front Wall _____ft ☐ without Tie-Down
2. New Foundation Sill Anchorage to be used: (check all that apply)
   Bolts: Diameter_____ ☐ Adhesive ☐ Screw
   ☐ Type "A" Connector ☐ Type "C" Connector
   ☐ Type "B" Connector
   Minimum required number of Sill Anchors per wall line _____
3. Floor Framing Connectors (to Foundation Sill or to Top Plate) to be used: (check all that apply)
   ☐ Type "D" ☐ Type "F"
   ☐ Type "E" ☐ Type "G"
   Minimum required number of Floor Framing Connectors per wall line _____
4. ☐ Check this box if tie-downs and the SUPPLEMENTAL TECHNICAL NOTES will be used.

⑧ Supplemental Earthquake Retrofit Schedule

1. Check boxes if additional Earthquake Retrofit Schedues are included.
   ☐ S3.2-1.5 ☐ S3.4-1.5 ☐ S3.6-1.5
   ☐ S3.3-1.5 ☐ S3.5-1.5

APPLICANT: _____

PROPERTY ADDRESS: _____

Earthquake Retrofit Schedule - at front of garage only in dwelling with ground story residential unit

Retrofit of Living-Space-Over-Garage Dwellings (Plan Set)
Vulnerability-Based Seismic Assessment and Retrofit of One- and Two-Family Dwellings
FEMA P-1100, Volume 2 - Plan Sets
Issued: SEPT 2019

FEMA

Date:

Sheet:

S3.4-1.5

EARTHQUAKE RETROFIT SCHEDULE (S_{DS} = 1.5) Two Sections of Wall at Front of Garage - Only

① WEIGHT CLASSIFICATION	② Floor Area in Square Feet	③ ☒ Mark row that applies	④ MINIMUM TOTAL REQUIRED LENGTH OF EACH SECTION OF WOOD STRUCTURAL PANEL SHEAR WALLS For a Two Section of Wall Option						⑤ FOUNDATION SILL ANCHORAGE Min. No. of Foundation Connectors or Anchors at Each Section of Wall					⑥ FLOOR FRAMING TO WALL CONNECTION Min. No. of Connectors at Each Section of Wall		
			Length per Section for a Two Section Option													
			8d at 6" O.C.			8d at 2" O.C.										
			Wall Length	Tie-down	New Fdn Req'd ?	Wall Length	Tie-down	New Fdn Req'd ?	Type "A"	Type "B"	Type "C"	1/2"ø Bolt	5/8"ø Bolt	Type "D"	Type "E" or "F"	Type "G"
Light Construction	800		4'-6"	TD1	No	2'-6"	TD4	Yes	2	2	3	3	2	4	4	5
	1000		6'-0"	TD1	No	3'-0"	TD4	Yes	2	3	4	3	2	5	4	6
	1200		7'-0"	TD1	No	3'-0"	TD4	Yes	2	3	4	4	3	5	5	7
	1500		9'-0"	TD1	No	4'-0"	TD4	Yes	3	4	5	4	3	7	6	8
	2000		12'-0"	TD1	No	5'-0"	TD5	Yes	3	5	7	6	4	9	8	11
Medium Construction	800		6'-0"	TD1	No	3'-0"	TD4	Yes	2	3	4	3	2	5	5	6
	1000		7'-6"	TD1	No	3'-6"	TD5	Yes	2	4	5	4	3	6	6	7
	1200		9'-0"	TD1	No	4'-0"	TD5	Yes	3	4	5	5	3	7	7	8
	1500		11'-6"	TD1	No	4'-6"	TD5	Yes	3	5	7	6	4	8	8	10
	2000		15'-0"	TD1	No	6'-0"	TD5	Yes	4	7	9	7	5	11	11	14
Heavy Construction	800		8'-0"	TD1	No	3'-6"	TD4	Yes	3	4	5	4	3	6	6	7
	1000		10'-0"	TD1	No	4'-0"	TD4	Yes	3	5	6	5	3	7	7	9
	1200		12'-0"	TD1	No	5'-0"	TD4	Yes	4	5	7	6	4	9	8	11
	1500		15'-0"	None	No	6'-0"	TD4	Yes	4	7	8	7	5	11	10	14
	2000		20'-0"	None	No	8'-0"	TD4	Yes	6	9	11	9	6	14	14	18

Notes:

1. Anchor bolts and Connectors shown in the Earthquake Retrofit Schedule are the minimum required per section of wall, placed within the length of strengthening where possible. Total number of anchor bolts and connectors shall equal twice the number shown in the schedule. Additional anchors and connectors may be necessary to meet the requirements of specific details and General Notes.
2. Tie-downs: If your foundation meets the criteria, you may choose the tie-down option to decrease the required length of strengthening. This may be required where the length of the wall without tie downs specified in this schedule is longer than can be accommodated by existing conditions. However, there is a level of uncertainty when dealing with existing foundations, therefore, where possible, longer lengths of strengthening, without tie-downs, are preferred. (See Supplemental Technical Notes, Sheet S2 to verify the existing foundation is suitable and meets criteria.) Where "None" occurs, no tie-down is required.
3. Foundations: Where new foundations are required, see Sheet D2 for details.
4. Connector Type "F" should be used as an alternative only if joists are blocked on both sides and where accessibility makes the use of Types "D" or "E" impractical.
5. Any of the connectors listed within a particular group and as shown on Sheet S3 may be used for strengthening the particular condition.
6. This Plan Set was developed using the lowest listed manufacturer's capacity within a particular group. Cells marked "NG" on the applicable Earthquake Retrofit Schedule may be found to have an acceptable spacing where an alternate connector is used. Any such substitution can only be made by a Registered Design Professional.
7. Wall lengths are minimum length of each wall section required on the garage front wall line.
8. See Sheet S3.6-1.5 for Alternate Earthquake Retrofit Options where sufficient length of wall panel does not occur or where wood structural panel shear wall retrofit installations are otherwise prohibited.

INSTRUCTIONS

① Locate the section that matches your home's construction. Use the chart on Sheet S3 to determine "Weight Category".

② Find the home's Floor Area "B" x "L" (See Figures D-3 thru D-5) in the schedule, this number should be at least as large as the number listed below. Do not use a smaller number, even if it is closer.

a. Approximate floor area _____

③ Check the box that matches your home's area per ②. You will use information in this row of the schedule to determine length of plywood bracing panels, nailing requirements, quantities of hardware, etc.

④ Determine the length of plywood bracing required. The columns contain the length of required bracing, including options for bracing without tie-downs, with tie-downs into existing foundations and tie-downs w/ new foundations, see schedule Note 3. Follow the row across from the total floor area that you checked for your home (in Step 3) to find the bracing length for each side of the house (front, back, left side, right side).

⑤ Determine the number of Foundation Sill Connectors or Anchors required. The columns show the number of anchors required, depending on whether you use Types A through C, or number of 1/2"ø or 5/8"ø anchor bolts. (ø = diameter of the bolts.) See Sheet S3.

⑥ Determine the number of Floor to Wall connectors. The columns indicate how many framing connectors are required, depending on whether you use Types D, E, F, or G. See Sheet S3.

⑦ Complete the Retrofit Summary for your project. Fill in the lengths found in ④ for each line. If no option is available, see Schedule notes 6 & 7. Check the boxes for the anchor and connector types you plan to use. If you intend to use tie-downs, check the box for tie-downs after each wall line you plan to use them for, check the box on line 4, and read the Supplemental Technical Notes for additional information.

⑧ Include Earthquake Retrofit Schedule Sheets S3.1-1.5 thru S3.6-1.5 where applicable. See sheet S3, Figure 2 and schedule notes 6 and 7.

⑦ RETROFIT SUMMARY
BRACING, ANCHORS, CONNECTORS, AND TIE-DOWNS

1. Required length of each section of strengthening per wall line: (check box if tie-downs will be used on that line)
   Front Wall _____ft ☐ with Tie-Down Type _____
   Front Wall _____ft ☐ without Tie-Down
2. New Foundation Sill Anchorage to be used: (check all that apply)
   Bolts: Diameter_____ ☐ Adhesive ☐ Screw
   ☐ Type "A" Connector ☐ Type "C" Connector
   ☐ Type "B" Connector
   Minimum required number of Sill Anchors per wall line _____
3. Floor Framing Connectors (to Foundation Sill or to Top Plate) to be used: (check all that apply)
   ☐ Type "D" ☐ Type "F"
   ☐ Type "E" ☐ Type "G"
   Minimum required number of Floor Framing Connectors per wall line _____
4. ☐ Check this box if tie-downs and the SUPPLEMENTAL TECHNICAL NOTES will be used.

⑧ Supplemental Earthquake Retrofit Schedule

1. Check boxes if additional Earthquake Retrofit Schedules are included.
   ☐ S3.1-1.5 ☐ S3.3-1.5 ☐ S3.6-1.5
   ☐ S3.2-1.5 ☐ S3.4-1.5

APPLICANT: _____

PROPERTY ADDRESS: _____

Earthquake Retrofit Schedule at front of garage only in dwelling with ground story residential unit

Retrofit of Living-Space-Over-Garage Dwellings (Plan Set)
Vulnerability-Based Seismic Assessment and Retrofit of One- and Two-Family Dwellings
FEMA P-1100, Volume 2 - Plan Sets
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Sheet: **S3.5-1.5**

EARTHQUAKE RETROFIT SCHEDULE (S_{DS} = 1.5) at front of Garage

① WEIGHT CLASSIFICATION	② Floor Area in Square Feet	③ ☒ Mark row that applies	STEEL COLUMN RETROFIT (2) (3)		PROPRIETARY SHEAR WALL RETROFIT (4) (5)	DIAPHRAGM NAILING (3) (5)
			Steel Column	Column Connection Type (per detail 2 on sheet D7) at Upper Floor	Minimum Required at Allowable Shear Capacity (lbs)	Edge Nail Spacing
Light Construction	800		W8x21	C1	2440	6
	1000		W8x21	C1	3050	6
	1200		W8x21	C1	3650	6
	1500		W8x21	C1	4570	6
	2000		W8x28	C1	6090	6
Medium Construction	800		W8x21	C1	3150	6
	1000		W8x21	C1	3940	6
	1200		W8x28	C1	4730	6
	1500		W8x28	C1	5910	6
	2000		W10x30	C2	7880	6
Heavy Construction	800		W8x21	C1	4120	6
	1000		W8x28	C1	5150	6
	1200		W8x28	C1	6170	6
	1500		W10x30	C2	7720	6
	2000		W12x35	C3	10,300	6

Notes:
1. Steel column and Proprietary Shear Wall Options are provided for front of garage or back of garage or house only.
2. See detail 4 on Sheet D7 for footing detail at steel column retrofit.
3. See details 1 & 2 on Sheet D7 for steel column connections at upper floor.
4. See details 4 & 5 on Sheet D8 for footing details at proprietary shear wall.
5. See details 1 & 2 on Sheet D8 for upper floor connection at proprietary shear wall.

INSTRUCTIONS

① Locate the section that matches your home's construction. Use the chart on Sheet S3 to determine "Weight Category".

② Find the home's Floor Area "B" x "L" (See Figures D-3 thru D-5) in the schedule, this number should be at least as large as the number listed below. Do not use a smaller number, even if it is closer.

a. Approximate floor area _____

③ Check the box that matches your home's area per ②. You will use information in this row of the schedule to steel column size and connection type or proprietary shear wall required.

④ Determine size of steel column and connection detail or see ⑤.

⑤ Determine minimum required allowable shear capacity to be used in selection of a proprietary shear wall. Consult manufacturer's load tables for final selection. Note that more than one shear wall panel may be needed to obtain the required shear capacity. Consult manufacturer's load tables for final selection.

⑥ See details 1 & 2 on sheet D7 for steel column connections at upper floor.
See details 1 & 2 on sheet D8 for upper floor connection at proprietary shear wall.

⑦ Complete retrofit it summary below.

⑦ RETROFIT SUMMARY
check box if selected

Steel Column
- ☐ At front wall
  - Column Size _____
  - Connection _____
  - Diaphragm Nailing _____
- ☐ At back wall
  - Column Size _____
  - Connection _____
  - Diaphragm Nailing _____

Proprietary Shear Wall
- ☐ At front wall
  - Req'd Capacity _____
  - MFR/ Size _____
  - Diaphragm Nailing _____
- ☐ At back wall
  - Req'd Capacity _____
  - MFR/ Size _____
  - Diaphragm Nailing _____

⑧ Supplemental Earthquake Retrofit Schedule

1. Check boxes if additional Earthquake Retrofit Schedules are included.
   - ☐ S3.1-1.5
   - ☐ S3.2-1.5
   - ☐ S3.3-1.5
   - ☐ S3.4-1.5
   - ☐ S3.5-1.5

APPLICANT: _____

PROPERTY ADDRESS: _____

Alternate Earthquake Retrofit Sched. at front of garage in dwelling w/ ground story residential unit

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FEMA P-1100, Volume 2 - Plan Sets
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Date:

Sheet:

S3.6-1.5

RETROFIT SCHEDULE SUMMARY

See the Retrofit Summary on the Sheet indicated below for additional requirements on each wall line.

Front Wall _____
Back Wall _____
Left Side Wall _____
Right Side Wall _____

General Sheet Notes:

1. For Shear Wall Framing at walls without Tie-Downs, see Det. 1/D4.
2. For Shear Wall Framing at walls with Tie-Downs, see Det. 1/D5.
3. For wall sheathing cutouts, see Det. 3/D6.
4. For wall stud and top plate penetrations, see Det. 4/D6.
5. For wall top plate splices, see Det. 1/D6 at existing double top plates and Det. 2/D6 at single top plates.

Key:

- # — Retrofit shear wall edge nail spacing per the Earthquake Retrofit Schedule. # denotes the edge nail spacing.
- + — Foundation sill anchor bolt or connector, number per line per the Retrofit Schedule
- ■ — Floor to wall framing connector, number per line per the Retrofit Schedule
- TD-# — Tie-down. # denotes the tie down size per schedule, see sheet S3.

ONE SQUARE = _____ FEET

Show north arrow and indicate street side (front) of home.

APPLICANT: _____

PROPERTY ADDRESS: _____

Foundation and Retrofit Layout Plan

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FEMA P-1100, Volume 2 - Plan Sets
Issued: SEPT 2019

FEMA

Date:

Sheet:

S4

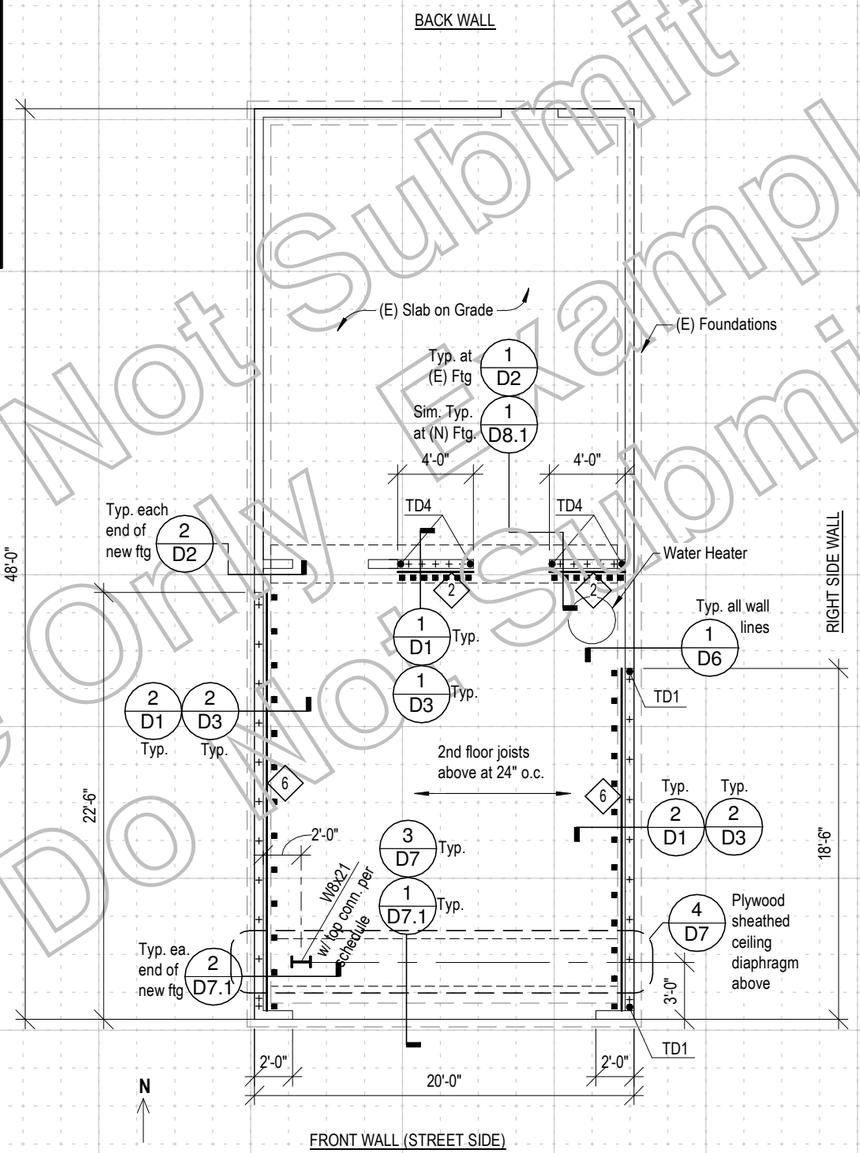
RETROFIT SCHEDULE SUMMARY

See the Retrofit Summary on the Sheet indicated below for additional requirements on each wall line.

Front Wall	S3.6-1.2
Back Wall	S3.2-1.2
Left Side Wall	S3.1-1.2
Right Side Wall	S3.1-1.2

General Sheet Notes:

1. For Shear Wall Framing at walls without Tie-Downs, see Det. 1/D4.
2. For Shear Wall Framing at walls with Tie-Downs, see Det. 1/D5.
3. For wall sheathing cutouts, see Det. 3/D6.
4. For wall stud and top plate penetrations, see Det. 4/D6.
5. For wall top plate splices, see Det. 1/D6 at existing double top plates and Det. 2/D6 at single top plates.



Key:

- # — Retrofit shear wall edge nail spacing per the Earthquake Retrofit Schedule. # denotes the edge nail spacing.
- \+ — Foundation sill anchor bolt or connector, number per line per the Retrofit Schedule
- ■ — Floor to wall framing connector, number per line per the Retrofit Schedule
- TD-# — Tie-down. # denotes the tie down size per schedule, see sheet S3.

ONE SQUARE = 2 FEET

APPLICANT: _____

PROPERTY ADDRESS: _____

Foundation and Retrofit Layout Plan

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FEMA P-1100, Volume 2 - Plan Sets
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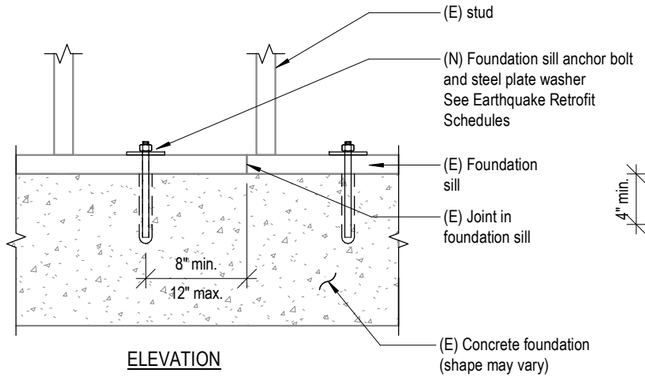
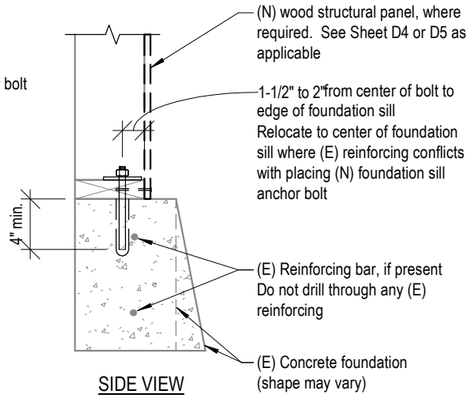
Date:

Sheet: **S4ex**



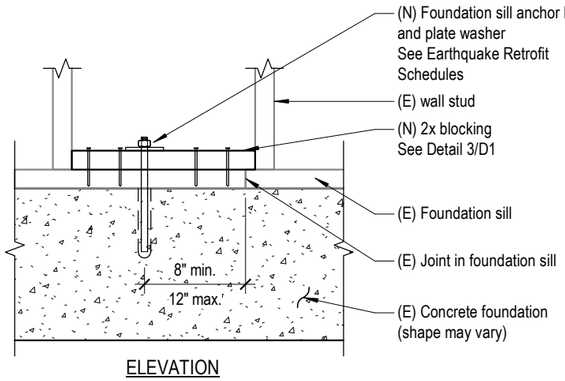
ELEVATION



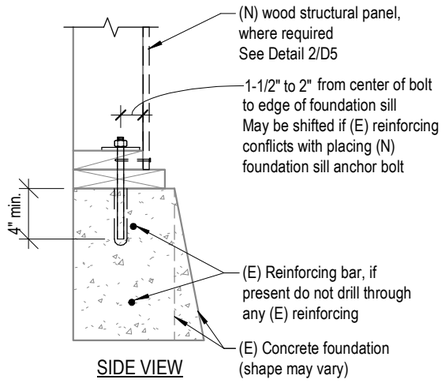
SIDE VIEW

1 ANCHOR THROUGH FOUNDATION SILL ONLY

Detail applies where (E) foundation sill is the same width as the (E) wall studs



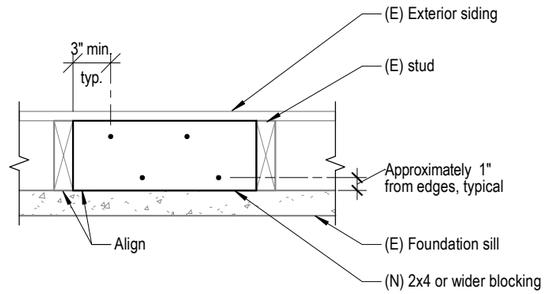
ELEVATION



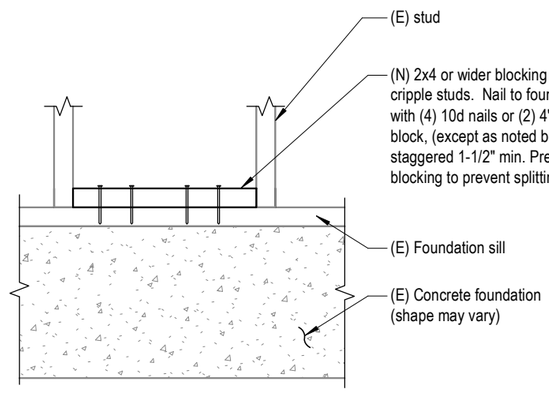
SIDE VIEW

2 ANCHOR THROUGH BLOCKING AND FOUNDATION SILL

Detail applies where (E) foundation sill is wider than the (E) wall studs



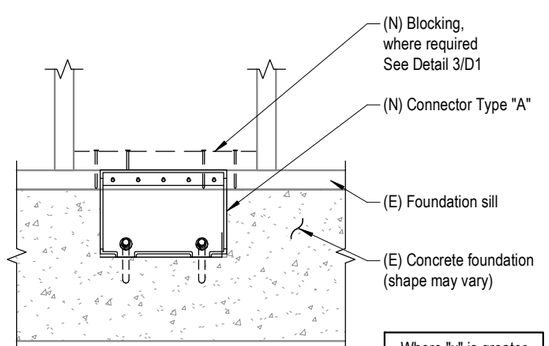
TOP VIEW



ELEVATION

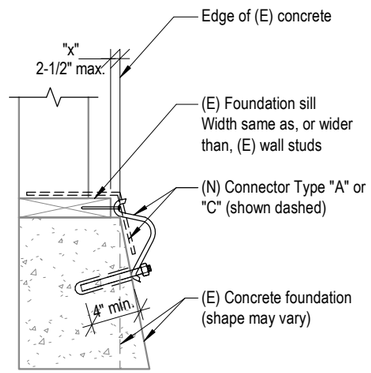
Note:
Where 8d at 2" O.C. are required per the schedules, provide (6) 10d nails or (3) 4" screws per block.

3 NEW BLOCKING INSTALLATION FOR WOOD STRUCTURAL PANEL ATTACHMENT

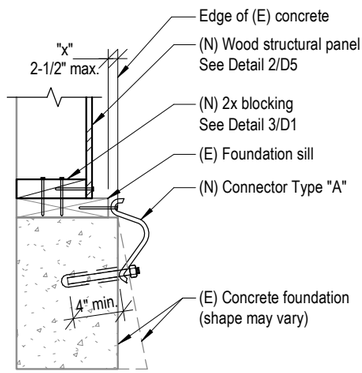


ELEVATION

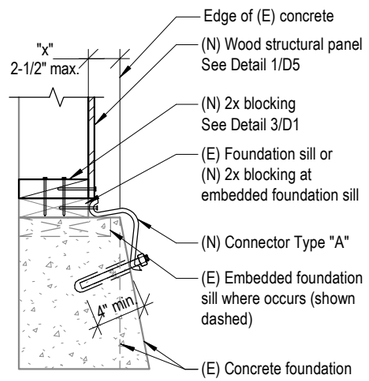
Where "x" is greater than 2-1/2", use Connector Type "C".



SIDE VIEW
Where no wood structural panel is required



SIDE VIEW
At (N) wood structural panel where (E) foundation sill is wider than (E) wall studs



SIDE VIEW
At (N) wood structural panel where (E) foundation sill is same width as (E) wall studs

4 FOUNDATION SILL CONNECTORS

MATERIAL KEY:

Below is a key to common call-outs in the details. Unless specified otherwise in the details, use the sizes and materials as follows:

Term	Description
Nails	
8d (8 penny) at Connectors attached over plywood	0.131" x 2-1/2" long
8d (8 penny) at Connectors attached directly to framing	0.131" x 1-1/2" long
10d (10 penny) at Connectors attached over plywood	0.148" x 3" long
10d (10 penny) at Connectors attached directly to framing	0.148" x 1-1/2" long
16d (16 penny)	0.162" x 3-1/2" long
20d (20 penny)	0.192" x 4" long
Screws	Simpson Strong-Tie 1/4" SDS, GRK 3/8" RSS "Climatek", USP Mitek 1/4" WS "Gold Coat", or equivalent.
3" screw	3" long structural wood screw
4" screw	4" long structural wood screw
6" screw	6" long structural wood screw
Wood Structural Panel	15/32" Wood Structural Panel-Sheathing. Exposure 1, 5-Ply.
LVL (Laminated Veneer Lumber)	Weyerhauser "Microllam", Boise-Cascade "VersaLam", Georgia-Pacific "GP-Lam", LP "Solid Start", or equivalent.
Plate Washer	3" x 3" square x 0.229" thick.
"Peel & Stick" Flashing Tape	Fortiflash, Orange Peel-n-Seal, Typar, Tyvek, Vycor, HardieWrap, or equivalent.

For Connector types see Sheet S3.

ABBREVIATIONS

Clr.	Clearance
Conc.	Concrete
Dia.	Diameter
(E)	Existing
EQ.	Equal
E.N.	Edge Nail
Emb.	Embedment
(N)	New
Max.	Maximum
Min.	Minimum
Mfr.	Manufacturer
N.T.S.	Not to Scale
O.C.	On Center
PL	Plate
S.O.G.	Slab on ground
Typ.	Typical
w/	with

APPLICANT:

PROPERTY ADDRESS:

Foundation Sill to Concrete Foundation Connection Details

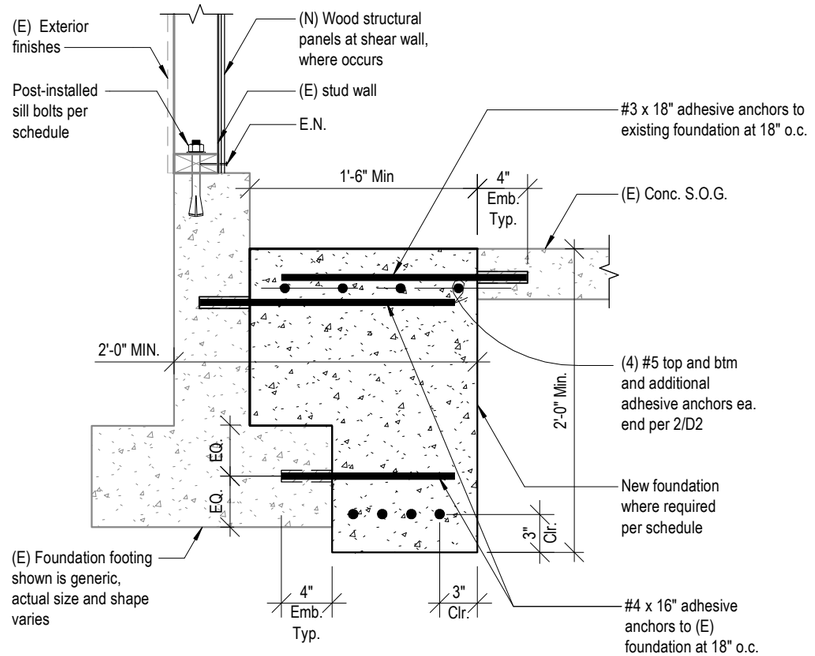
Retrofit of Living-Space-Over-Garage Dwellings (Plan Set)
Vulnerability-Based Seismic Assessment and Retrofit of One- and Two-Family Dwellings
FEMA P-1100, Volume 2 - Plan Sets
Issued: SEPT 2019

FEMA

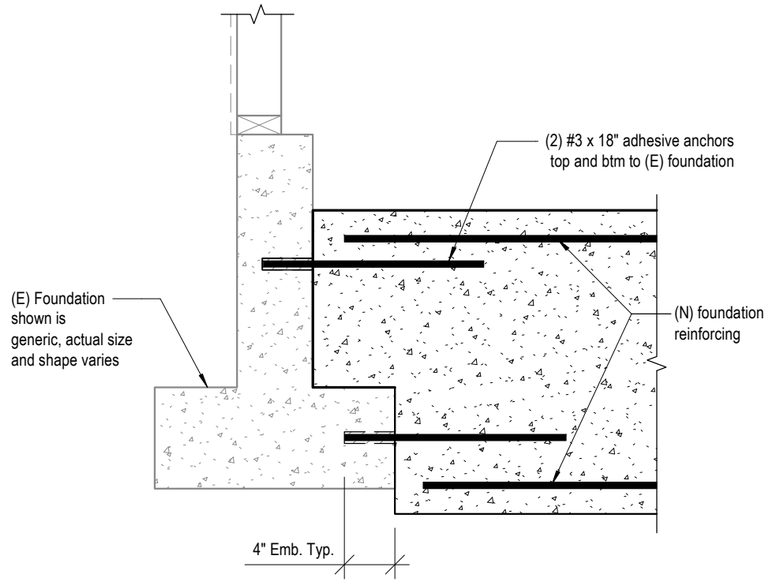
Date:

Sheet:

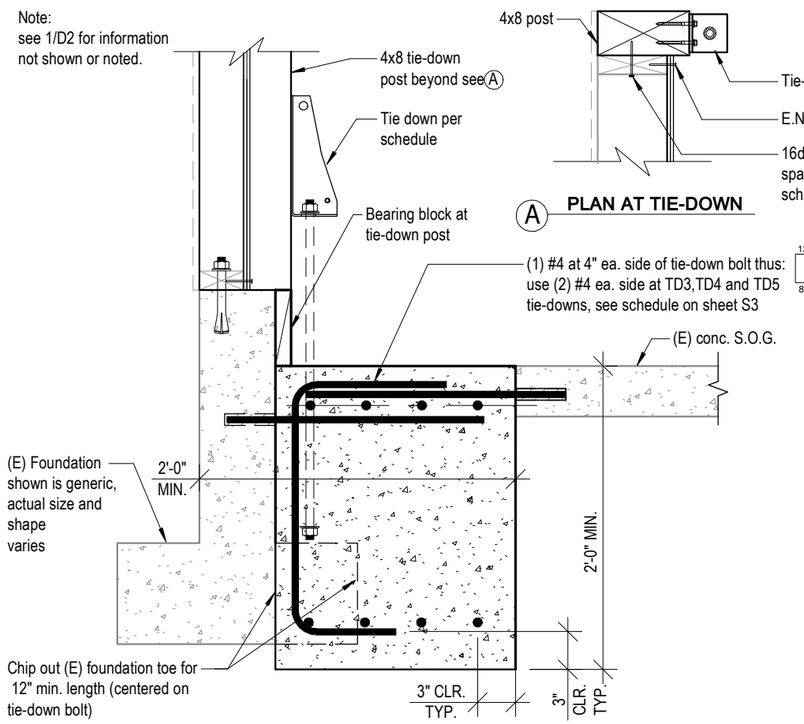
D1



1 NEW FOOTING INSTALLATION AT NEW WOOD STRUCTURAL PANEL SHEAR WALL



2 TIES FROM NEW TO EXISTING FOUNDATION



3 TYPICAL TIE-DOWN AT NEW FOUNDATION

MATERIAL KEY:

Below is a key to common call-outs in the details. Unless specified otherwise in the details, use the sizes and materials as follows:

Term	Description
Nails	
8d (8 penny) at Connectors attached over plywood	0.131" x 2-1/2" long
8d (8 penny) at Connectors attached directly to framing	0.131" x 1-1/2" long
10d (10 penny) at Connectors attached over plywood	0.148" x 3" long
10d (10 penny) at Connectors attached directly to framing	0.148" x 1-1/2" long
16d (16 penny)	0.162" x 3-1/2" long
20d (20 penny)	0.192" x 4" long
Screws	Simpson Strong-Tie 1/4" SDS, GRK 3/8" RSS "Climatek", USP Mitek 1/4" WS "Gold Coat", or equivalent.
3" screw	3" long structural wood screw
4" screw	4" long structural wood screw
6" screw	6" long structural wood screw
Wood Structural Panel	15/32" Wood Structural Panel-Sheathing. Exposure 1, 5-Ply.
LVL (Laminated Veneer Lumber)	Weyerhauser "Microllam", Boise-Cascade "VersaLam", Georgia-Pacific "GP-Lam", LP "Solid Start", or equivalent.
Plate Washer	3" x 3" square x 0.229" thick.
"Peel & Stick" Flashing Tape	Fortiflash, Orange Peel-n-Seal, Typar, Tyvek, Vycor, HardieWrap, or equivalent.

ABBREVIATIONS

Clr.	Clearance
Conc.	Concrete
Dia.	Diameter
(E)	Existing
EQ.	Equal
E.N.	Edge Nail
Emb.	Embedment
(N)	New
Max.	Maximum
Min.	Minimum
Mfr.	Manufacturer
N.T.S.	Not to Scale
O.C.	On Center
PL	Plate
S.O.G.	Slab on ground
Typ.	Typical
w/	with

APPLICANT: _____

PROPERTY ADDRESS: _____

Foundation Details at Wood Structural Panel Shear Walls

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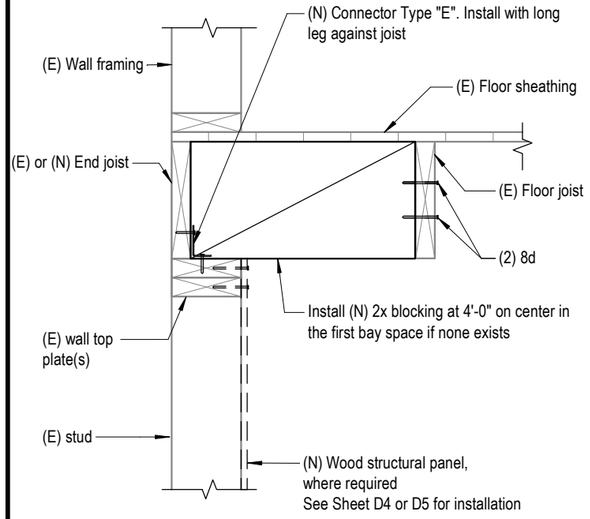
FEMA P-1100, Volume 2 - Plan Sets
Issued: SEPT 2019

FEMA

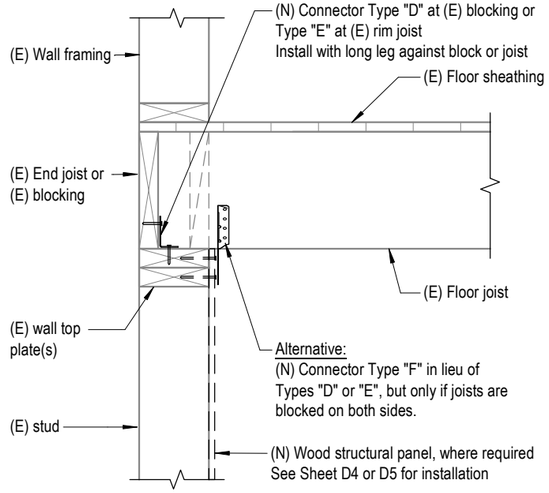
Date:

Sheet: **D2**



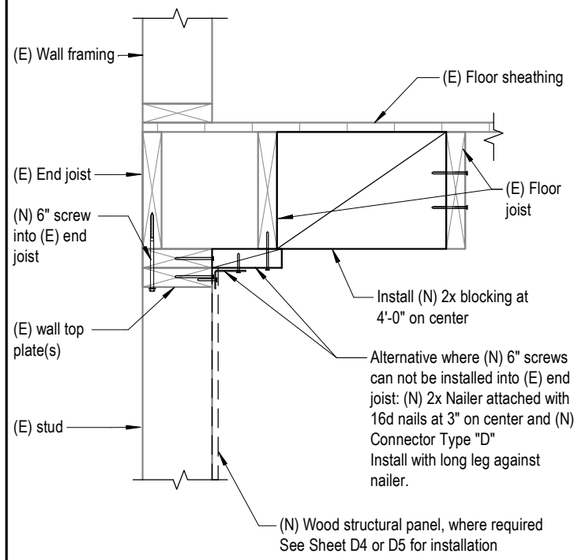
Note:
See Detail 2/D3 where joist framing is perpendicular to (E) wall.

1 FLOOR-TO-WALL CONNECTION
AT PARALLEL JOISTS

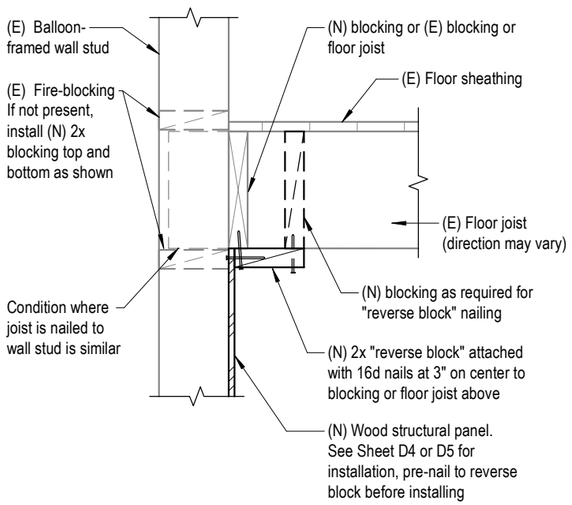


Note:
See Detail 1/D3 where joist framing is parallel to (E) wall.

2 FLOOR-TO WALL CONNECTION
AT PERPENDICULAR JOISTS

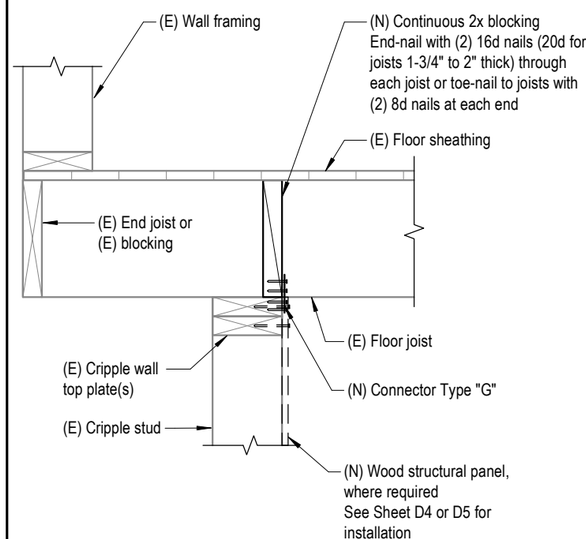


3 FLOOR-TO-WALL CONNECTION
WHERE END JOIST IS NOT ACCESSIBLE



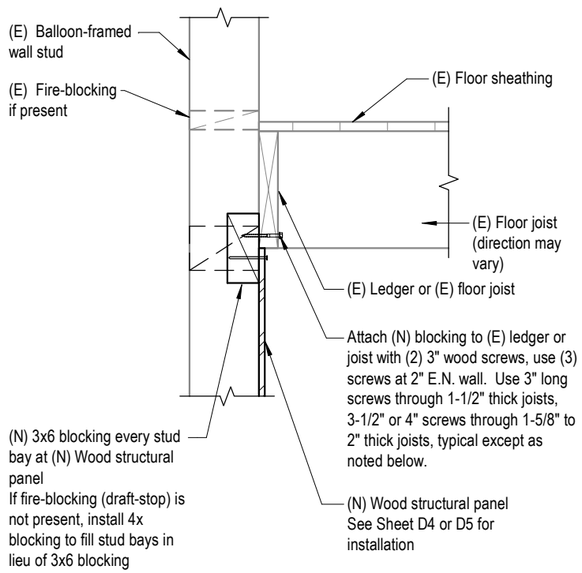
Note:
(N) blocking shall be installed snug tight with (3) 8d toe nails each end into perpendicular members.

4 FLOOR-TO-WALL CONNECTION
AT BALLOON-FRAMED WALLS



Note:
Use detail where no joist blocks exist above wall top plate

5 FLOOR-TO-WALL CONNECTION
AT FLOOR OVERHANG



Note:
Where 8d at 2" o.c. is required per the schedules, provide (3) screws.

6 FLOOR-TO-WALL CONNECTION

MATERIAL KEY:

Below is a key to common call-outs in the details. Unless specified otherwise in the details, use the sizes and materials as follows:

Term	Description
Nails	
8d (8 penny) at Connectors attached over plywood	0.131" x 2-1/2" long
8d (8 penny) at Connectors attached directly to framing	0.131" x 1-1/2" long
10d (10 penny) at Connectors attached over plywood	0.148" x 3" long
10d (10 penny) at Connectors attached directly to framing	0.148" x 1-1/2" long
16d (16 penny)	0.162" x 3-1/2" long
20d (20 penny)	0.192" x 4" long
Screws	Simpson Strong-Tie 1/4" SDS, GRK 3/8" RSS "Climatek", USP Mitek 1/4" WS "Gold Coat", or equivalent.
3" screw	3" long structural wood screw
4" screw	4" long structural wood screw
6" screw	6" long structural wood screw
Wood Structural Panel	15/32" Wood Structural Panel-Sheathing. Exposure 1, 5-Ply.
LVL (Laminated Veneer Lumber)	Weyerhauser "Microllam", Boise-Cascade "VersaLam", Georgia-Pacific "GP-Lam", LP "Solid Start", or equivalent.
Plate Washer	3" x 3" square x 0.229" thick.
"Peel & Stick" Flashing Tape	Fortiflash, Orange Peel-n-Seal, Typar, Tyvek, Vycor, HardieWrap, or equivalent.

For Connector types see Sheet S3.

ABBREVIATIONS

Clr.	Clearance
Conc.	Concrete
Dia.	Diameter
(E)	Existing
EQ.	Equal
E.N.	Edge Nail
Emb.	Embedment
(N)	New
Max.	Maximum
Min.	Minimum
Mfr.	Manufacturer
N.T.S.	Not to Scale
O.C.	On Center
PL	Plate
S.O.G.	Slab on ground
Typ.	Typical
w/	with

APPLICANT:

PROPERTY ADDRESS:

Floor Framing to Wall Connection Details

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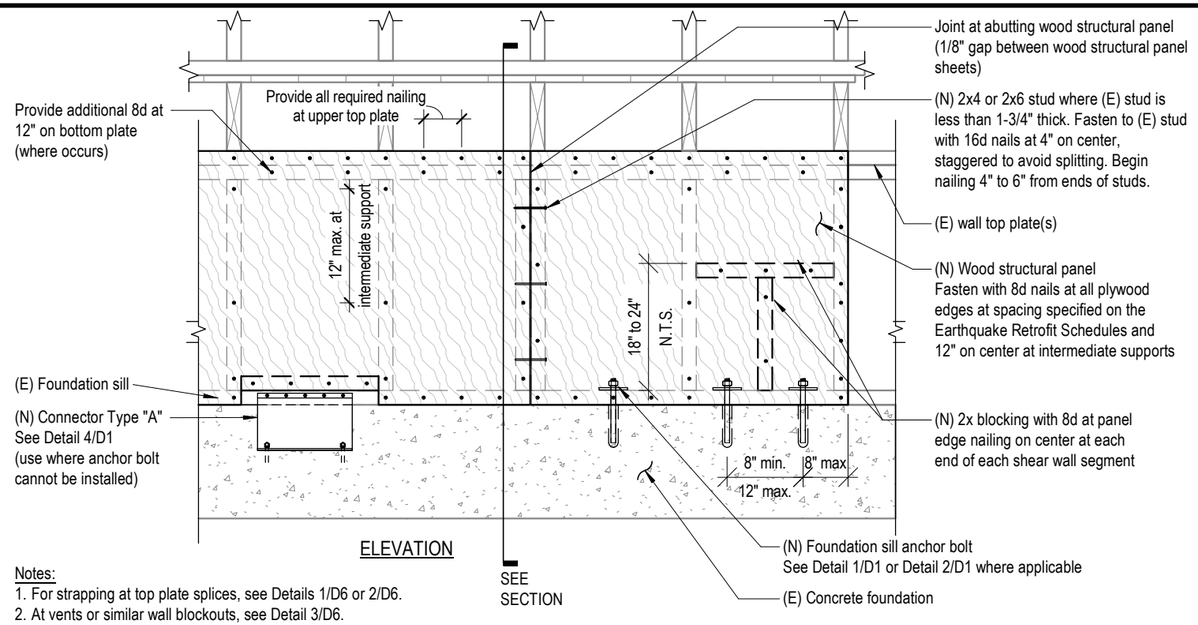
FEMA P-1100, Volume 2 - Plan Sets
Issued: SEPT 2019

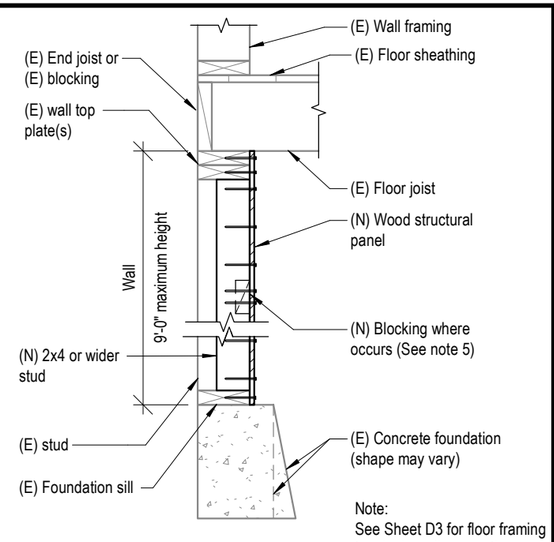
FEMA

Date:

Sheet:

D3



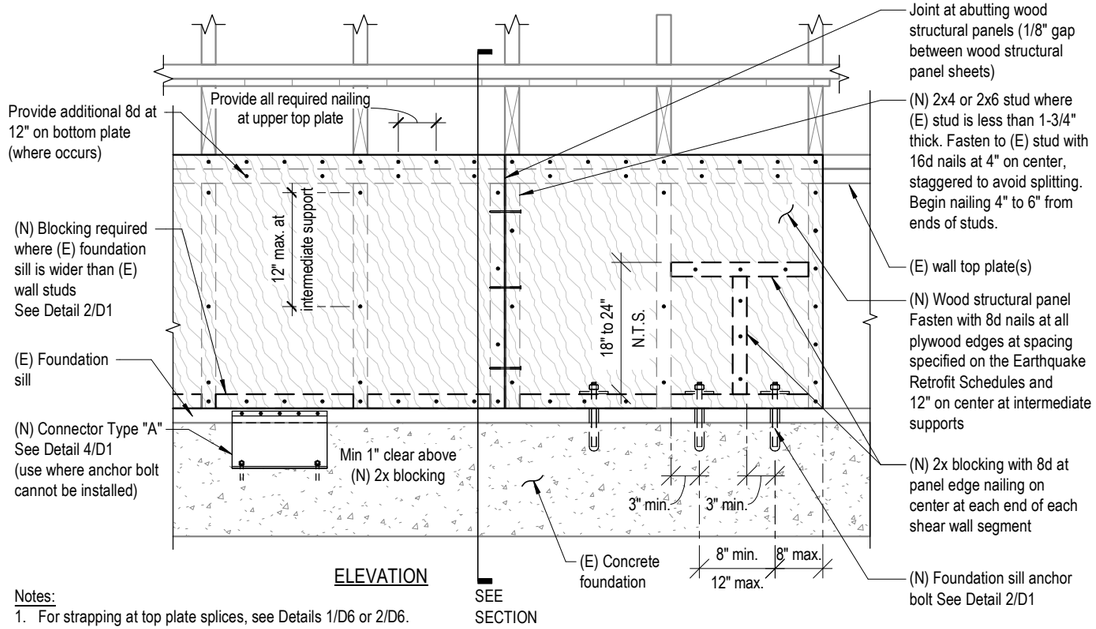


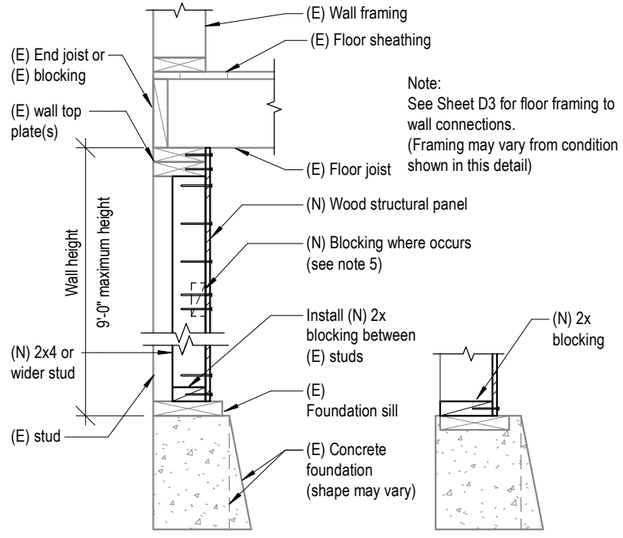
SECTION

Note:
See Sheet D3 for floor framing to cripple wall connections.
(Framing may vary from condition shown in this detail).

Notes:
1. For strapping at top plate splices, see Details 1/D6 or 2/D6.
2. At vents or similar wall blockouts, see Detail 3/D6.
3. Prior to installing wood structural panels, see Detail 4/D6 where pipes or conduits pass through studs or top plates.
4. Wood structural panels may be installed vertically (face grain parallel to stud) or horizontally.
5. Provide 2x4 flat blocking at all horizontal panel edges.

1 FOUNDATION SILL SAME WIDTH AS WALL





SECTION

Note:
See Sheet D3 for floor framing to wall connections.
(Framing may vary from condition shown in this detail)

SECTION
Condition where (E) foundation sill is embedded in concrete

Notes:
1. For strapping at top plate splices, see Details 1/D6 or 2/D6.
2. At crawlspace vents or similar cripple-wall blockouts, see Detail 3/D6.
3. Prior to installing wood structural panels, see Detail 4/D6 where pipes or conduits pass through studs or top plates.
4. Wood structural panels may be installed vertically (face grain parallel to stud) or horizontally.
5. Provide 2x4 flat blocking at all horizontal panel edges.

2 FOUNDATION SILL WIDER THAN WALL

MATERIAL KEY:

Below is a key to common call-outs in the details. Unless specified otherwise in the details, use the sizes and materials as follows:

Term	Description
Nails	
8d (8 penny) at Connectors attached over plywood	0.131" x 2-1/2" long
8d (8 penny) at Connectors attached directly to framing	0.131" x 1-1/2" long
10d (10 penny) at Connectors attached over plywood	0.148" x 3" long
10d (10 penny) at Connectors attached directly to framing	0.148" x 1-1/2" long
16d (16 penny)	0.162" x 3-1/2" long
20d (20 penny)	0.192" x 4" long
Screws	Simpson Strong-Tie 1/4" SDS, GRK 3/8" RSS "Climatek", USP Mitek 1/4" WS "Gold Coat", or equivalent.
3" screw	3" long structural wood screw
4" screw	4" long structural wood screw
6" screw	6" long structural wood screw
Wood Structural Panel	15/32" Wood Structural Panel-Sheathing. Exposure 1, 5-Ply.
LVL (Laminated Veneer Lumber)	Weyerhauser "Microllam", Boise-Cascade "VersaLam", Georgia-Pacific "GP-Lam", LP "Solid Start", or equivalent.
Plate Washer	3" x 3" square x 0.229" thick.
"Peel & Stick" Flashing Tape	Fortiflash, Orange Peel-n-Seal, Typar, Tyvek, Vycor, HardieWrap, or equivalent.

For Connector types see Sheet S3.

ABBREVIATIONS

Clr.	Clearance
Conc.	Concrete
Dia.	Diameter
(E)	Existing
EQ.	Equal
E.N.	Edge Nail
Emb.	Embedment
(N)	New
Max.	Maximum
Min.	Minimum
Mfr.	Manufacturer
N.T.S.	Not to Scale
O.C.	On Center
PL	Plate
S.O.G.	Slab on ground
Typ.	Typical
w/	with

APPLICANT: _____

PROPERTY ADDRESS: _____

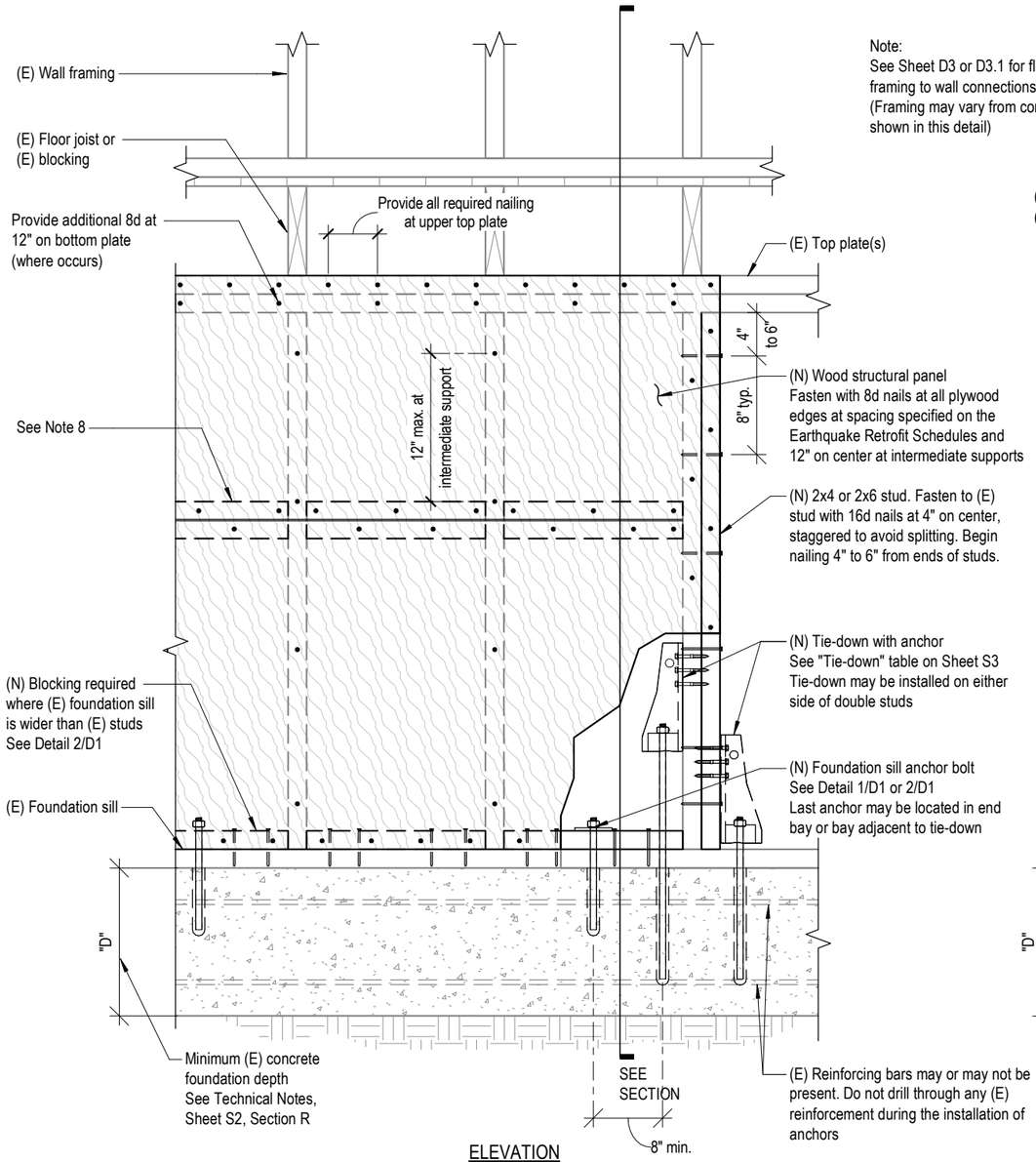
Wood Structural Panel Installation at Shear Walls without Tie-Downs

Retrofit of Living-Space-Over-Garage Dwellings (Plan Set)
Vulnerability-Based Seismic Assessment and Retrofit of One- and Two-Family Dwellings
FEMA P-1100, Volume 2 - Plan Sets
Issued: SEPT 2019

FEMA

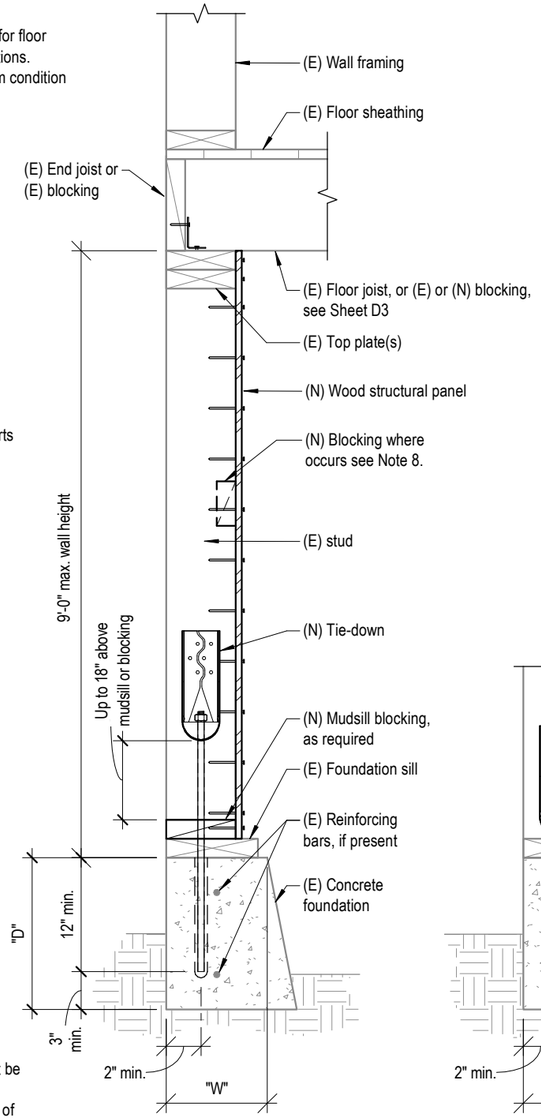
Date:

Sheet: **D4**

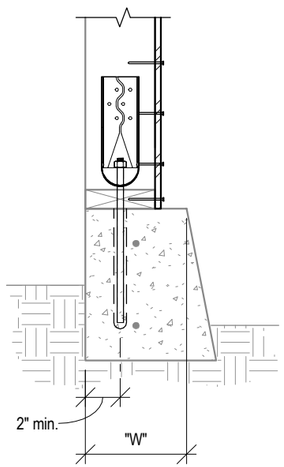


ELEVATION

Note:
See Sheet D3 or D3.1 for floor framing to wall connections. (Framing may vary from condition shown in this detail)



SECTION
(MUDSILL BLOCKING REQUIRED)



SECTION
(NO MUDSILL BLOCKING REQUIRED)

Notes:
1. For strapping at top plate splices, see Details 1/D6 or 2/D6.
2. At vents or similar wall blockouts, see Detail 3/D6.
3. Prior to installing wood structural panels, see Detail 4/D6 where pipes or conduits pass through cripple studs or top plates.
4. "W" indicates the width of an existing foundation, or new foundation constructed in accordance with Detail 1/D7.
5. "D" indicates the depth of an existing foundation, or new foundation constructed in accordance with Detail 1/D7.
6. For existing foundations, see Sheet S2, Section R for additional requirements.
7. Wood structural panels may be installed vertically (face grain parallel to stud) or horizontally.
8. Provide 2x4 flat blocking at all horizontal panel edges.

1 TYPICAL TIE-DOWN INSTALLATION

MATERIAL KEY:

Below is a key to common call-outs in the details. Unless specified otherwise in the details, use the sizes and materials as follows:

Term	Description
Nails	
8d (8 penny) at Connectors attached over plywood	0.131" x 2-1/2" long
8d (8 penny) at Connectors attached directly to framing	0.131" x 1-1/2" long
10d (10 penny) at Connectors attached over plywood	0.148" x 3" long
10d (10 penny) at Connectors attached directly to framing	0.148" x 1-1/2" long
16d (16 penny)	0.162" x 3-1/2" long
20d (20 penny)	0.192" x 4" long
Screws	Simpson Strong-Tie 1/4" SDS, GRK 3/8" RSS "Climatek", USP Mitek 1/4" WS "Gold Coat", or equivalent.
3" screw	3" long structural wood screw
4" screw	4" long structural wood screw
6" screw	6" long structural wood screw
Wood Structural Panel	15/32" Wood Structural Panel-Sheathing. Exposure 1, 5-Ply.
LVL (Laminated Veneer Lumber)	Weyerhauser "Microllam", Boise-Cascade "VersaLam", Georgia-Pacific "GP-Lam", LP "Solid Start", or equivalent.
Plate Washer	3" x 3" square x 0.229" thick.
"Peel & Stick" Flashing Tape	Fortiflash, Orange Peel-n-Seal, Typar, Tyvek, Vycor, HardieWrap, or equivalent.

For Connector types see Sheet S3.

ABBREVIATIONS

Clr.	Clearance
Conc.	Concrete
Dia.	Diameter
(E)	Existing
EQ.	Equal
E.N.	Edge Nail
Emb.	Embedment
(N)	New
Max.	Maximum
Min.	Minimum
Mfr.	Manufacturer
N.T.S.	Not to Scale
O.C.	On Center
PL	Plate
S.O.G.	Slab on ground
Typ.	Typical
w/	with

APPLICANT:

PROPERTY ADDRESS:

Wood Structural Panels with Tie-Downs

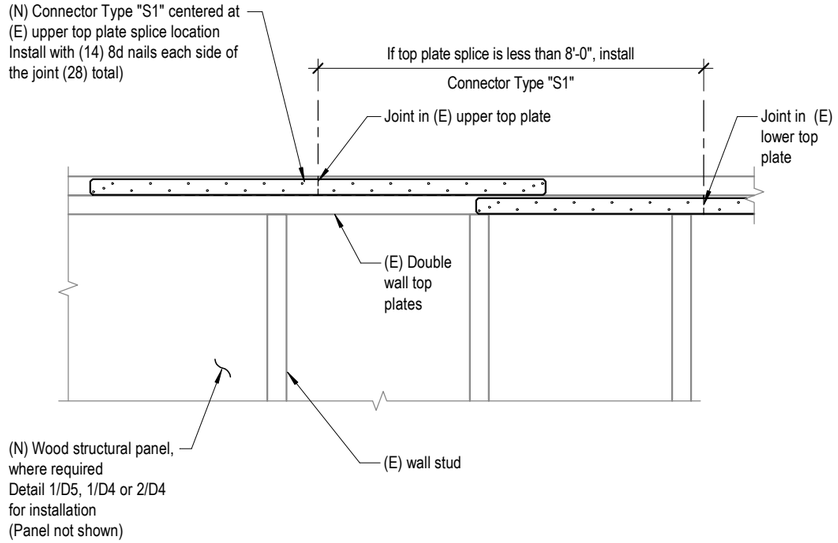
Retrofit of Living-Space-Over-Garage Dwellings (Plan Set)
Vulnerability-Based Seismic Assessment and Retrofit of One- and Two-Family Dwellings
FEMA P-1100, Volume 2 - Plan Sets
Issued: SEPT 2019

FEMA

Date:

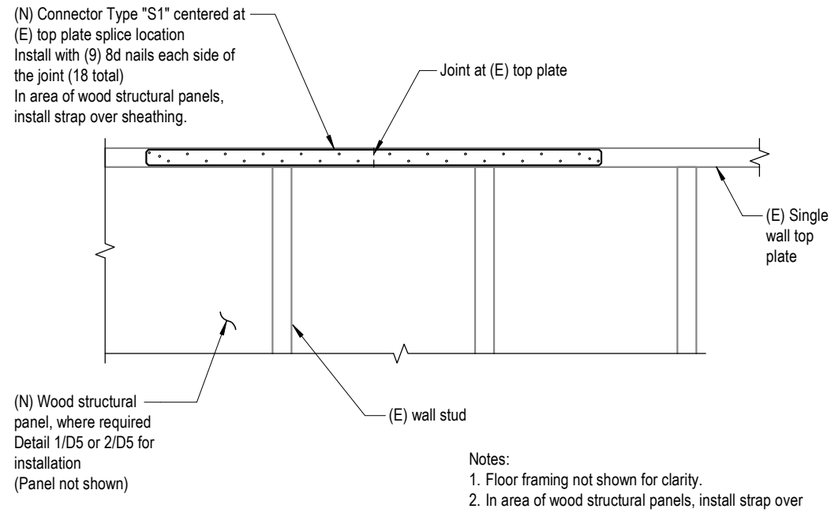
Sheet:

D5



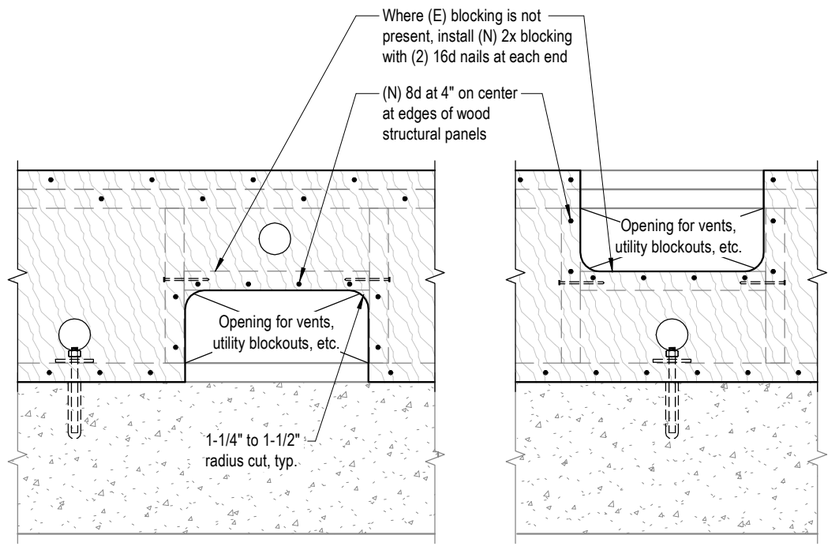
Notes:
1. Floor framing not shown for clarity.
2. In area of wood structural panels, install strap over sheathing.

1 TOP PLATE SPLICE AT EXISTING DOUBLE TOP PLATES



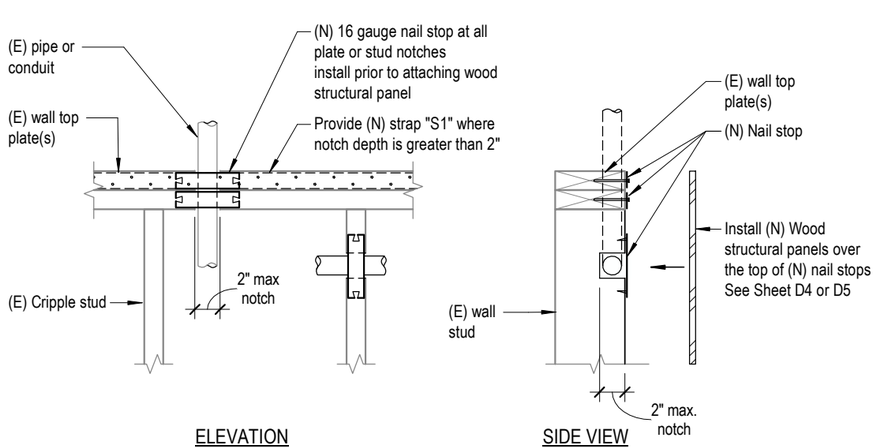
Notes:
1. Floor framing not shown for clarity.
2. In area of wood structural panels, install strap over sheathing.

2 TOP PLATE SPLICE AT EXISTING SINGLE TOP PLATE



Notes:
1. Do not cover existing vents.
2. Increase wood structural panel length a distance equal to the length of blockout(s) or one stud bay width whichever is greater.

3 CUTOUT REQUIREMENTS IN WOOD STRUCTURAL PANELS



Note:
Floor framing not shown.

4 ALLOWABLE NOTCHING AND REINFORCING FOR TOP PLATES AND STUDS

MATERIAL KEY:

Below is a key to common call-outs in the details. Unless specified otherwise in the details, use the sizes and materials as follows:

Term	Description
Nails	
8d (8 penny) at Connectors attached over plywood	0.131" x 2-1/2" long
8d (8 penny) at Connectors attached directly to framing	0.131" x 1-1/2" long
10d (10 penny) at Connectors attached over plywood	0.148" x 3" long
10d (10 penny) at Connectors attached directly to framing	0.148" x 1-1/2" long
16d (16 penny)	0.162" x 3-1/2" long
20d (20 penny)	0.192" x 4" long
Screws	Simpson Strong-Tie 1/4" SDS, GRK 3/8" RSS "Climatek", USP Mitek 1/4" WS "Gold Coat", or equivalent.
3" screw	3" long structural wood screw
4" screw	4" long structural wood screw
6" screw	6" long structural wood screw
Wood Structural Panel	15/32" Wood Structural Panel-Sheathing. Exposure 1, 5-Ply.
LVL (Laminated Veneer Lumber)	Weyerhauser "Microllam", Boise-Cascade "VersaLam", Georgia-Pacific "GP-Lam", LP "Solid Start", or equivalent.
Plate Washer	3" x 3" square x 0.229" thick.
"Peel & Stick" Flashing Tape	Fortiflash, Orange Peel-n-Seal, Typar, Tyvek, Vycor, HardieWrap, or equivalent.

For Connector types see Sheet S3.

ABBREVIATIONS

Clr.	Clearance
Conc.	Concrete
Dia.	Diameter
(E)	Existing
EQ.	Equal
E.N.	Edge Nail
Emb.	Embedment
(N)	New
Max.	Maximum
Min.	Minimum
Mfr.	Manufacturer
N.T.S.	Not to Scale
O.C.	On Center
PL	Plate
S.O.G.	Slab on ground
Typ.	Typical
w/	with

APPLICANT:

PROPERTY ADDRESS:

Vent Openings and Top Plate Details

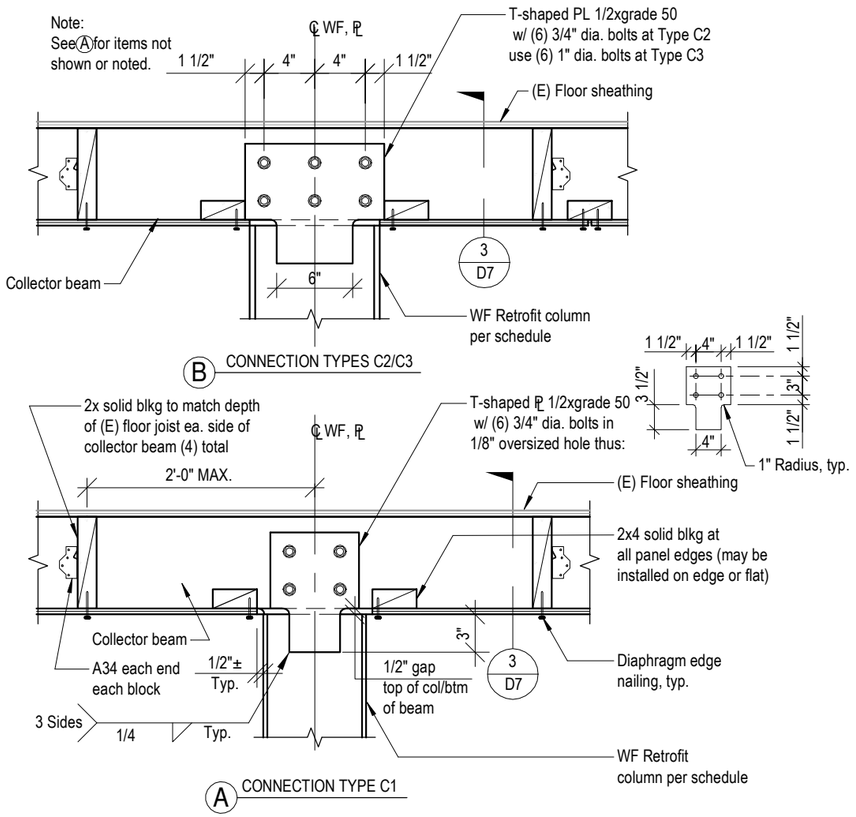
Retrofit of Living-Space-Over-Garage Dwellings (Plan Set)
Vulnerability-Based Seismic Assessment and Retrofit of One- and Two-Family Dwellings
FEMA P-1100, Volume 2 - Plan Sets
Issued: SEPT 2019

FEMA

Date:

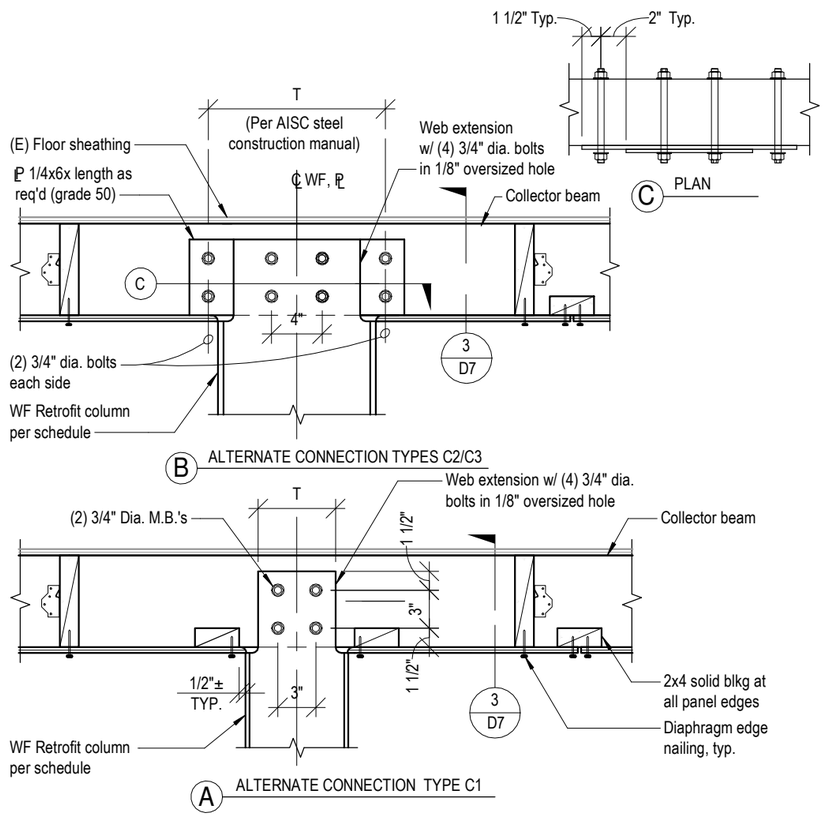
Sheet:

D6

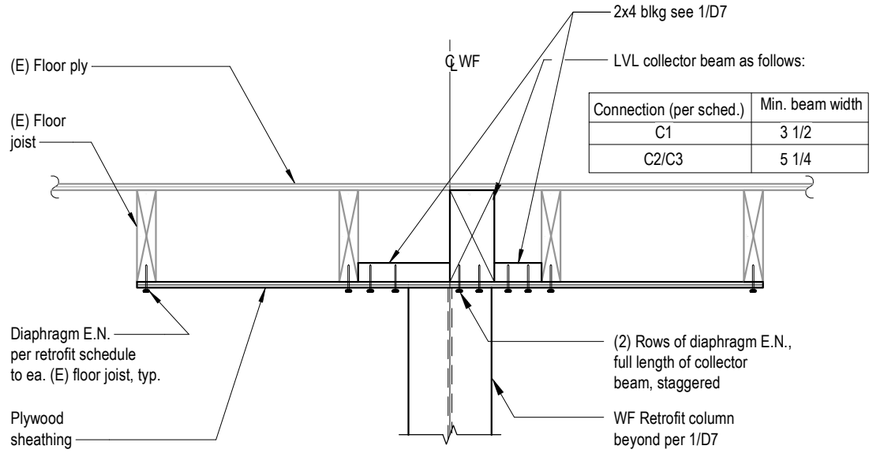


1 CONN. AT TOP OF WF RETROFIT COLUMN

SEE DETAIL 2/D7 FOR ALTERNATE CONNECTIONS

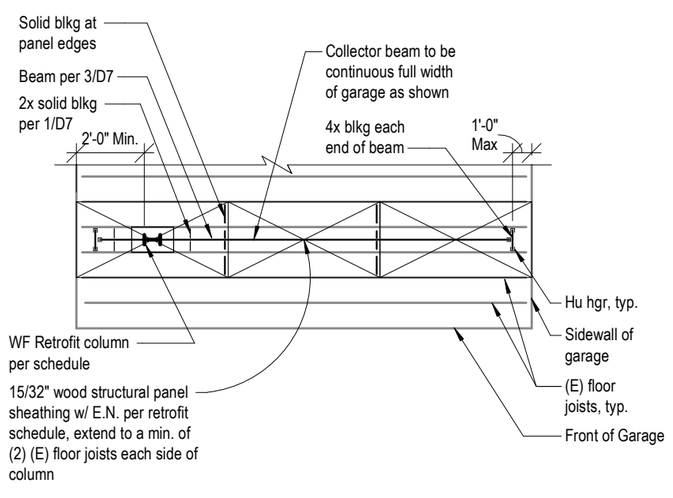


2 ALTERNATE CONN. AT TOP OF WF RETROFIT COLUMN



Connection (per sched.)	Min. beam width
C1	3 1/2
C2/C3	5 1/4

3 WF RETROFIT COLUMN - JOIST PARALLEL



4 PLYWOOD DIAPHRAGM AT COLLECTOR BEAM

MATERIAL KEY:

Below is a key to common call-outs in the details. Unless specified otherwise in the details, use the sizes and materials as follows:

Term	Description
Nails	
8d (8 penny) at Connectors attached over plywood	0.131" x 2-1/2" long
8d (8 penny) at Connectors attached directly to framing	0.131" x 1-1/2" long
10d (10 penny) at Connectors attached over plywood	0.148" x 3" long
10d (10 penny) at Connectors attached directly to framing	0.148" x 1-1/2" long
16d (16 penny)	0.162" x 3-1/2" long
20d (20 penny)	0.192" x 4" long
Screws	Simpson Strong-Tie 1/4" SDS, GRK 3/8" RSS "Climatek", USP Mitek 1/4" WS "Gold Coat", or equivalent.
3" screw	3" long structural wood screw
4" screw	4" long structural wood screw
6" screw	6" long structural wood screw
Wood Structural Panel	15/32" Wood Structural Panel-Sheathing. Exposure 1, 5-Ply.
LVL (Laminated Veener Lumber)	Weyerhauser "Microllam", Boise-Cascade "VersaLam", Georgia-Pacific "GP-Lam", LP "Solid Start", or equivalent.
Plate Washer	3" x 3" square x 0.229" thick.
"Peel & Stick" Flashing Tape	Fortiflash, Orange Peel-n-Seal, Typar, Tyvek, Vycor, HardieWrap, or equivalent.

For Connector types see Sheet S3.

ABBREVIATIONS

Clr.	Clearance
Conc.	Concrete
Dia.	Diameter
(E)	Existing
EQ.	Equal
E.N.	Edge Nail
Emb.	Embedment
(N)	New
Max.	Maximum
Min.	Minimum
Mfr.	Manufacturer
N.T.S.	Not to Scale
O.C.	On Center
PL	Plate
S.O.G.	Slab on ground
Typ.	Typical
w/	with

APPLICANT:

PROPERTY ADDRESS:

Structural Details at Steel Retrofit Column

Retrofit of Living-Space-Over-Garage Dwellings (Plan Set)

Vulnerability-Based Seismic Assessment and Retrofit of One- and Two-Family Dwellings

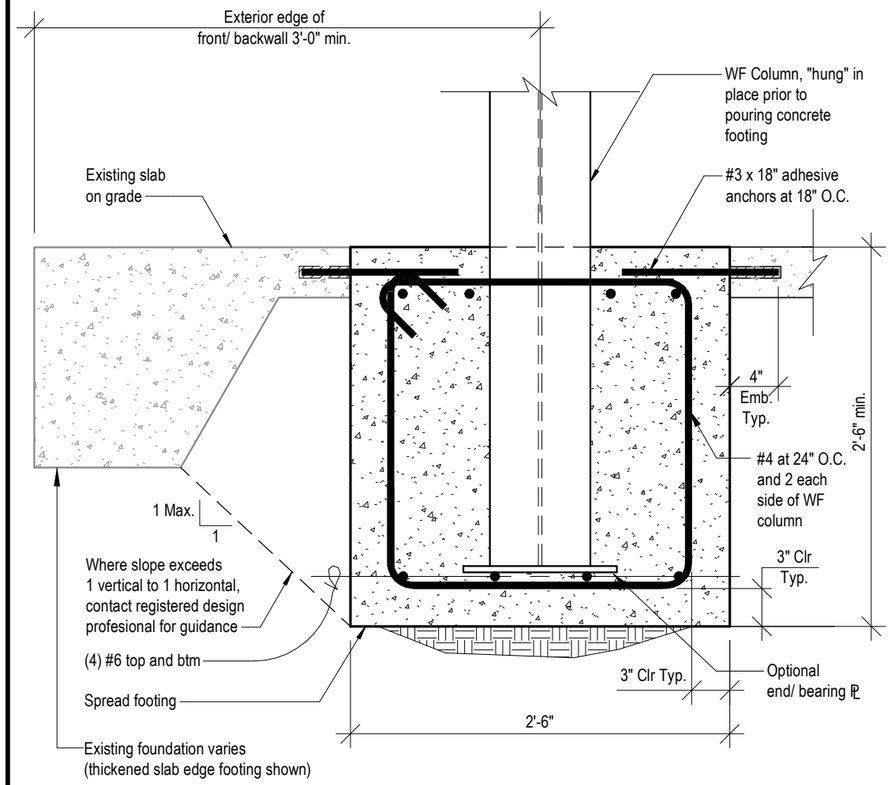
FEMA P-1100, Volume 2 - Plan Sets

Issued: SEPT 2019

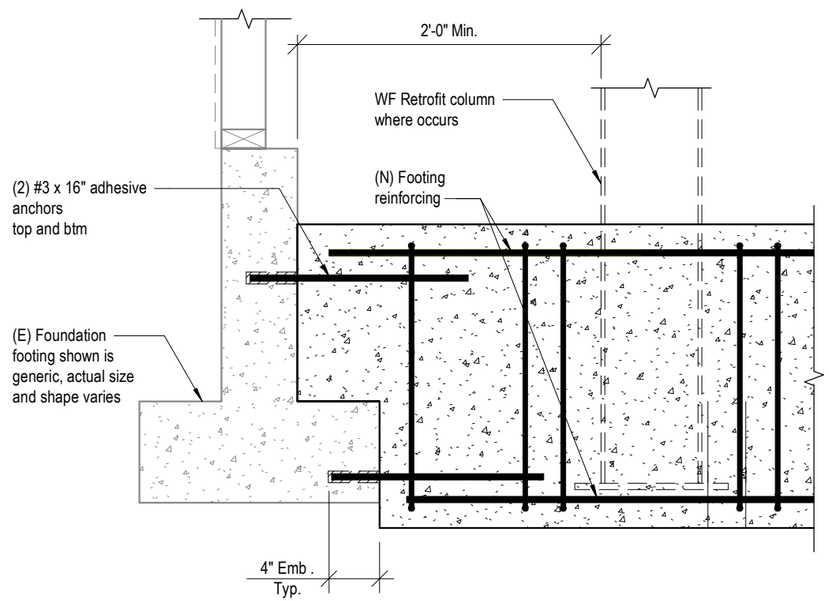
FEMA

Date:

Sheet: **D7**



1 FOOTING AT NEW RETROFIT COLUMN



2 TIES FROM NEW TO EXISTING FOUNDATION

MATERIAL KEY:

Below is a key to common call-outs in the details. Unless specified otherwise in the details, use the sizes and materials as follows:

Term	Description
Nails	
8d (8 penny) at Connectors attached over plywood	0.131" x 2-1/2" long
8d (8 penny) at Connectors attached directly to framing	0.131" x 1-1/2" long
10d (10 penny) at Connectors attached over plywood	0.148" x 3" long
10d (10 penny) at Connectors attached directly to framing	0.148" x 1-1/2" long
16d (16 penny)	0.162" x 3-1/2" long
20d (20 penny)	0.192" x 4" long
Screws	Simpson Strong-Tie 1/4" SDS, GRK 3/8" RSS "Climatek", USP Mitek 1/4" WS "Gold Coat", or equivalent.
3" screw	3" long structural wood screw
4" screw	4" long structural wood screw
6" screw	6" long structural wood screw
Wood Structural Panel	15/32" Wood Structural Panel-Sheathing. Exposure 1, 5-Ply.
LVL (Laminated Veneer Lumber)	Weyerhauser "Microllam", Boise-Cascade "VersaLam", Georgia-Pacific "GP-Lam", LP "Solid Start", or equivalent.
Plate Washer	3" x 3" square x 0.229" thick.
"Peel & Stick" Flashing Tape	Fortiflash, Orange Peel-n-Seal, Typar, Tyvek, Vycor, HardieWrap, or equivalent.

For Connector types see Sheet S3.

ABBREVIATIONS

Clr.	Clearance
Conc.	Concrete
Dia.	Diameter
(E)	Existing
EQ.	Equal
E.N.	Edge Nail
Emb.	Embedment
(N)	New
Max.	Maximum
Min.	Minimum
Mfr.	Manufacturer
N.T.S.	Not to Scale
O.C.	On Center
PL	Plate
S.O.G.	Slab on ground
Typ.	Typical
w/	with

APPLICANT:

PROPERTY ADDRESS:

Foundation Details at Steel Retrofit Column

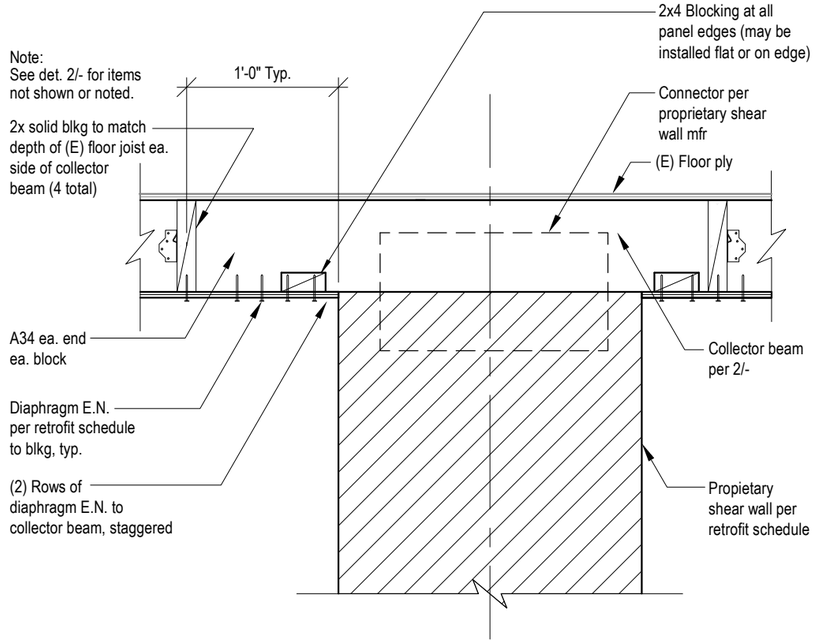
Retrofit of Living-Space-Over-Garage Dwellings (Plan Set)
Vulnerability-Based Seismic Assessment and Retrofit of One- and Two-Family Dwellings
FEMA P-1100, Volume 2 - Plan Sets
Issued: SEPT 2019

FEMA

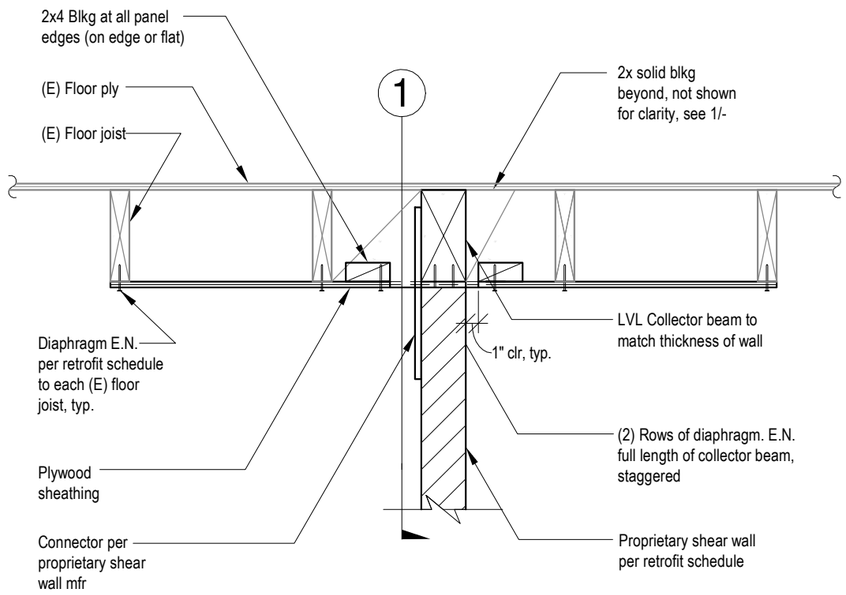
Date:

Sheet:

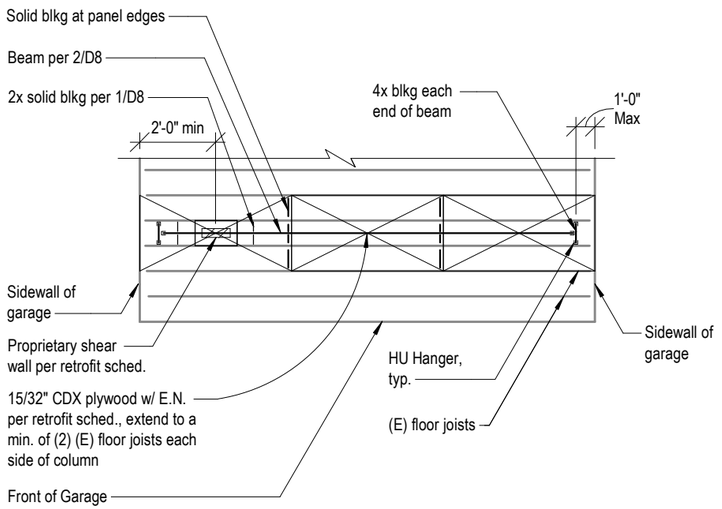
D7.1



1 FLOOR CONN. AT PROPRIETARY SHEAR WALL
FLOOR FRAMING PARALLEL TO GARAGE FRONT



2 FLOOR CONN. AT PROPRIETARY SHEAR WALL
FLOOR FRAMING PARALLEL TO GARAGE FRONT



3 PLYWOOD CEILING SOFFIT DIAPHRAGM AT COLLECTOR BEAM
PLAN VIEW AT CEILING

MATERIAL KEY:

Below is a key to common call-outs in the details. Unless specified otherwise in the details, use the sizes and materials as follows:

Term	Description
Nails	
8d (8 penny) at Connectors attached over plywood	0.131" x 2-1/2" long
8d (8 penny) at Connectors attached directly to framing	0.131" x 1-1/2" long
10d (10 penny) at Connectors attached over plywood	0.148" x 3" long
10d (10 penny) at Connectors attached directly to framing	0.148" x 1-1/2" long
16d (16 penny)	0.162" x 3-1/2" long
20d (20 penny)	0.192" x 4" long
Screws	Simpson Strong-Tie 1/4" SDS, GRK 3/8" RSS "Climatek", USP Mitek 1/4" WS "Gold Coat", or equivalent.
3" screw	3" long structural wood screw
4" screw	4" long structural wood screw
6" screw	6" long structural wood screw
Wood Structural Panel	15/32" Wood Structural Panel-Sheathing. Exposure 1, 5-Ply.
LVL (Laminated Veneer Lumber)	Weyerhauser "Microllam", Boise-Cascade "VersaLam", Georgia-Pacific "GP-Lam", LP "Solid Start", or equivalent.
Plate Washer	3" x 3" square x 0.229" thick.
"Peel & Stick" Flashing Tape	Fortiflash, Orange Peel-n-Seal, Typar, Tyvek, Vycor, HardieWrap, or equivalent.

ABBREVIATIONS

Clr.	Clearance
Conc.	Concrete
Dia.	Diameter
(E)	Existing
EQ.	Equal
E.N.	Edge Nail
Emb.	Embedment
(N)	New
Max.	Maximum
Min.	Minimum
Mfr.	Manufacturer
N.T.S.	Not to Scale
O.C.	On Center
PL	Plate
S.O.G.	Slab on ground
Typ.	Typical
w/	with

APPLICANT:

PROPERTY ADDRESS:

Structural Details at Proprietary Shear Wall Retrofit

Retrofit of Living-Space-Over-Garage Dwellings (Plan Set)
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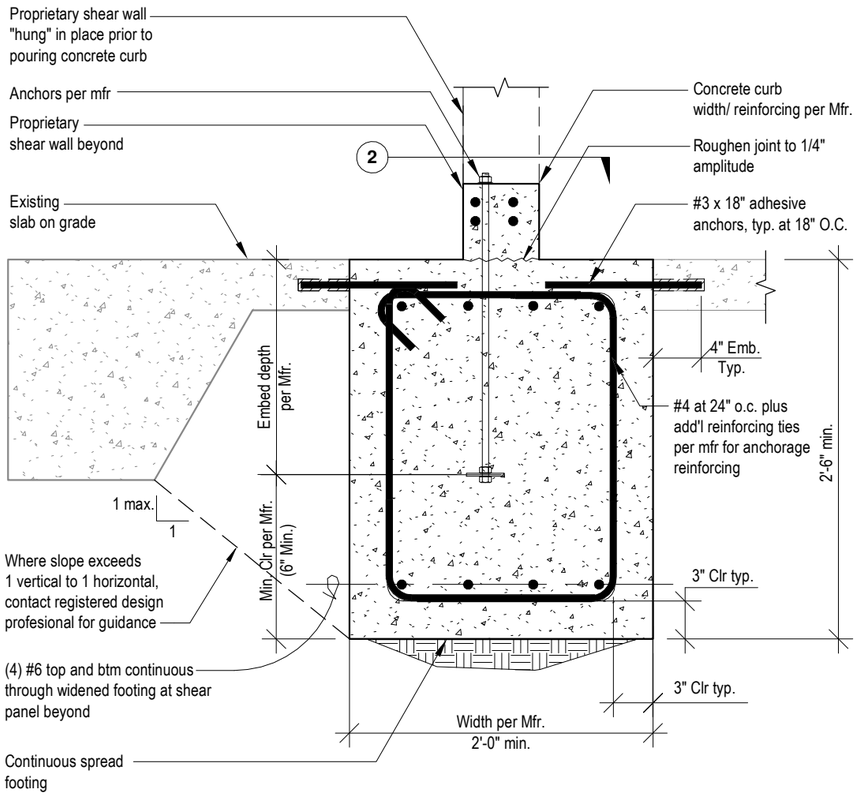
FEMA P-1100, Volume 2 - Plan Sets
Issued: SEPT 2019

FEMA

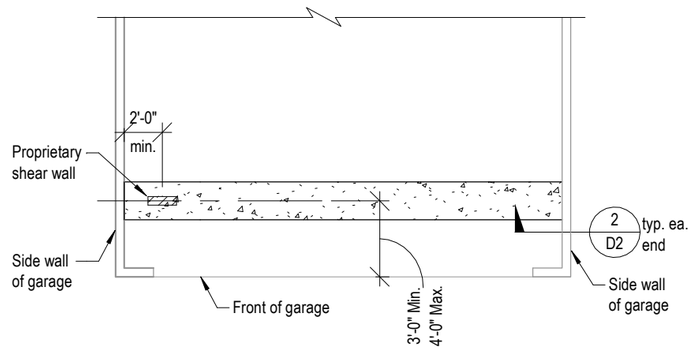
Date:

Sheet:

D8



1 CONT. FOOTING/ GRADE BEAM AT PROPRIETARY



2 PLAN VIEW AT FOUNDATION

MATERIAL KEY:

Below is a key to common call-outs in the details. Unless specified otherwise in the details, use the sizes and materials as follows:

Term	Description
Nails	
8d (8 penny) at Connectors attached over plywood	0.131" x 2-1/2" long
8d (8 penny) at Connectors attached directly to framing	0.131" x 1-1/2" long
10d (10 penny) at Connectors attached over plywood	0.148" x 3" long
10d (10 penny) at Connectors attached directly to framing	0.148" x 1-1/2" long
16d (16 penny)	0.162" x 3-1/2" long
20d (20 penny)	0.192" x 4" long
Screws	Simpson Strong-Tie 1/4" SDS, GRK 3/8" RSS "Climatek", USP Mitek 1/4" WS "Gold Coat", or equivalent.
3" screw	3" long structural wood screw
4" screw	4" long structural wood screw
6" screw	6" long structural wood screw
Wood Structural Panel	15/32" Wood Structural Panel-Sheathing. Exposure 1, 5-Ply.
LVL (Laminated Veneer Lumber)	Weyerhauser "Microllam", Boise-Cascade "VersaLam", Georgia-Pacific "GP-Lam", LP "Solid Start", or equivalent.
Plate Washer	3" x 3" square x 0.229" thick.
"Peel & Stick" Flashing Tape	Fortiflash, Orange Peel-n-Seal, Typar, Tyvek, Vycor, HardieWrap, or equivalent.

For Connector types see Sheet S3.

ABBREVIATIONS

Clr.	Clearance
Conc.	Concrete
Dia.	Diameter
(E)	Existing
EQ.	Equal
E.N.	Edge Nail
Emb.	Embedment
(N)	New
Max.	Maximum
Min.	Minimum
Mfr.	Manufacturer
N.T.S.	Not to Scale
O.C.	On Center
PL	Plate
S.O.G.	Slab on ground
Typ.	Typical
w/	with

APPLICANT:

PROPERTY ADDRESS:

Foundation Details at Proprietary Shear Wall Retrofit

Retrofit of Living-Space-Over-Garage Dwellings (Plan Set)
Vulnerability-Based Seismic Assessment and Retrofit of One- and Two-Family Dwellings
FEMA P-1100, Volume 2 - Plan Sets
Issued: SEPT 2019

FEMA

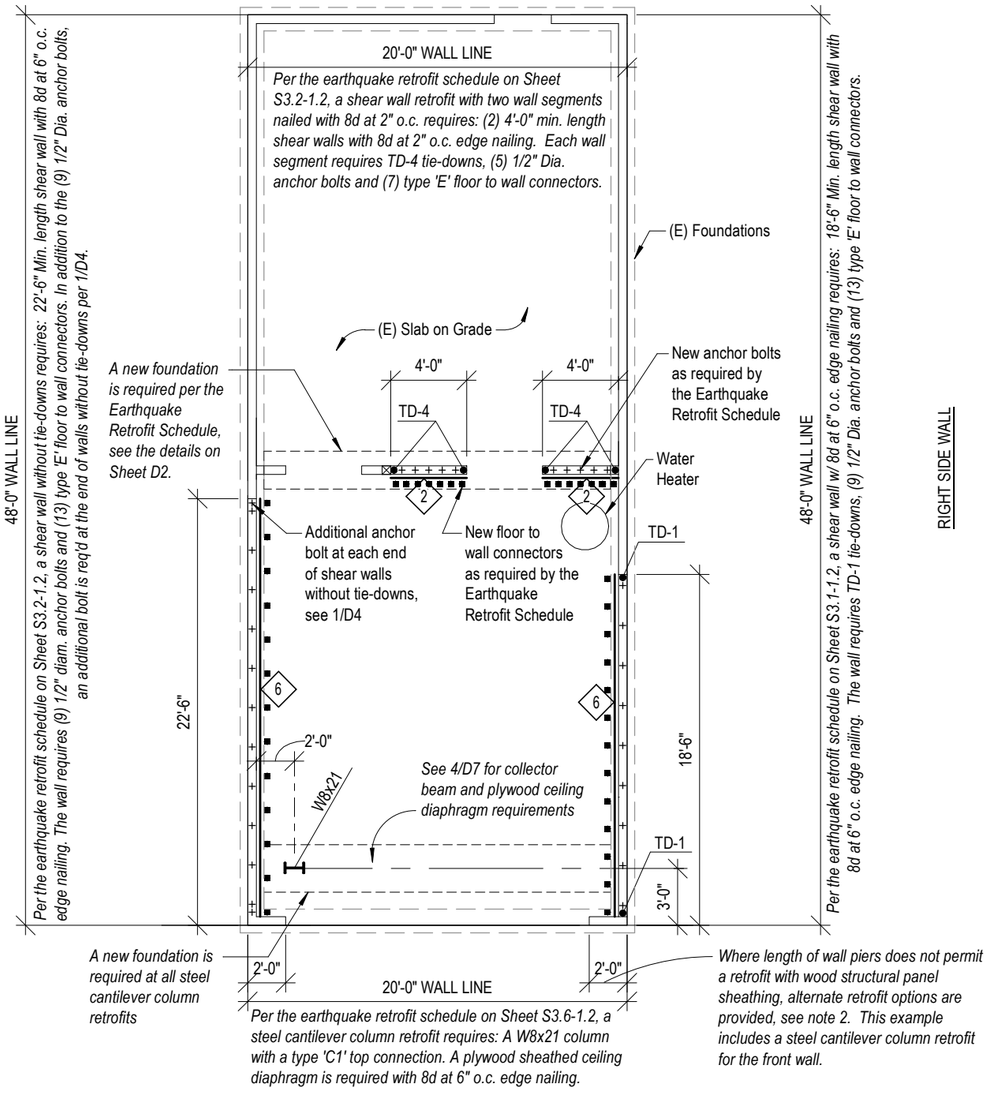
Date:

Sheet:

D8.1

BACK WALL

With a ground floor residential unit, the back wall retrofit occurs at the garage separation wall.

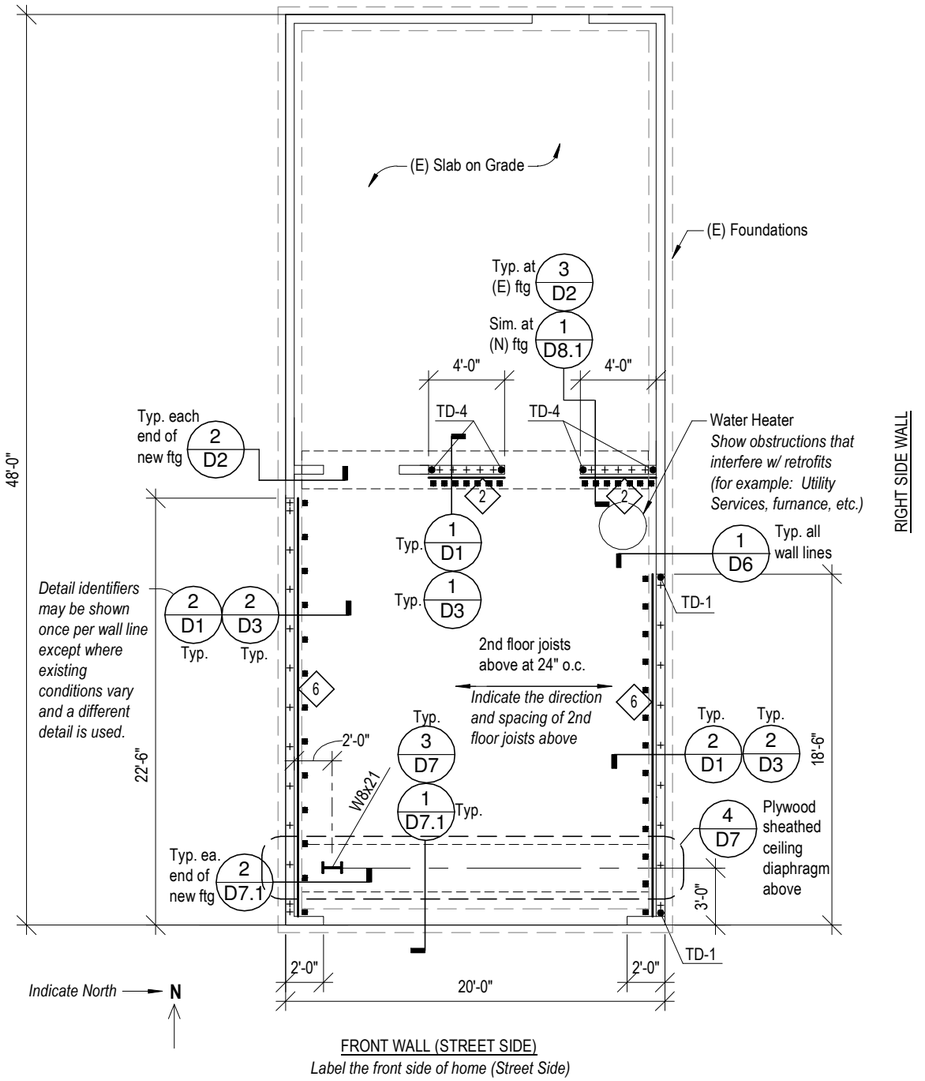


Per the earthquake retrofit schedule on Sheet S3.6-1.2, a steel cantilever column retrofit requires: A W8x21 column with a type 'C1' top connection. A plywood sheathed ceiling diaphragm is required with 8d at 6" o.c. edge nailing.

FRONT WALL (STREET SIDE)

EXAMPLE OF RETROFIT SELECTION SUMMARY

BACK WALL



FRONT WALL (STREET SIDE)

Label the front side of home (Street Side)

NOTES:

1. Plan shows typical notation. Instructional notes are in *italics* and should not be included on submittal drawing. Refer to Sheet 01 for additional instructions.
2. This example illustrates potential retrofit options selected from the provided Earthquake Retrofit Schedules. There are multiple options that are applicable to a building of this size and weight that are not shown.

Key:

#	Retrofit shear wall edge nail spacing per the Earthquake Retrofit Schedule. # denotes the edge nail spacing.
+	Foundation sill anchor bolt or connector
■	Floor to wall framing connector
TD-#	Tie-down. # denotes the tie down size per schedule, see sheet S3.

Definitions:

(E)	Existing
(N)	New
Wall line:	All wall segments forming the overall building dimensions on one side

This example includes a house qualifying as a Living-Space-Over-Garage Dwelling with a Ground Floor Residential unit. The following parameters apply:
960 square foot home
"Light" weight classification
S_{DS} = 1.2 (located in SDC D)

- The front wall retrofit is selected from the Earthquake Retrofit Schedule on Sheet S3.6-1.2, using a steel cantilever column. A steel column was selected due to the limited length of the wall piers at the front of the garage.
- The side wall retrofits are selected from the schedule on Sheet S3.1-1.2. The left side is free of obstructions, so a long shear wall retrofit not requiring tie-downs is used. The right side wall is retrofitted with a shorter length wall with tie-downs due to the location of the water heater. The back of garage separation wall includes multiple door openings, so a double shear wall retrofit option was selected from the schedule on Sheet S3.2-1.2.

APPLICANT: _____

PROPERTY ADDRESS: _____

Example - Living-Space-Over-Garage Dwelling with a wood structural panel shearwall & cantilever column retrofit

Retrofit of Living-Space-Over-Garage Dwellings (Plan Set)

Vulnerability-Based Seismic Assessment and Retrofit of One- and Two-Family Dwellings

FEMA P-1100, Volume 2 - Plan Sets

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X1

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