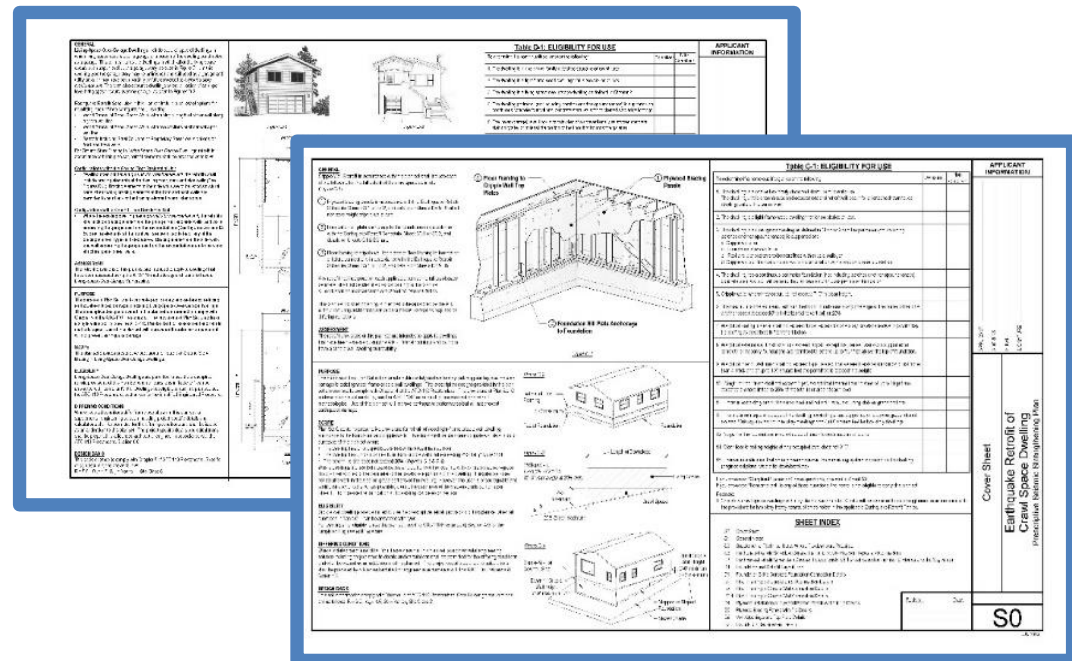
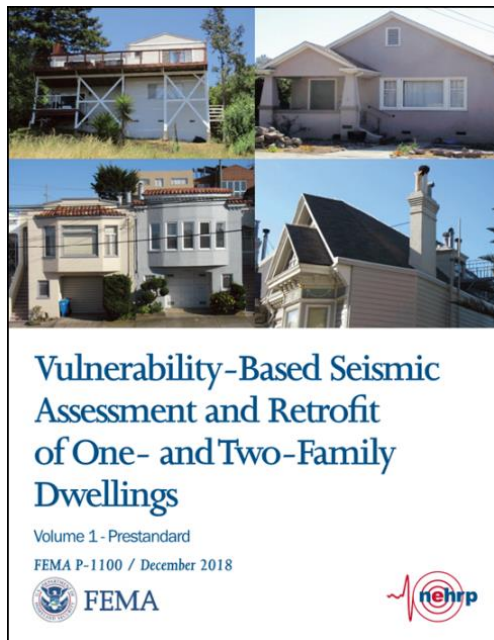
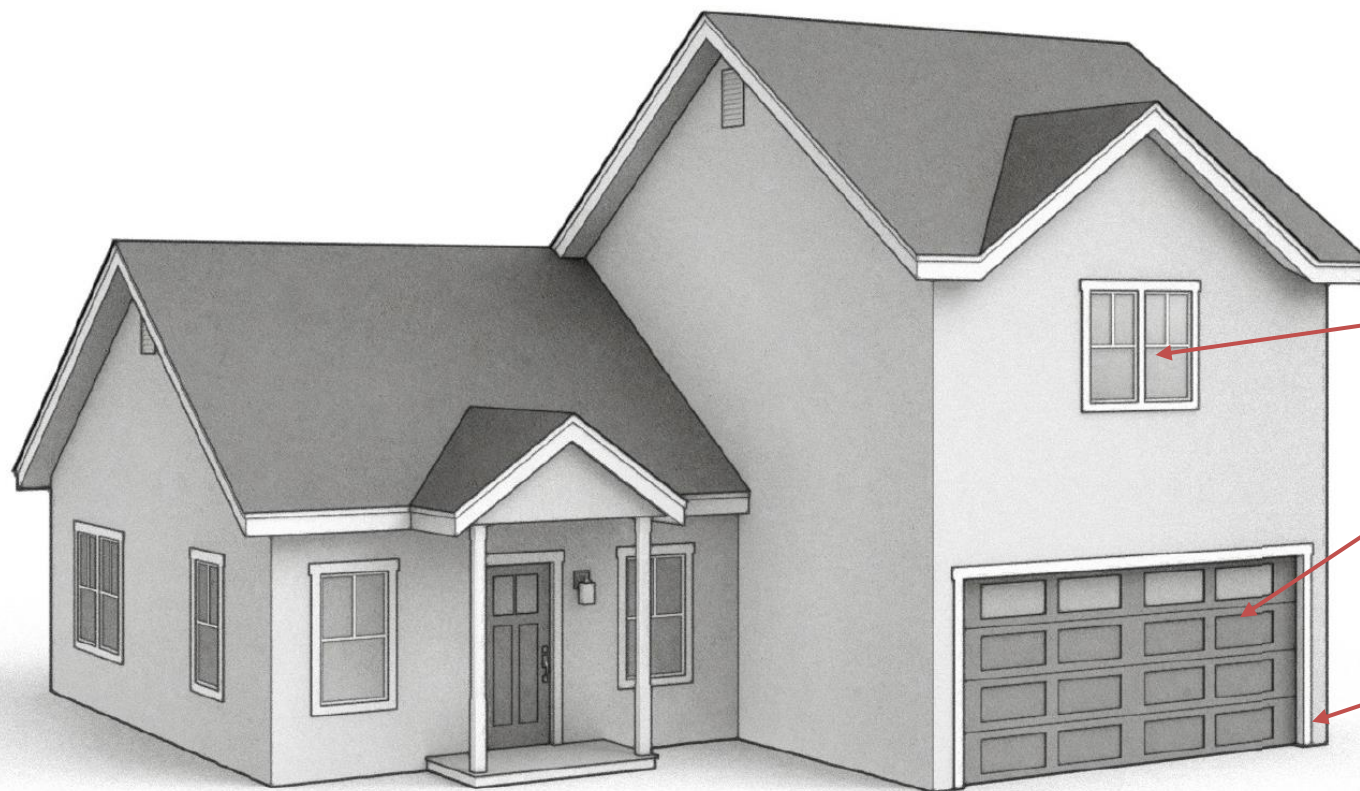


FEMA P-1100

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



Module 3 – *Living-Space-Over-Garage (LOG) Dwellings*



Living space in upper floor over garage

Garage provides little or no bracing

Narrow walls at garage front provide little earthquake bracing

Source: FEMA 530

Acknowledgements

Project funded by:



The California
Earthquake Authority



FEMA

The Federal Emergency
Management Agency

FEMA P-1100 Available Training

TOPIC	Primary Audience ¹ and Training Modules		
	Building Official	Contractor	Engineer
<i>FEMA P-1100 Introduction</i>	1B	1C	1E
Crawlspace Dwellings		2C	2E
Living-Space-Over-Garage Dwellings		3C	3E
Chimneys and Fireplace Surrounds		4C	
Hillside Dwellings		5C	5E

Module 3 Outline

- Purpose, scope, and retrofit objectives
- Available documents
- What is a *Living-Space-Over-Garage* (LOG) Dwelling?
- Prescriptive vulnerability-based retrofit
- Prescriptive retrofit concepts for LOG Dwellings
- LOG Plan Set Overview
- When might an engineer be required?
- Permitting and building department approval
- LOG Plan Set Application Example

FEMA P-1100 Purpose

- To promote public safety and welfare by reducing earthquake-induced damage to existing wood light-frame dwellings
- To provide a simple and systematic procedure to identify and retrofit known vulnerabilities in wood light-frame dwellings
- To set a recommended retrofit scope and level based on best available science

FEMA P-1100 Scope

- Wood light-frame
- One- and two-family dwellings
- Townhouses
- Single-family dwellings divided into multiple dwelling units
- Seismic Design Category (SDC) B through E



Why Retrofit One- and Two-Family Wood-Frame Dwellings?

- Most common dwelling type in the US
- Well known vulnerabilities that have repeatedly led to significant damage and dwellings being uninhabitable following earthquakes

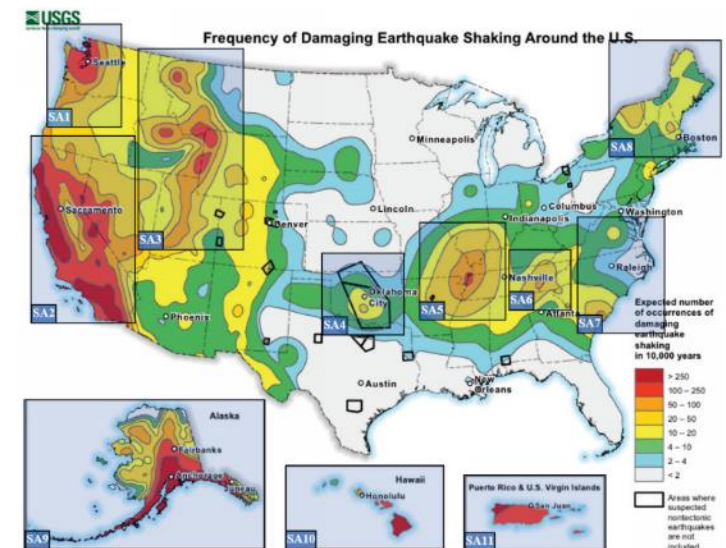
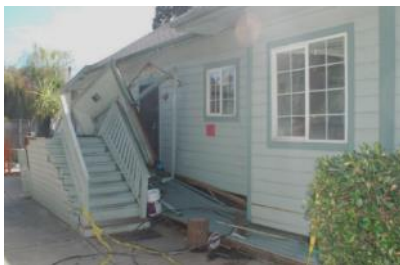


Figure A-1 Map showing the frequency of damaging earthquake shaking.

Retrofit Performance Objective

- Primary objective is reduction of hazard to occupants
- Results in reduction of damage
- Target performance somewhat lower than but as close as practical to the performance targeted for new buildings

See Module 1 for FEMA P-1100 additional Overview and Background information.

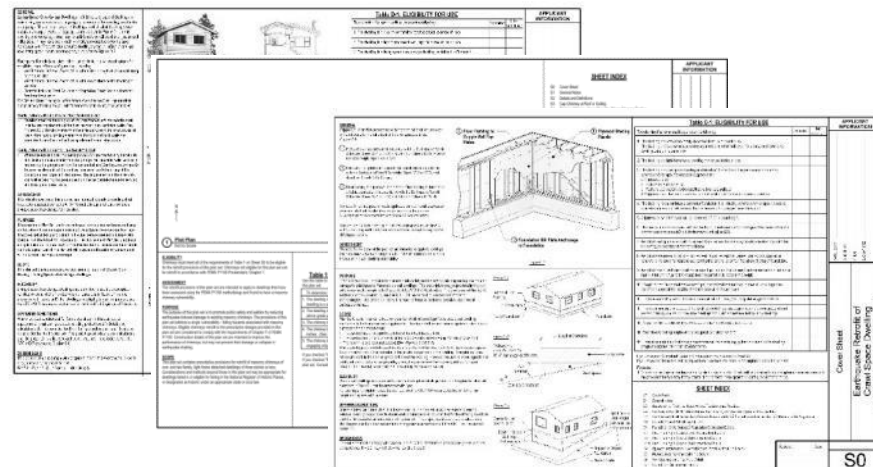
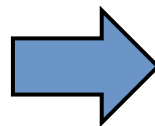
Available Documents



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

Volume 1 - Prestandard

FEMA P-1100 / December 2018



- Plan sets
- General Contractor training materials
- Design examples

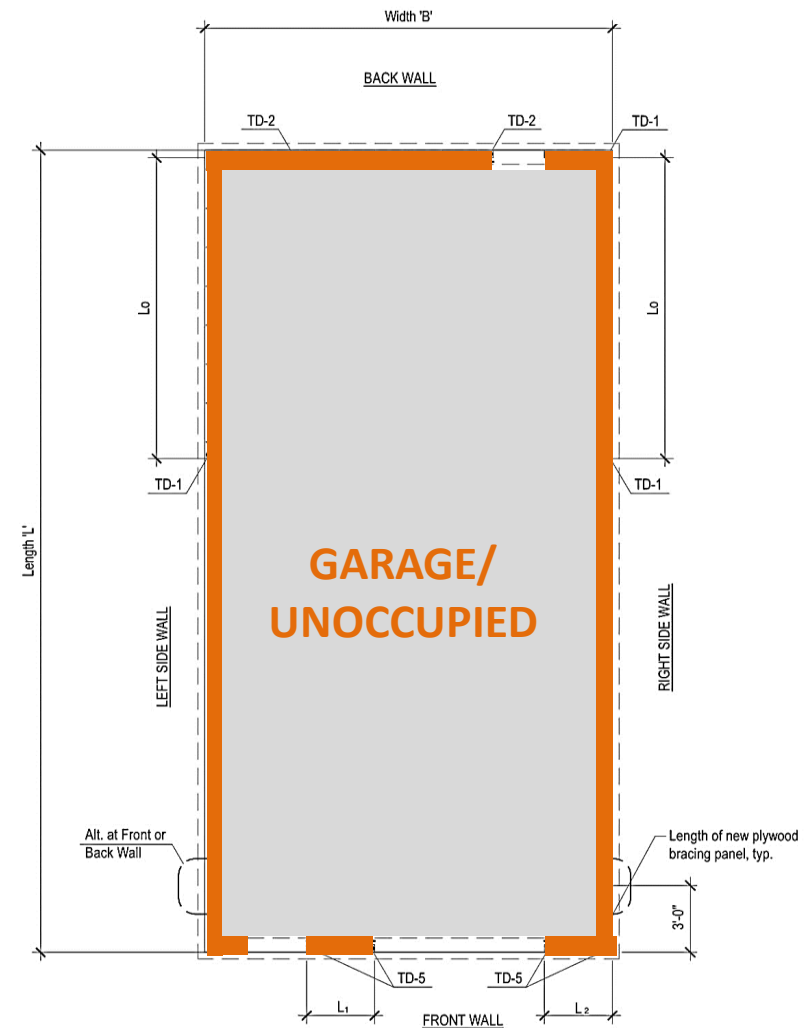
VOLUME 1 - Prestandard

**VOLUME 2 – Implementation Material
Plan sets**

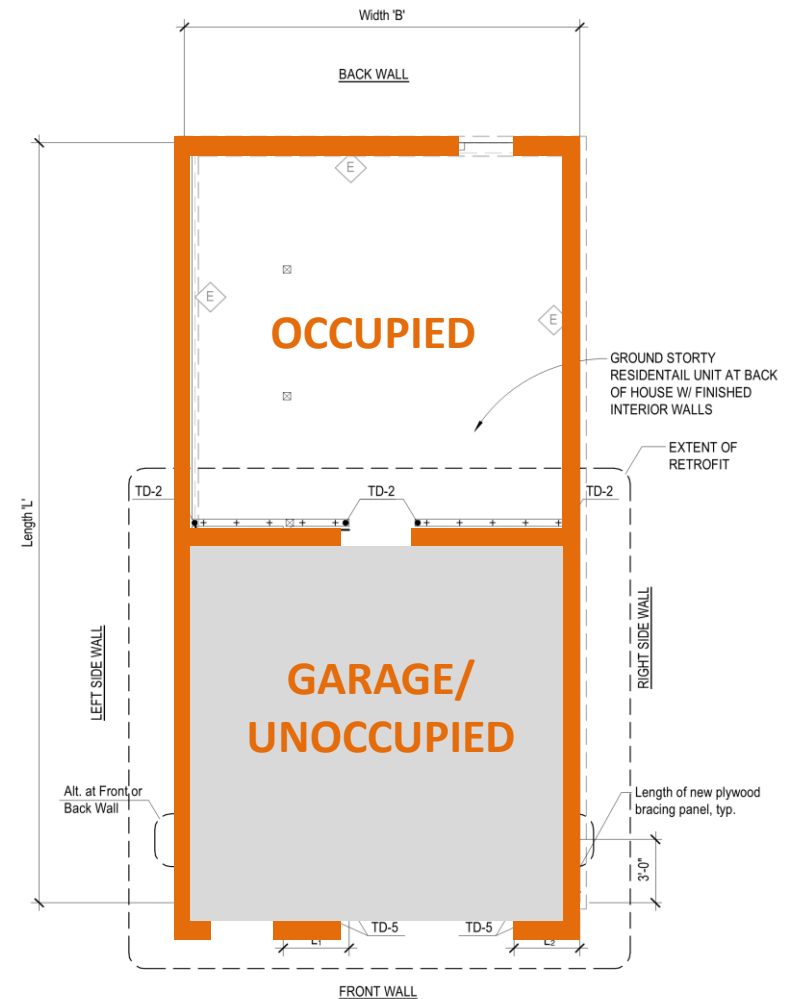
What is a *Living-Space-Over-Garage (LOG)* Dwelling



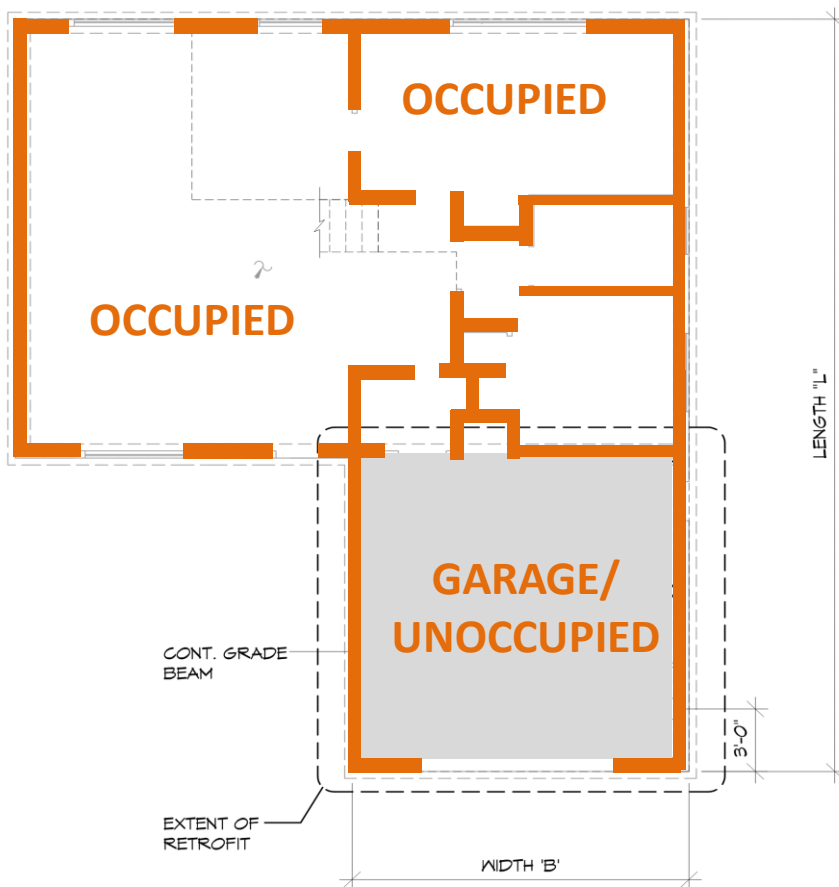
What Dwellings are Included?



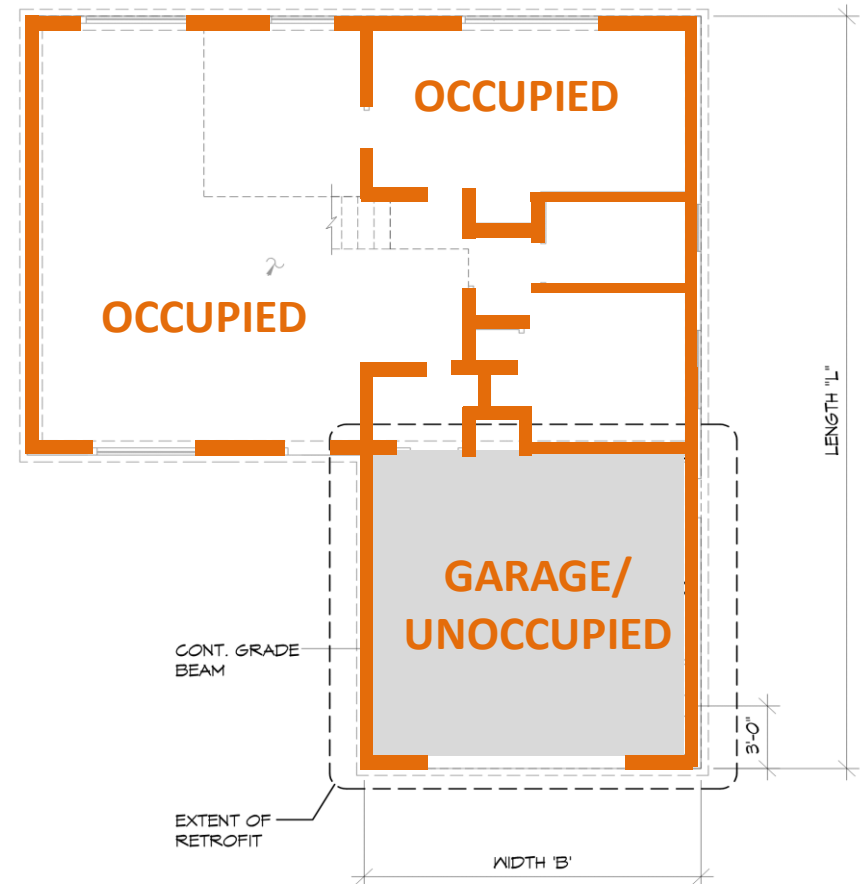
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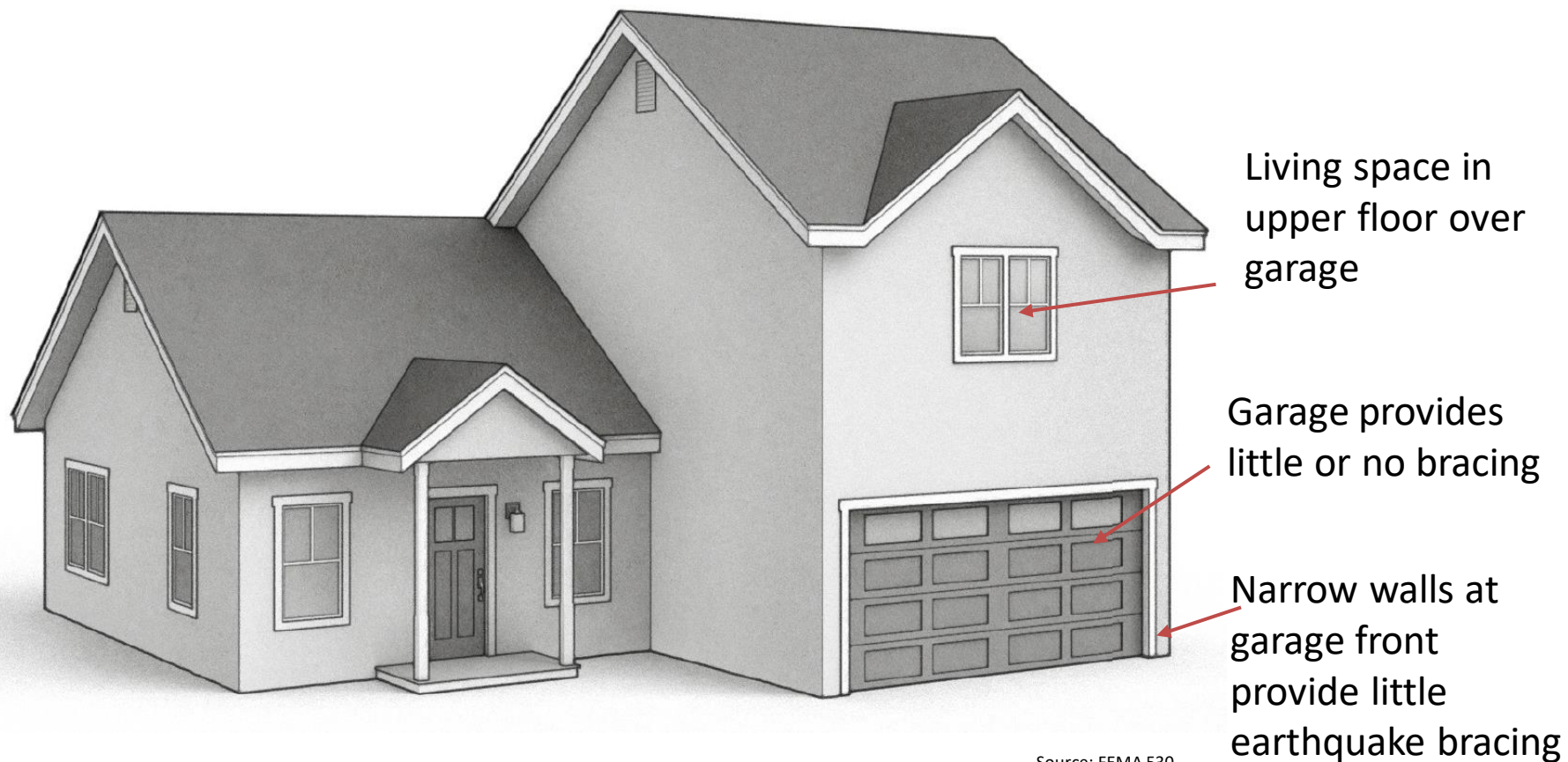
What Dwellings are Included?



What Dwellings are Included?



Why Retrofit *Living-Space-Over-Garage (LOG)* Dwellings?



Source: FEMA 530

Collapses at the ground floor do pose a large Life Safety risk!

Why Retrofit *Living-Space-Over-Garage (LOG)* Dwellings?



Source: Ron Gallagher



PHOTO COURTESY OF J.K NAKATA, AVAILABLE AT WWW.USGS.GOV,
LAST ACCESSED 7/7/19

Collapses at the ground floor do pose a large Life Safety risk!

Retrofit Methods

- **Prescriptive vulnerability-based retrofit**
- Simplified engineered vulnerability-based retrofit
- General engineering vulnerability-based retrofit

What is a Prescriptive Vulnerability-based Retrofit?

- Focuses on known vulnerability
- Most cost-effective safety improvement
- Engineering is embedded (conservative)
- Applies to a wide range of dwelling (but has limitations)

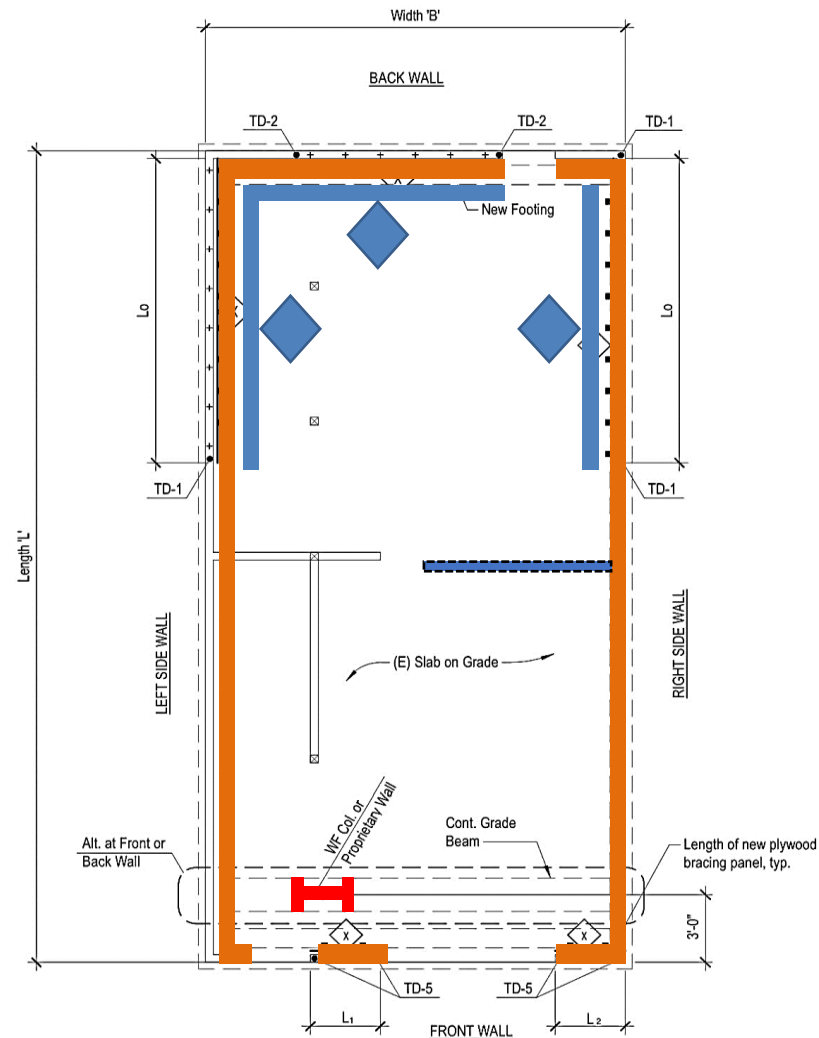
See Module 1C for Overview of Vulnerability-based Retrofit Options per FEMA P-1100

LOG Retrofit Preview

Adds lateral load resisting elements and load path connections

Locations of element:

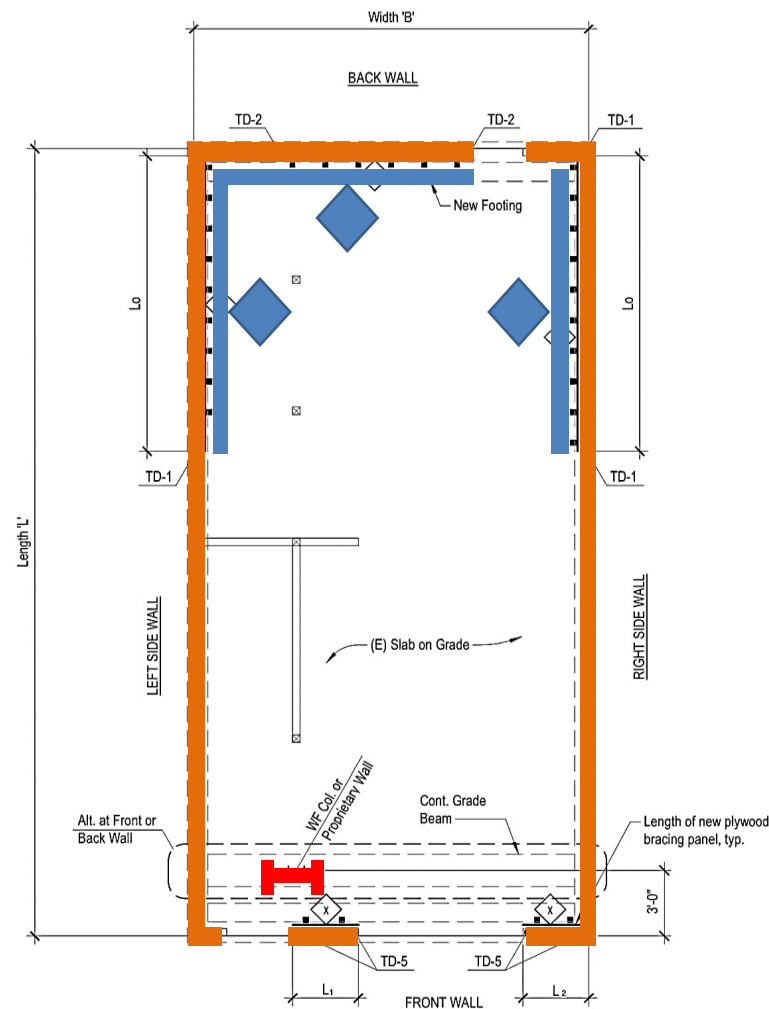
- Front of garage
- Back of garage
- Side walls



LOG Retrofit Preview

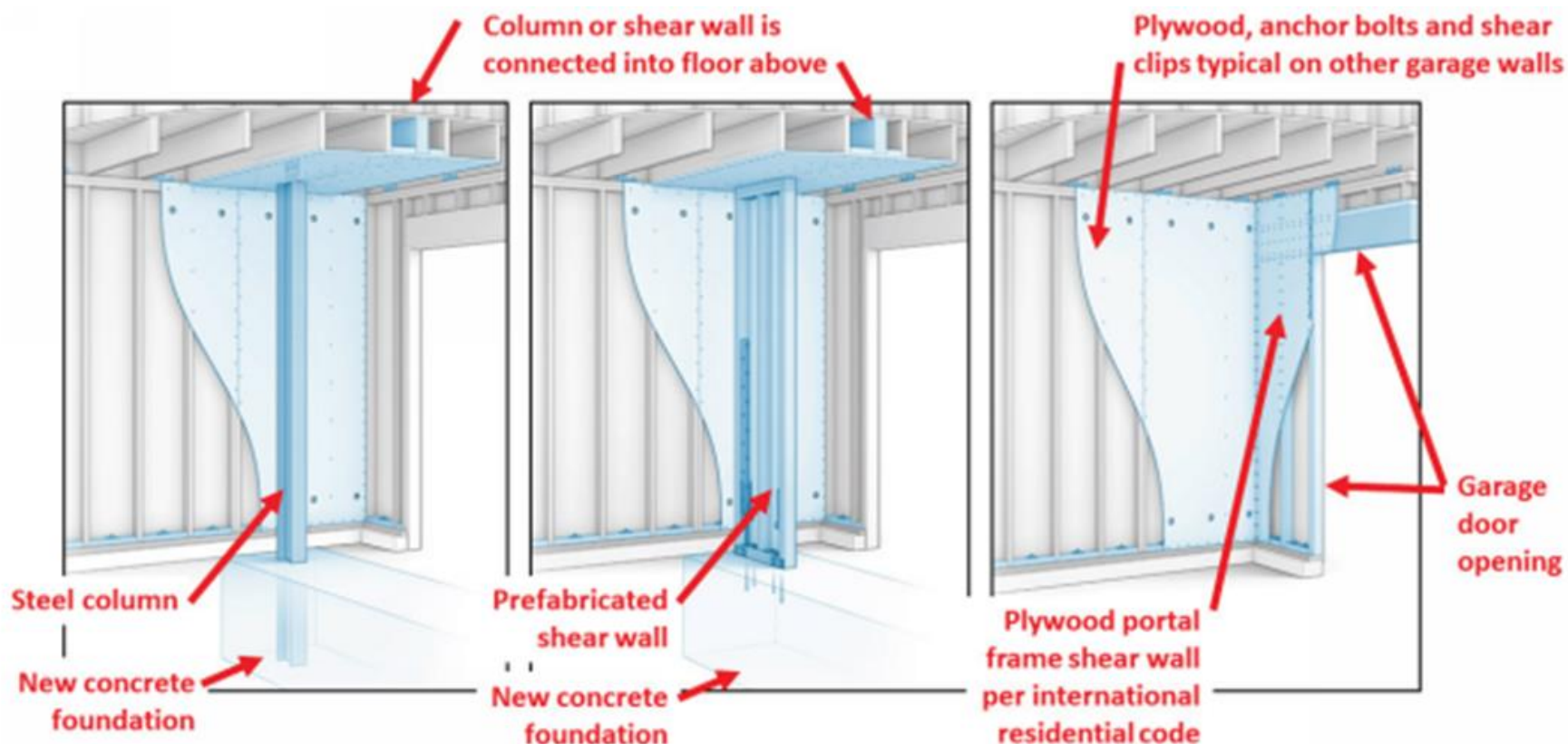
Types of elements:

- Steel retrofit column
- Proprietary shear wall
- Wood structural panel shear wall

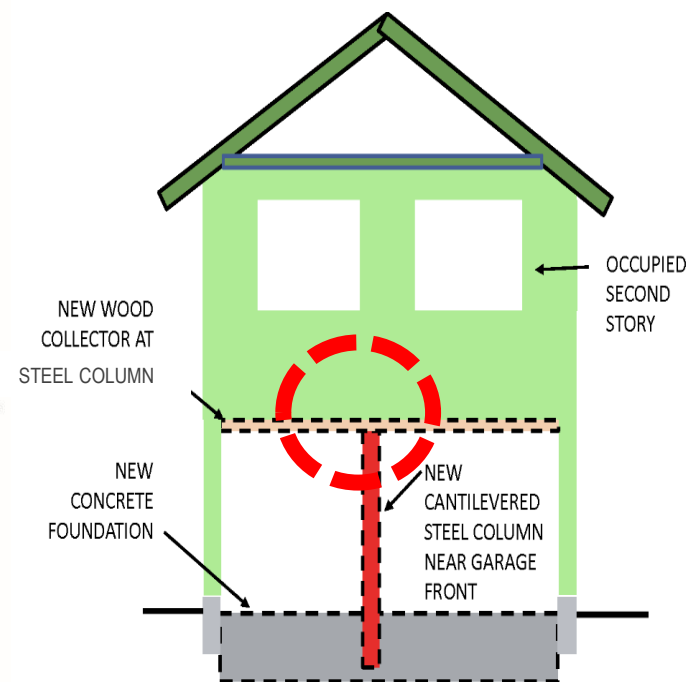
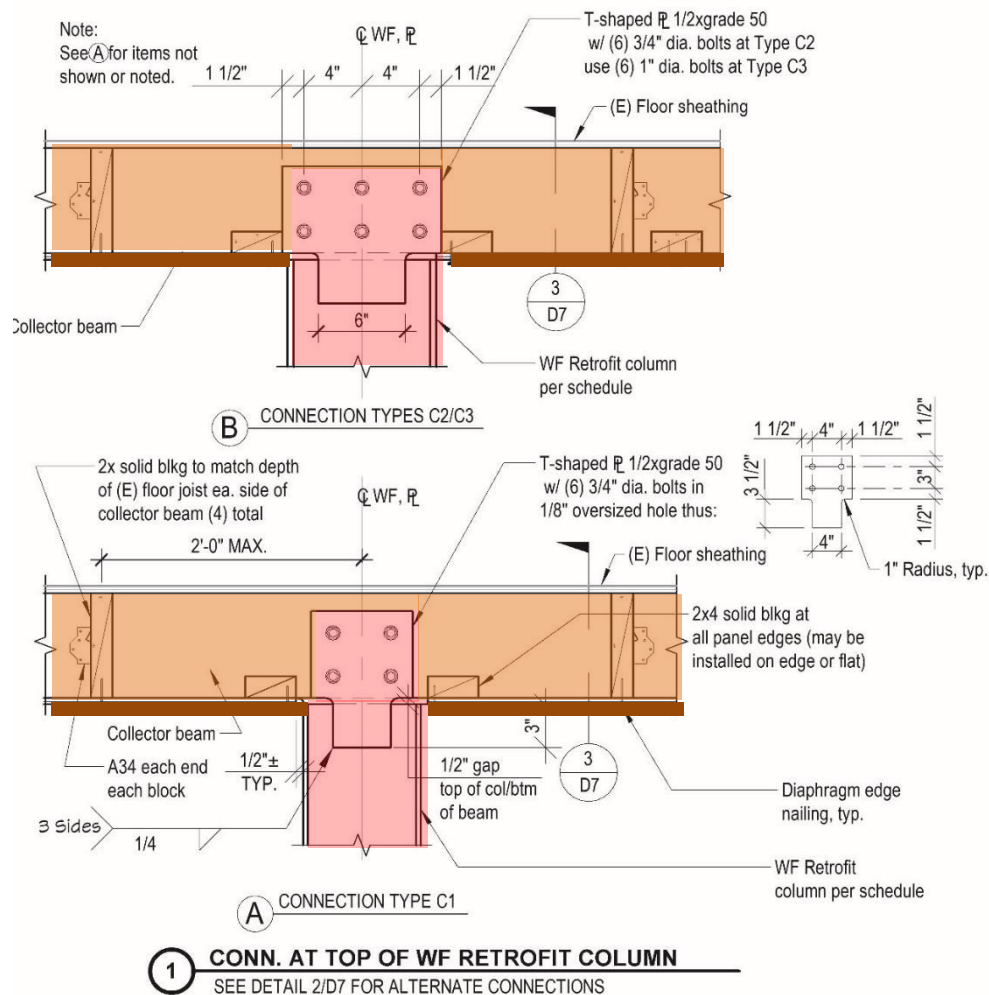


LOG Retrofit Preview

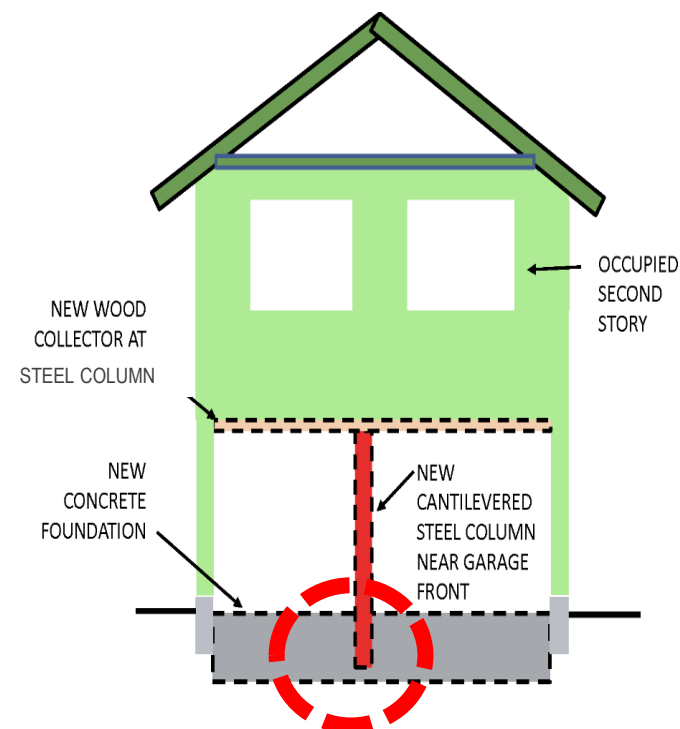
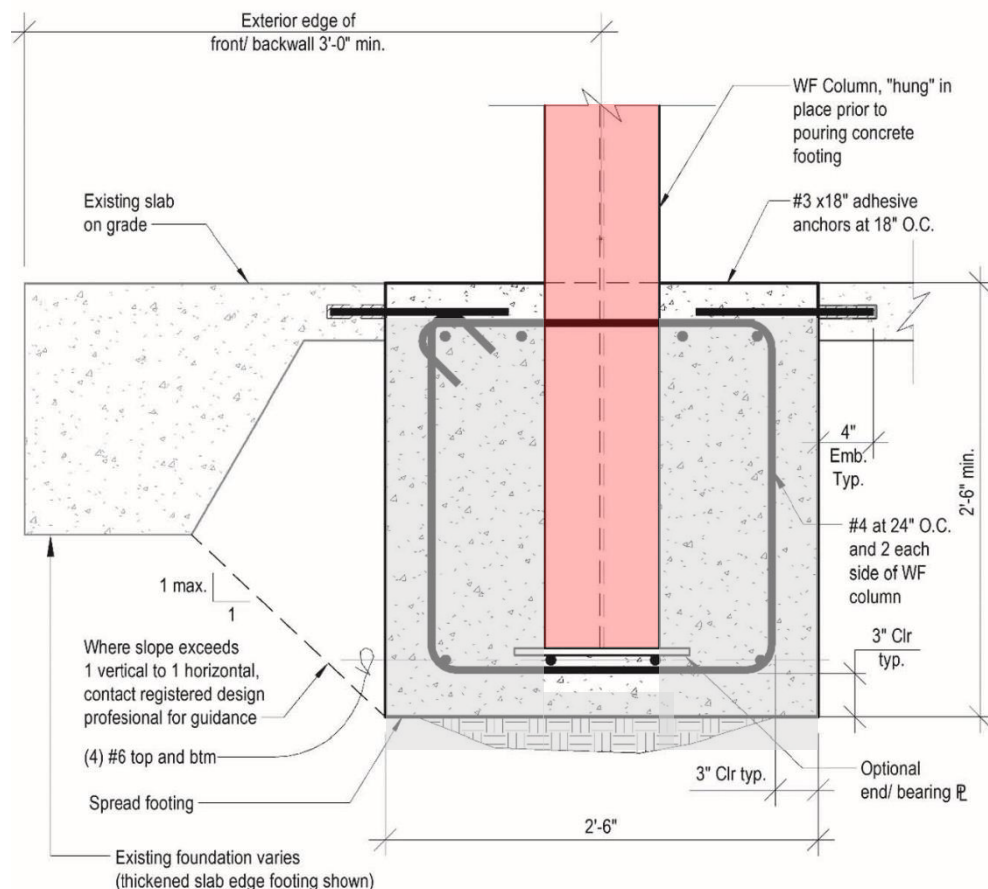
- Required strengthening limited to connections for load path into and out of new vertical elements



Steel Retrofit Column

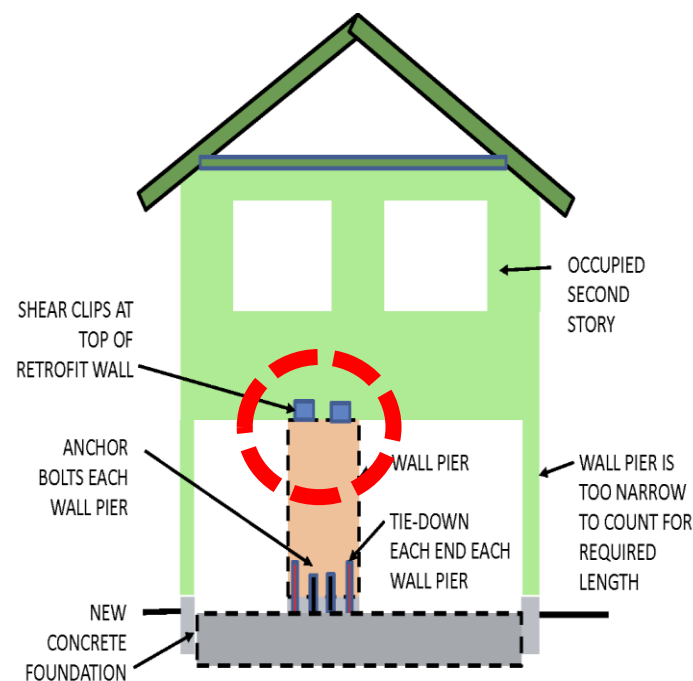
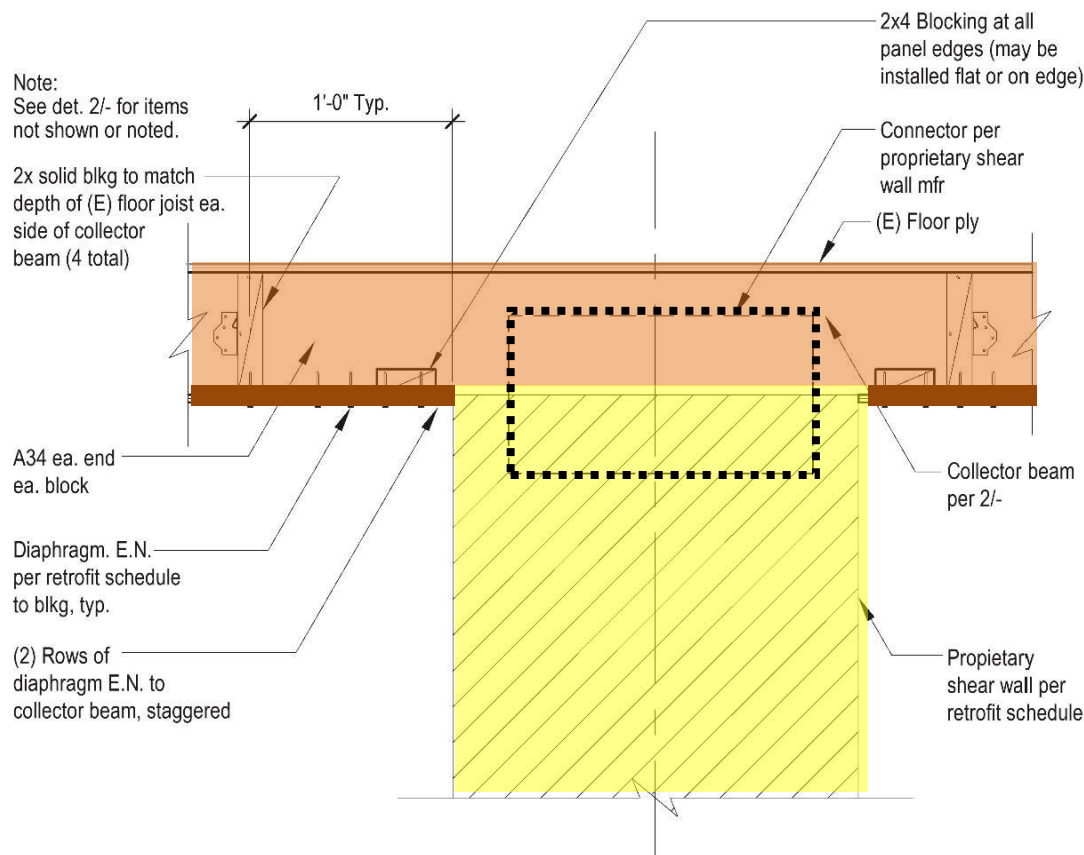


Steel Retrofit Column



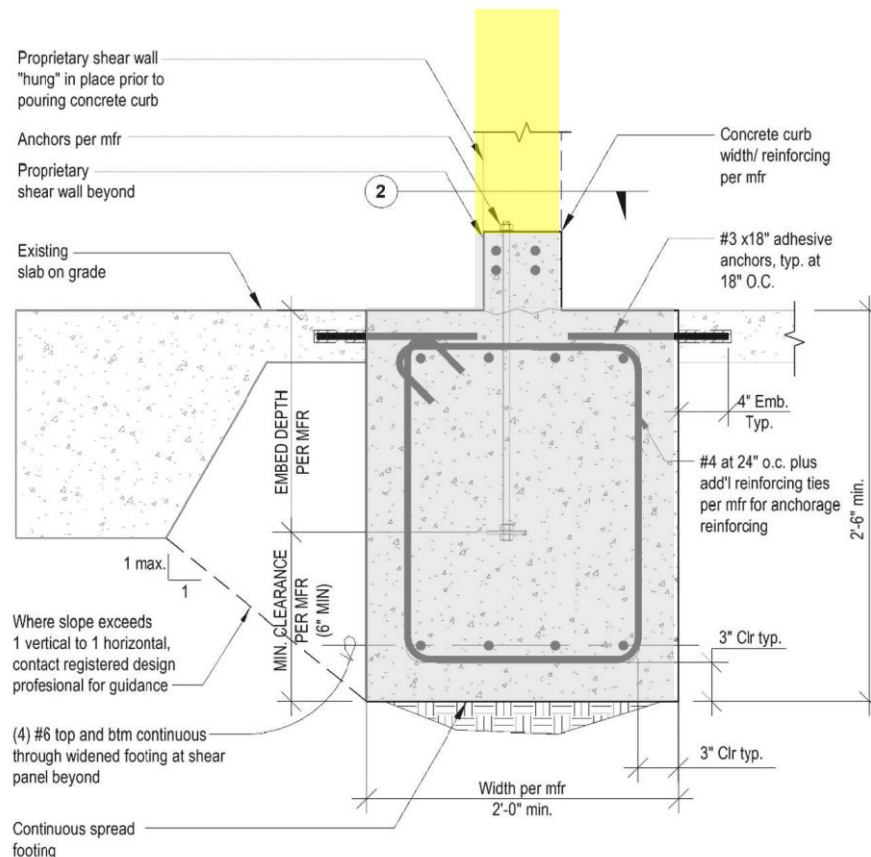
1 FOOTING AT NEW RETROFIT COLUMN

Proprietary Shear Walls

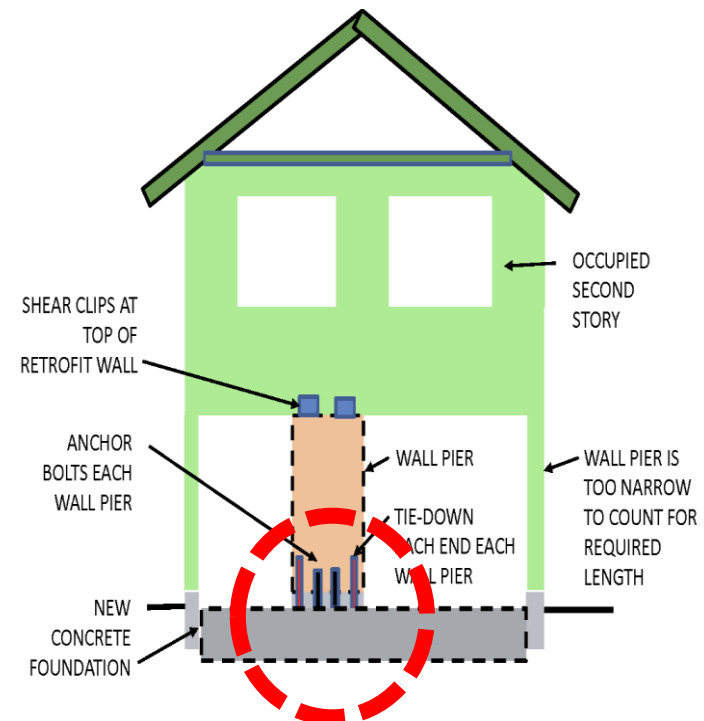


1 FLOOR CONN. AT PROPRIETARY SHEAR WALL FLOOR FRAMING PARALLEL TO GARAGE FRONT

Proprietary Shear Walls



1 CONT. FOOTING/ GRADE BEAM AT PROPRIETARY



Introduction to Plan Sets

- Volume 2A: Plan Set for Crawlspace Dwellings
- Volume 2B: Plan Set for Living Space Over Garage Dwellings
- Volume 2C: Plan Set for Masonry Chimneys

VOLUME 2 – Plan Sets

See Module 1C for Full Overview of Plan Sets

Plan Set Fundamentals

- Intended to be used by a contractor or owner without an engineer for most common configurations
- Intended to be submitted for permit
- Standalone self-contained package
- Does not include assessment, assumes that the need to retrofit has already been identified

Plan Set Content

- Instructions for use
- Purpose and scope
- Eligibility checks
- General notes for materials and implementation
- Sheet to draw plan and note details
- Multiple details from which to choose those most applicable
- Example

LOG Dwellings Plan Set

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 design provided in this Plan Set, which is being published 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; $I_h = 1.5$; $S_{DC} = V$aries (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 the 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 retrofit 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 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 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.		TABLE 1: ELIGIBILITY FOR USE <table border="1"> <thead> <tr> <th>To determine if a home qualifies, answer the following:</th> <th>Compliant</th> <th>Non-Compliant</th> </tr> </thead> <tbody> <tr> <td>1. 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Submittal Sheet Index <table border="1"> <tbody> <tr><td>S0</td><td>Cover Sheet</td></tr> <tr><td>S1</td><td>General Notes</td></tr> <tr><td>S2</td><td>Supplemental Technical Notes Where Tie-downs are Required at Existing Foundations</td></tr> <tr><td>S3</td><td>Earthquake Retrofit Schedule General Instructions, Weight Category, and Connectors</td></tr> <tr><td>S3.1-1.0</td><td>Earthquake Retrofit Schedule - Wood Structural Panel with single section of wall</td></tr> <tr><td>S3.2-1.0</td><td>Earthquake Retrofit Schedule - Wood Structural Panel with two sections of wall</td></tr> <tr><td>S3.3-1.0</td><td>Alternate Earthquake Retrofit Schedule (Steel Column or Proprietary Shear Wall)</td></tr> <tr><td>S3.4-1.0</td><td>Earthquake Retrofit Schedule at front of garage only in dwelling with Ground Floor Residential Unit</td></tr> <tr><td>S3.5-1.0</td><td>Earthquake Retrofit Schedule at front of garage only in dwelling with Ground Floor Residential Unit</td></tr> <tr><td>S3.6-1.0</td><td>Alternate Earthquake Retrofit Schedule at front of garage in dwelling w/ Ground Floor Residential Unit</td></tr> <tr><td>S4</td><td>Foundation and Retrofit Layout Plan</td></tr> <tr><td>D1</td><td>Foundation Sill to Concrete Foundation Connection Details</td></tr> <tr><td>D2</td><td>Foundation Details at Wood Structural Panel Shear Walls</td></tr> <tr><td>D3</td><td>Floor Framing to Wall Connection Details</td></tr> <tr><td>D4</td><td>Wood Structural Panel Installation at Shear Walls without Tie-Downs</td></tr> <tr><td>D5</td><td>Wood Structural Panels with Tie-Downs</td></tr> <tr><td>D6</td><td>Wall Openings and Top Plate Details</td></tr> <tr><td>D7</td><td>Structural Details at Steel Retrofit Column</td></tr> <tr><td>D7.1</td><td>Foundation Details at Steel Retrofit Column</td></tr> <tr><td>D8</td><td>Structural Details at Proprietary Shear Wall Retrofit</td></tr> <tr><td>D8.1</td><td>Foundation Details at Proprietary Shear Wall Retrofit</td></tr> </tbody> </table> (*) Retrofit schedules sheet #1 listed above (sheets S3.1-1.0 thru S3.6-1.0) are for $S_{DC} = 1.0$ only. See sheet S3, Figure 1 for sheet numbers for Earthquake Retrofit Schedules for $S_{DC}=1.2$ and $S_{DC}=1.5$.	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 assessment 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 appendages) 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. 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- Volume 2A: Plan Set for Crawlspace Dwellings
- Volume 2B: Plan Set for *Living-Space-Over-Garage* Dwellings
- Volume 2C: Plan Set for Masonry Chimneys

Instructions for Use

Before you begin: - This Plan Set is intended for use by a general contractor or homeowner without necessarily having to involve a Registered Design Professional. - Contact your local Building Official, often known as the Building Department, to understand the building permit application. Inquire about: - Fees - How many copies of the plans must be submitted - Which inspections are required - 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. - 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 - Refer to Sheet S3. - Find Seismic Design Category (SDC) which will inform what S_{DS} value to use for the dwelling. - Determine building retrofit configuration type (see descriptions and the figures on Sheet S0 for guidance). - After you have obtained S_{DS} and configuration type, use Figure 1 on Sheet S3 to determine which retrofit schedules are applicable to use. - Determine weight classification for use in the selected schedules. C. Prepare your plans: - 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: - The location of any obstructions along the perimeter of the foundation that make the retrofitting work difficult or impossible such as freepipes, 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. - 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. - Dimensions for each length of perimeter wall segment and interior ground floor walls in the area of work and overall dimensions of wall lines. - An arrow pointing to North. - Label the street side (front) of the home. - See Sheet S4 for an example of a Plan Set submitted for the Building Official. - See Sheet S4 for an example of a Plan Set submitted for the Building Official. D. Gather information: - Review the condition of the foundation. - 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. - Identify the details used for the wood structural panel (Sheets D4 or D5). - If tie-downs are used, identify the details used (Sheet D5). - Identify the details used for the top plate splice (Sheet D6). - Identify the details used for notching and/or cutouts (Sheet D6). - If steel column retrofits are to be applied at the front or back walls, identify the details used (Sheets D7 and D7.1). - If Proprietary Shear Wall retrofits are to be applied at the front or back walls, identify the details used (Sheets D8 and D8.1). E. Complete your plans: - 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: - 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. - 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. - Identify the details used for the wood structural panel (Sheets D4 or D5). - If tie-downs are used, identify the details used (Sheet D5). - Identify the details used for the top plate splice (Sheet D6). - Identify the details used for notching and/or cutouts (Sheet D6). - If steel column retrofits are to be applied at the front or back walls, identify the details used (Sheets D7 and D7.1). - 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: - 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. - 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. - Inspection(s) by the Building Official may be required for: - Foundation anchor bolts / anchor plate installation, - Blocking installation, - Wood structural panel wall; sheathing and nailing, - Steel column installation, - Proprietary Shear Wall installation, - Metal hardware "connectors" installation, - Tie-downs, and - Final inspection.	FEMA Package Sheet List <table border="0"> <tr><td>S0</td><td>Instructions for Use</td></tr> <tr><td>S1</td><td>Cover Sheet</td></tr> <tr><td>S1</td><td>General Notes</td></tr> <tr><td>S2</td><td>Supplemental Technical Notes Where Tie-downs are Required at Existing Foundations</td></tr> <tr><td>S3</td><td>Earthquake Retrofit Schedule General Instructions, Weight Category, and Connectors</td></tr> <tr><td>S3.1-1.0</td><td>Earthquake Retrofit Schedule - Wood Structural Panel with single section of wall</td></tr> <tr><td>S3.2-1.0</td><td>Earthquake Retrofit Schedule - Wood Structural Panel with two sections of wall</td></tr> <tr><td>S3.3-1.0</td><td>Alternate Earthquake Retrofit Schedule (Steel Column or Proprietary Shear Wall)</td></tr> <tr><td>S3.4-1.0</td><td>Earthquake Retrofit Schedule at front of garage only in dwelling with Ground Floor Residential Unit</td></tr> <tr><td>S3.5-1.0</td><td>Earthquake Retrofit Schedule at front of garage only in dwelling with Ground Floor Residential Unit</td></tr> <tr><td>S3.6-1.0</td><td>Alternate Earthquake Retrofit Schedule at front of garage in dwelling w/ Ground Floor Residential Unit</td></tr> <tr><td>S4</td><td>Foundation and Retrofit Layout Plan</td></tr> <tr><td>* S4ex</td><td>Foundation and Retrofit Layout Plan</td></tr> <tr><td>D1</td><td>Foundation Sill to Concrete Foundation Connection Details</td></tr> <tr><td>D2</td><td>Foundation Details at Wood Structural Panel Shear Walls</td></tr> <tr><td>D3</td><td>Floor Framing to Wall Connection Details</td></tr> <tr><td>D4</td><td>Wood Structural Panel Installation at Shear Walls without Tie-Downs</td></tr> <tr><td>D5</td><td>Wood Structural Panels with Tie-Downs</td></tr> <tr><td>D6</td><td>Vent Openings and Top Plate Details</td></tr> <tr><td>D7</td><td>Structural Details at Steel Retrofit Column</td></tr> <tr><td>D7.1</td><td>Foundation Details at Steel Retrofit Column</td></tr> <tr><td>D8</td><td>Structural Details at Proprietary Shear Wall Retrofit</td></tr> <tr><td>D8.1</td><td>Foundation Details at Proprietary Shear Wall Retrofit</td></tr> <tr><td>* X1</td><td>Example - Living-Space-Over-Garage Dwelling with a wood structural panel shearwall & cantilever column retrofit</td></tr> </table> 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.	S0	Instructions for Use	S1	Cover Sheet	S1	General Notes	S2	Supplemental Technical Notes Where Tie-downs are Required at Existing Foundations	S3	Earthquake Retrofit Schedule General Instructions, Weight Category, and Connectors	S3.1-1.0	Earthquake Retrofit Schedule - Wood Structural Panel with single section of wall	S3.2-1.0	Earthquake Retrofit Schedule - Wood Structural Panel with two sections of wall	S3.3-1.0	Alternate Earthquake Retrofit Schedule (Steel Column or Proprietary Shear Wall)	S3.4-1.0	Earthquake Retrofit Schedule at front of garage only in dwelling with Ground Floor Residential Unit	S3.5-1.0	Earthquake Retrofit Schedule at front of garage only in dwelling with Ground Floor Residential Unit	S3.6-1.0	Alternate Earthquake Retrofit Schedule at front of garage in dwelling w/ Ground Floor Residential Unit	S4	Foundation and Retrofit Layout Plan	* S4ex	Foundation and Retrofit Layout Plan	D1	Foundation Sill to Concrete Foundation Connection Details	D2	Foundation Details at Wood Structural Panel Shear Walls	D3	Floor Framing to Wall Connection Details	D4	Wood Structural Panel Installation at Shear Walls without Tie-Downs	D5	Wood Structural Panels with Tie-Downs	D6	Vent Openings and Top Plate Details	D7	Structural Details at Steel Retrofit Column	D7.1	Foundation Details at Steel Retrofit Column	D8	Structural Details at Proprietary Shear Wall Retrofit	D8.1	Foundation Details at Proprietary Shear Wall Retrofit	* X1	Example - Living-Space-Over-Garage Dwelling with a wood structural panel shearwall & cantilever column retrofit	This sheet is for instruction and reference only. 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Step-by-step instructions for use	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	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 are 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>.

Official in accordance with the FEMA P-1100 Prestandard, Section 5.5.

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

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:

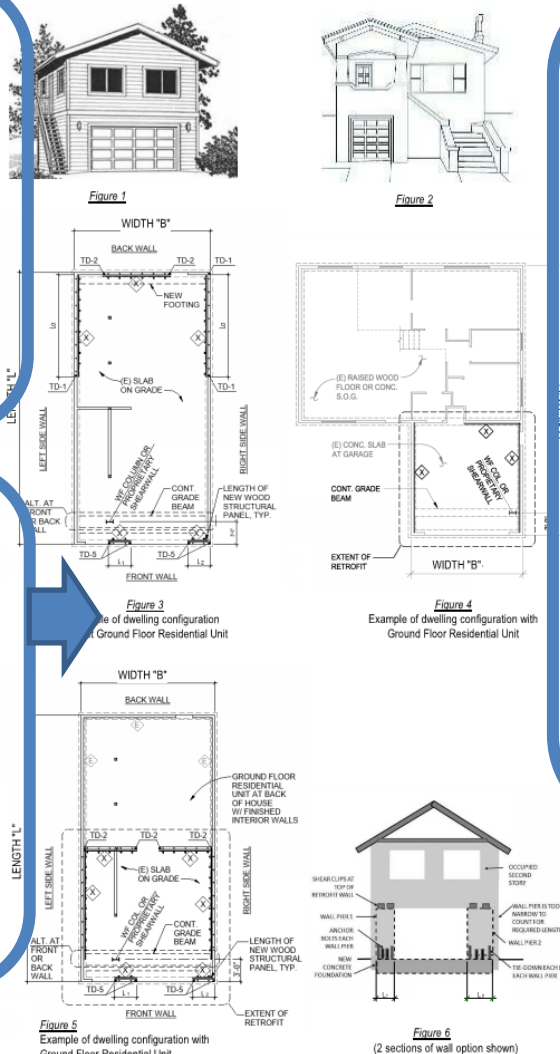
- Wood Structural Panel Shear Walls, with a single length of shear wall along a given wall line;
- Wood Structural Panel Shear Walls, with two sections of shear wall per wall line;
- Retrofits including Steel Columns or Proprietary Shear Walls options for front and back walls.

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

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.

**TABLE 1: ELIGIBILITY FOR USE**

To determine if a home qualifies, answer the following:

1. The dwelling is a one or two-family detached structure or the dwelling is a unit in a townhouse and assessment and retrofit will occur for each attached townhouse.			Complete
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 square 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

<u>Submittal Sheet Index</u>	
S0	Cover Sheet
S1	G
S2	S
S3	E
S3.1-1.0	E
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S3.3-1.0	A
S3.4-1.0	Earthquake Retrofit Schedule at front of garage only in dwelling with Ground Floor Residential Unit
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D7	Vent Openings and Top Plate Details
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D8	Foundation Details at Steel Retrofit Column
D8.1	Structural Details at Proprietary Shear Wall Retrofit
D8.1	Foundation Details at Proprietary Shear Wall Retrofit

(*) 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

100 ANY STREET
SAN RAFAEL, CA

APPLICANT: _____
ADDRESS: _____
PHONE: _____
SIGNATURE: _____

Cover Sheet

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

Date: _____
Sheet: _____

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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.

Section 1: Purpose

The purpose of the Plan Set is to promote public safety and welfare by reducing earthquake-related damages to existing Living Space-Over-Garage Dwellings. The prescriptive designs provided in this Plan Set, when published as per FEMA-1100, Volume 2, are deemed to comply with the provisions of the FEMA-1100. The provisions of this Plan Set address a single vulnerability, see the FEMA-1100 Presentation for assessment and retrofit methodologies. Use of this Plan Set is to improve earthquake performance but is not intended to prevent earthquake damage. For additional information, see www.fema.gov/earthquake-recovery (FEMA-1100).

Section 2: Scope

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

Section 3: Assumptions

Living Space-Over-Garage Dwellings are permitted to use the prescriptive retrofit of the Plan Set that are identified in Table 1. Items are assumed to be "compliant" for dwellings on stilts to meet this Plan Set, and FEMA-1100 recommendations, and to be the Integrated Engineering Professional.

Section 4: References

When 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 meet the prescriptive provisions of this Plan Set. These supplemental details shall be stamped and signed by a Registered Design Professional and approved by the Building Official's signature with the FEMA-1100 Presentation, Section 5.5.

Section 5: Design Basis

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

- 1. $R = 5.0$, $S_{DS} = 1.5$, $S_{D1} = 0.5$ Values (Sections 1 and 1.1). See Class C.

Section 6: 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 containing garage space. This term applies to the dwelling of the living space occurs on an upper level over a garage, as in Figure 1. This dwelling type the garage may be the full-width and full depth of the garage and still, area may have partially or fully converted to a general open residential unit. This also captures dwellings having a portion of an upper level converted to use the garage as in Figure 2.

Section 7: Details

Details identified in this table and include the following for retrofitting each type of configuration, including:

- The number of required Floor Plates, with a single strength of wall at each plate line.
- Wood Structural Panel Shear Walls, with ten details of three wall sets and one.
- Reinforced concrete Slabs or Proprietary Shear Walls options for braced and braced walls.
- For Ground Story Bracing a Living Space-Over-Garage Dwellings retrofit in accordance with this Plan Set, wall details are provided to prevent the following configurations without a Ground Story Braced wall:

- The north-south and east-west bracing elements at the dwelling front, back and side (see Figure 3). Bracing elements at the side are to be braced structural panel walls, bracing elements at the front and back walls are permitted to be a form of the bracing element shown below.

Section 8: Configurations with a Ground Floor Braced wall

The retrofit shall include bracing elements at the dwelling front and back walls, and east-west bracing the garage over the residential area (see Figure 4 and 5). Bracing elements at the front wall are permitted to be a form of the bracing element shown in braced above. Bracing elements at the side walls are not separating the garage from the residential area or be the wood structural panel shear wall.

Section 9: Assessment

This retrofit provisions of this Plan Set are intended to apply to dwellings that have been assessed using the FEMA-1100 methodology for retrofit of Living Space-Over-Garage Vulnerability.

Section 10: Table 1: Eligibility for Use

1. Determine if a home qualifies, answer the following:

- The dwelling is on a two-family detached structure or the dwelling is on a townhouse and assessment and retrofit occur on the attached wall.
- The dwelling is a light-gauge frame dwelling and has a maximum of only one above the ground story.
- The dwelling is a light-gauge frame garage dwelling as defined in Chapter 2 FEMA-1100 presentation.
- The dwelling perimeter (not including porches or other appendages) is supported on continuous foundations, concrete area walls or braced steel edge joist.
- The lower garage level is constructed of a continuously reinforced concrete wall on grade and has the portion of the wall that braced the garage.

2. Weight of existing material and not exceed 120 lb/ft² of pressure on any plate.

3. Weight of exterior wall from slab and not exceed 150 lb/ft², except that corner anchors supported on concrete foundations are permitted to support up to four feet of braced wall.

4. Weight of interior wall from slab and not exceed 60 lb/ft², except that masonry parapets supported on masonry walls that are 12 inches thick and up to 120 square feet are allowed to exceed the weight.

5. Weight of upper floor finish shall not exceed 50 lb/ft², except that heavier floor finishes of up to 10 lb/ft² are acceptable when limited to 25% of the total floor area of each level.

6. Floors in each story are at the same level and not split level, including full basements.

7. The home floor area, calculated as Net Area, shall be 3,000 sq. ft. or less.

8. No part of the facade is braced.

9. Clear floor to ceiling heights if any suspended floor, does not exceed 12 feet.

10. If any suspended floor is present, it must be supported on 2x12 joists.

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93. If any suspended floor is present, it must be supported on 2x12 joists.

94. If any suspended floor is present, it must be supported on 2x12 joists.

95. If any suspended floor is present, it must be supported on 2x12 joists.

96. If any suspended floor is present, it must be supported on 2x12 joists.

97. If any suspended floor is present, it must be supported on 2x12 joists.

Prescriptive vs. Engineered Retrofit

PURPOSE: The purpose of this Plan Set is to provide public safety and welfare by reducing earthquake-induced damage to existing Living Space-Over-Garage Dwellings. The prescriptive design included in this Plan Set, when in compliance with FEMA P-1100, is intended to be used by a Registered Design Professional (RDP) to provide a prescriptive retrofit for a Living Space-Over-Garage Dwelling. The prescriptive design included in this Plan Set is intended to be used by a Registered Design Professional (RDP) to provide a prescriptive retrofit for a Living Space-Over-Garage Dwelling. The prescriptive design included in this Plan Set is intended to be used by a Registered Design Professional (RDP) to provide a prescriptive retrofit for a Living Space-Over-Garage Dwelling.

SCOPE: This Plan Set provides prescriptive provisions for retrofit of Ground Floor Bearing Living Space-Over-Garage Dwellings.

ELIGIBILITY: Living Space-Over-Garage Dwellings are permitted to use the prescriptive retrofit provisions of this Plan Set other than those in Table 1. Table 1 can be accessed with the Plan Set. The dwelling retrofits are to be used in accordance with FEMA P-1100 Prestandard, Section 5.5 for the Registered Design Professional.

DEFINING CONDITIONS: Where a dwelling's actual conditions require modification of the vulnerability-based provisions, the dwelling shall be designed in accordance with the FEMA P-1100 Prestandard, Section 5.5 for the Registered Design Professional and used to supplement the prescriptive provisions of this Plan Set. These supplemental details shall be prepared 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 intended to comply with Chapter 1 of FEMA P-1100 Prestandard. Specific design assumptions are as follows:
 $R = 5.0$, $S_a = 1.0$, $S_{a1} = 0.5$ (between 1 and 1.5), Site Class C

REMARKS: Living Space-Over-Garage Dwellings include several types of dwellings in which living space occurs at or above a portion of the dwelling's footprint as a garage. This set captures the dwellings in which all of the living space occurs at an upper level over a garage only, as shown in Figure 1. In the dwelling the garage space may be finished or unfinished and used as a garage and utility area, or may have been finished and converted to ground floor residential use. This set also captures dwellings where a portion of an upper level living space occurs over the garage, as shown in Figure 2.

Earthquake Retrofit Schedule: In the 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 per line.
- Aluminum Composite Panel Shear Walls, with two lengths of shear wall per line.
- Aluminum Composite Panel Shear Walls, with two lengths of shear wall per line.
- Aluminum Composite Panel Shear Walls, with two lengths of shear wall per line.
- Aluminum Composite Panel Shear Walls, with two lengths of shear wall per line.

Configurations without 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 side walls are permitted to be in any of the bracing element types listed above. Bracing elements at the side walls and wall separating the garage use from the residential use are to be used at least at the garage use from the residential use.

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 side walls are permitted to be in any of the bracing element types listed above. Bracing elements at the side walls and wall separating the garage use from the residential use are to be used at least at the garage use from the residential use.

REMARKS: 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 Dwelling.

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 assessment 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, including steps on grade.	✓	
11. The base floor area, calculated at "0" level, as defined in Figure 3.4, d or e shall not exceed 2,000 square 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".	✓	

Submittal Sheet Index

01 Cover Sheet
 02 General Notes
 03 Earthquake Retrofit Schedule - Wood Structural Panel with single length of wall
 03.1-0 Earthquake Retrofit Schedule - Wood Structural Panel with single length of wall
 03.1-1 Earthquake Retrofit Schedule - Wood Structural Panel with single length of wall
 03.1-2 Earthquake Retrofit Schedule - Wood Structural Panel with single length of wall
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 03.1-99 Earthquake Retrofit Schedule - Wood Structural Panel with single length of wall
 03.1-100 Earthquake Retrofit Schedule - Wood Structural Panel with single length of wall

APPLICANT INFORMATION

Name: _____
 Address: _____
 City: _____
 State: _____
 Zip: _____
 Date: _____

RECORD OF LIVING SPACE-OVER-GARAGE DWELLINGS (Plan Set)

Project Name: _____
 Project Address: _____
 Project City: _____
 Project State: _____
 Project Zip: _____
 Project Date: _____

SO

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 assessment 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, including steps on grade.	✓	
11. The base floor area, calculated at "0" level, as defined in Figure 3.4, d or e shall not exceed 2,000 square 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-compliance issues in accordance with P-1100 Prestandard, Section 5.5. See Differing Conditions section on this sheet.

Can you use a prescriptive approach?

Dwelling Configuration Types

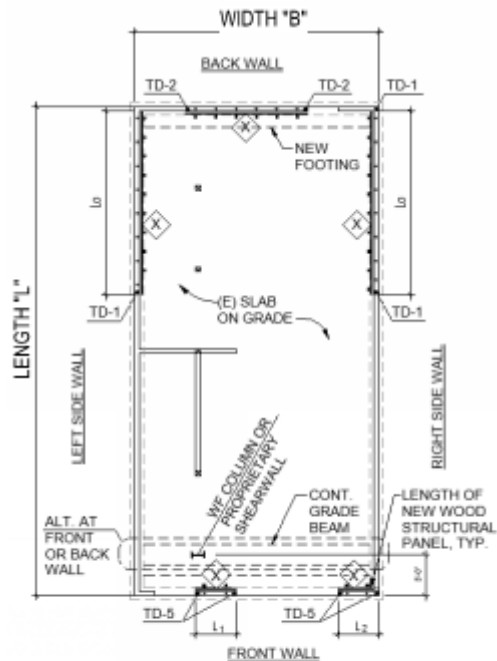


Figure 3
Example of dwelling configuration
without Ground Floor Residential Unit

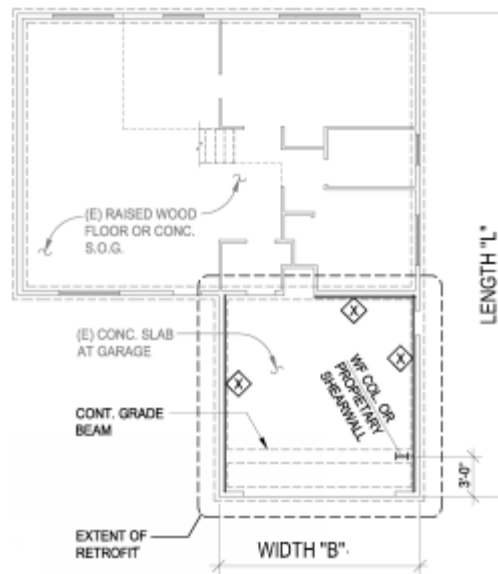


Figure 4
Example of dwelling configuration with
Ground Floor Residential Unit

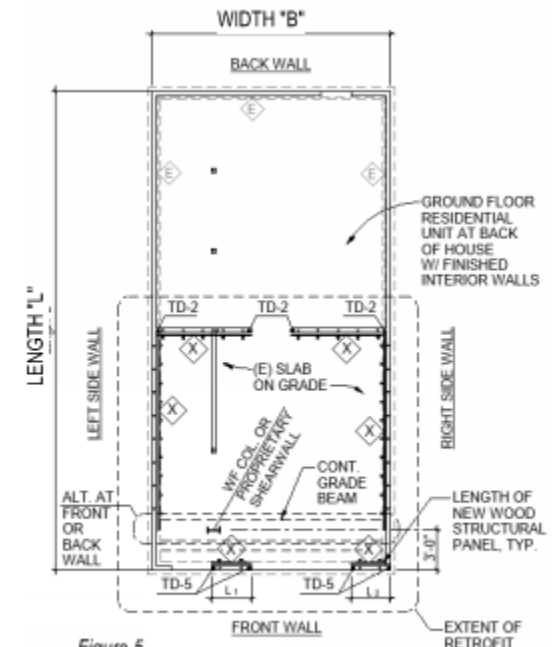


Figure 5
Example of dwelling configuration with
Ground Floor Residential Unit

Dwellings 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

Dwellings 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.

LOG Plan Set - Prescriptive Design

A. CODE

- 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

- 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

- 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.
- 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.
- 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 with 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.

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

D. NOTCHING, BORING AND CUTTING

- Do not cut, bore or notch structural members except as shown.
- Exception: Notching and boring of framing shall be permitted.
- When drilling in concrete, do not drill through existing reinforcement. Relocate hole. Fill original hole with non-shrink grout.

E. CONCRETE

- Concrete shall have a strength of not less than 3000 psi in accordance with the manufacturer's instructions using pot.

F. REINFORCING STEEL (REBAR)

- Reinforcing steel shall conform to ASTM A615 Grade 40 or 60, ASTM A706, or ASTM A996 Type R.
- Reinforcing steel bend radii and other rebar detailing shall be in accordance with Concrete Reinforcing Steel Institute.
- Minimum concrete cover over reinforcing steel:
 - Concrete cast against and permanently exposed to soil: 3 inches
 - Formed concrete exposed to weather: 2 inches
 - Concrete not exposed to weather or in contact with soil: 1-1/2 inch
 - Reinforcing steel lap splice lengths:

	No. 5	No. 6
Horizontal bars with more than 12 inches concrete below:	32 inches	42 inches
Other bars:	24 inches	32 inches

G. STRUCTURAL STEEL

- 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.
- Bolts shall conform to ASTM A-307. Threaded rods shall conform to ASTM A-36.

H. FASTENERS

- General
 - All bolts, nails and other fasteners in contact with preservative treated wood or exposed to weather shall be hot dip galvanized or stainless steel.
- Nails
 - Unless otherwise noted, all nails specified are to be common nails.
 - Special care is required when installing nails in existing framing. Where required to avoid splitting of framing, predrill to 75% of nail shank diameter.
 - 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.
 - 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

- Predrill bolt holes to not more than 1/16th inch larger than bolt or anchor bolt to be placed.
- At each perimeter wall line, provide 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.
- 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.
- 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.
- 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.
- 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

- 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.
- 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.
- Provide 1/8-inch minimum gap at all sheathing panel ends and edges.
- 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

- Framing shall be Douglas Fir-Larch, or an approved species having a greater or equal specific gravity.
- 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

shall be installed in accordance with the manufacturer's instructions. Connectors shall be galvanized in accordance with ASTM A653. Connectors exposed to weather shall be galvanized or G185 coating in accordance with the manufacturer's instructions. The length of each wall line or within the length of the

General Notes

L. POST-INSTALLED ANCHORS

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

M. PROPRIETARY SHEAR WALLS

- 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 D7889, in a manner and with documentation acceptable to the building official.
- Proprietary Shear Walls shall be installed in accordance with the manufacturer's installation requirements and the provisions of this Plan Set.

N. PERMITS

- All work required by this Plan Set shall be permitted through the building department.

O. INSPECTIONS

- 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

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

APPLICANT: **100 ANY STREET**
PROPERTY ADDRESS: **SAN RAFAEL, CA**

General Notes

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: **SEPTEMBER 2019**



Date:
Sheet:

S1

LOG Plan Set - Prescriptive Design

Q. PURPOSE OF SUPPLEMENTAL TECHNICAL NOTES - These Supplemental Technical Notes provide guidance for the installation of wood structural panels that use tie-downs and existing foundation systems. Tie-downs shall be used where there is insufficient wall length to install the length of wood structural panels specified in the Earthquake Retrofit Schedule, Sheet S3.1. - Where "With Tie-down" (as specified on the Earthquake Retrofit Schedule, Sheet S3.1) is used to determine the amount of strengthening required along each wall length, 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. - Where these requirements are not met, a new foundation system will be required in accordance with Sheet D7. R. EXISTING FOUNDATION REQUIREMENTS AND TESTING - 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. - 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. - 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 - 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. - End studs(s) to which tie-downs are installed, shall be 3x minimum or double 2x. For nailing at double studs, see Sheet D5. - All tie-downs shall use 5/8" (A36) threaded rod adhesive-type anchors with minimum embedment per Detail 1, Sheet D5. T. MINIMUM INSTALLATION REQUIREMENTS FOR TIE-DOWN ANCHORS TO FOUNDATIONS - All holes shall be drilled to the specified diameter and depth. - All holes shall be blown clean of dust with oil-free compressed air for a minimum of 4 seconds. - All holes shall be cleaned with a nylon brush for a minimum of 4 cycles. - Blow holes clean of dust with oil-free compressed air for a minimum of 4 seconds. - Check adhesive cartridge expiration date, open, and install per the manufacturer's instructions. - 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. - Insert a clean and oil-free anchor turning slowly until the anchor contacts the wall. - Do not disturb the anchor.	Additional Requirements for tie-downs <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 30%;"></td> <td style="width: 30%;"></td> <td style="width: 40%;">Signature _____</td> </tr> <tr> <td style="width: 30%;"></td> <td style="width: 30%;"></td> <td style="width: 40%;">Signature _____</td> </tr> <tr> <td style="width: 30%;"></td> <td style="width: 30%;"></td> <td style="width: 40%;">Signature _____</td> </tr> <tr> <td style="width: 30%;"></td> <td style="width: 30%;"></td> <td style="width: 40%;">Signature _____</td> </tr> </table>			Signature _____			Signature _____			Signature _____			Signature _____					
		Signature _____																
		Signature _____																
		Signature _____																
		Signature _____																
Table R-2: Foundation Verification Requirements <table border="1" style="width: 100%; border-collapse: collapse; text-align: center;"> <thead> <tr> <th></th> <th colspan="2">Screw Anchor</th> <th>Adhesive Anchor</th> </tr> <tr> <th>Diameter a</th> <th>Torque (ft-lbs)</th> <th>Torque (ft-lbs)</th> <th>Torque (ft-lbs)</th> </tr> </thead> <tbody> <tr> <td>1/2"</td> <td>35</td> <td>15</td> <td></td> </tr> <tr> <td>5/8"</td> <td>50</td> <td>20</td> <td></td> </tr> </tbody> </table>			Screw Anchor		Adhesive Anchor	Diameter a	Torque (ft-lbs)	Torque (ft-lbs)	Torque (ft-lbs)	1/2"	35	15		5/8"	50	20		Supplemental Technical Notes (Where Tie-downs are Required) Retrofit of Crawlspace 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  Date: _____ Sheet: S2
	Screw Anchor		Adhesive Anchor															
Diameter a	Torque (ft-lbs)	Torque (ft-lbs)	Torque (ft-lbs)															
1/2"	35	15																
5/8"	50	20																

APPLICANT: **100 ANY STREET**
 PROPERTY ADDRESS: **SAN RAFAEL, CA**

Earthquake Retrofit Schedule General Instructions

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

- The first two factors taken into consideration for determining the appropriate amount of Earthquake Strengthening:
 - Site seismicity or S_{DS} value
 - Building retrofit/ configuration type
- 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.
 - In your internet browser go to <http://www.atccouncil.org/fema-p-1100>
 - Click on one of the five (5) geographic areas listed to find your location on the appropriate map.
 - Locate your SDC (SDC A, SDC B, SDC C) by the color number shown on the map.
 - Find the appropriate retrofit/ configuration type by clicking the link below.
- Determine the appropriate retrofit/ configuration type by clicking the link below.
- Find the appropriate retrofit/ configuration type by clicking the link below.

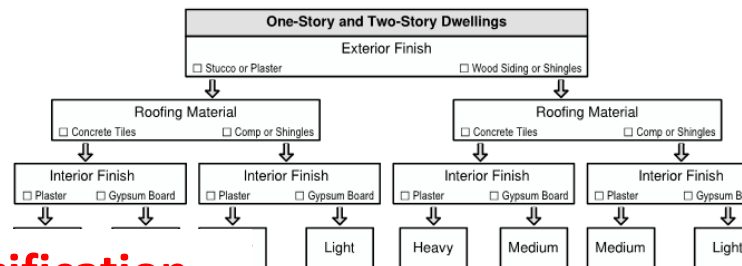
Seismic Design Category and Building Retrofit/Configuration Type

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	See Retrofit Schedules on Sheets S3.1-1.0	See Retrofit Schedules on Sheets S3.1-1.2	See Retrofit Schedules on Sheets S3.1-1.2	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.

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.
- Check the box of the material that most closely matches your home's finishes.
 - 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:
- The "wood siding or shingles" exterior finish category also includes finishes of similar weight, including but not limited to fiber-cement and aluminum siding.
 - 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.
 - The "gypsum board" interior finish category also includes wall finish materials of similar weight, including but not limited to wood board or panel.
 - The "light" weight classification category also includes wall finish materials of similar weight, including but not limited to wood board or panel.



Weight Classification

Connectors

- Manufacturer's model numbers and installation instructions are subject to change. Verify and follow manufacturer's written instructions.
- Connector images are general in nature only. Individual manufacturer's connectors may vary.
- Any of the connectors listed within a particular group (e.g. Type B) may be used for strengthening the particular condition.
- This Plan Set
- Where connectors are used, alternate approved by the Building Official.

Connectors

ANCHOR BOLTS

MANUFACTURER	MODEL	EMBEDMENT DEPTH
Powers	Titon HD Kwik-HUS-EZ Wedge-Bolt	3-1/2" 3-1/2" 3-3/8"
ADHESIVE	Threaded Rod with: SET Adhesive HIT-HY 200 CIA GEL 7000C	4-1/4" 5" 3-1/8" 3-1/8"

CONNECTORS			
IMAGE	MANUFACTURER	MODEL	CAPACITY (lbs)
	TYPE A Simpson Strong-Tie USP Structural Connectors	URFP SRC	1530 1450
	TYPE B Simpson Strong-Tie KC Metals USP Structural Connectors	FRFP RFP SRCP	1065 960 1570
	TYPE C KC Metals USP Structural Connectors Simpson	RFA66/88 RFA136/138 SFA68 FRFP	725 1145 875 1065
	TYPE D Simpson Strong-Tie KC Metals USP Structural Connectors	L70 CAT0 AC7	740 565 725
	TYPE E Simpson Strong-Tie KC Metals USP Structural Connectors	L90 CA90 AC9	925 740 905
	TYPE F Simpson Strong-Tie KC Metals USP Structural Connectors	H10A HT10A RT16A	590 590 800
	TYPE G Simpson Strong-Tie KC Metals USP Structural Connectors	LTP4 FAL MP4F	600 445 660
	TYPE S1 Simpson Strong-Tie KC Metals USP Structural Connectors	MSTA36 TSA36 MST36	725 1145 875
	TYPE S2 Simpson Strong-Tie KC Metals USP Structural Connectors	ST6236 TS36 KST234	2050 2075 2065

TIE-DOWNS

(Supplemental Technical Notes, Sheet S2, Section S)

IMAGE	MANUFACTURER	MODEL	CAPACITY (lbs)
	Simpson Strong-Tie KC Metals USP Structural Connectors	HOU2 ADST2 PHD2A	3075 4275 3215
	Simpson Strong-Tie KC Metals USP Structural Connectors	HOU4 ADST5 PHD5A	4565 5895 5215
	Simpson Strong-Tie KC Metals USP Structural Connectors	HOU8 ADG8 PHD8A	5645 5895 6525
	Simpson Strong-Tie KC Metals USP Structural Connectors	HOU8 ADG8 PHD8	7870 8820 8185
	Simpson Strong-Tie KC Metals USP Structural Connectors	HOU11 ADG12 UPHD9	11,175 13,200 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.

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



Sheet: **S3**

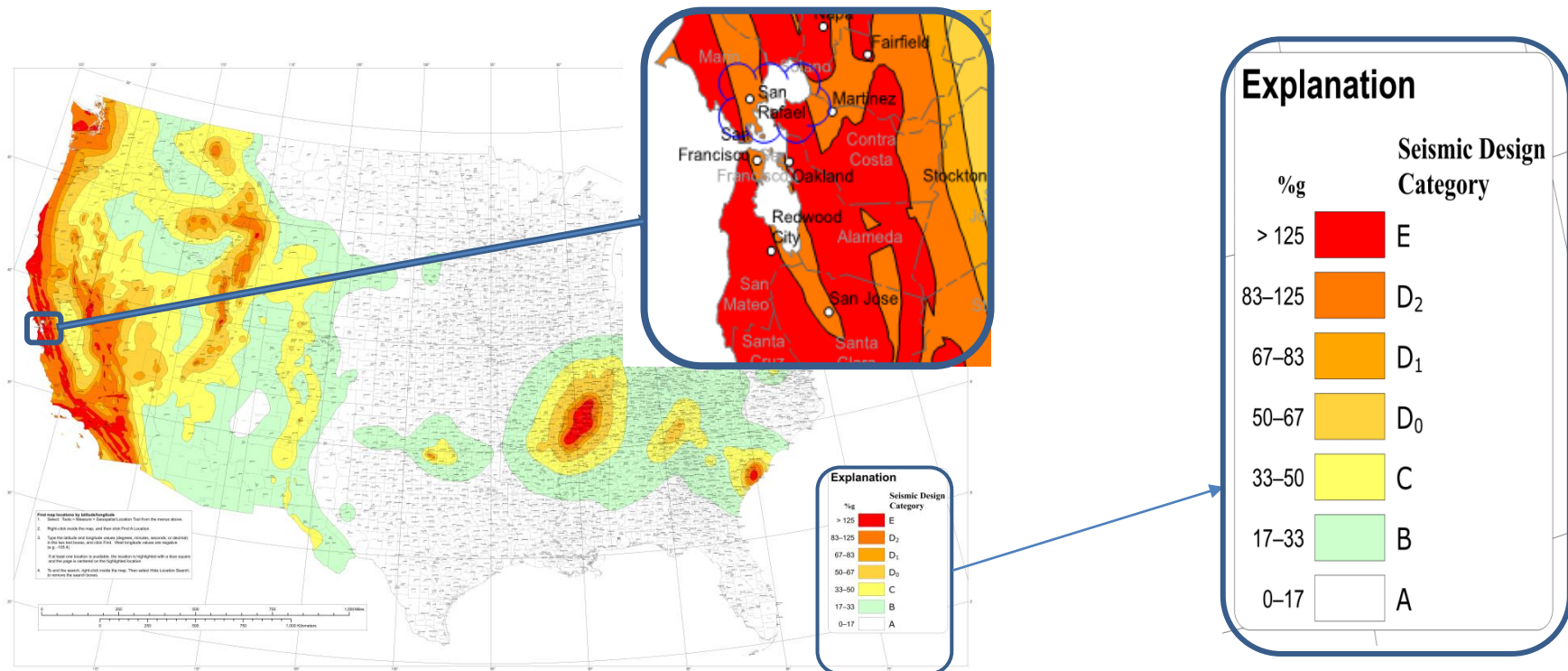
Earthquake Retrofit Schedule

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-D₁, use $S_{DS} = 1.0$.
 - e. For SDC D₂, 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.

Seismicity and Building Retrofit/Configuration Type

Seismic Design Category

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.



<http://www.atccouncil.org/fema-p-1100>

Earthquake Retrofit Schedule

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.

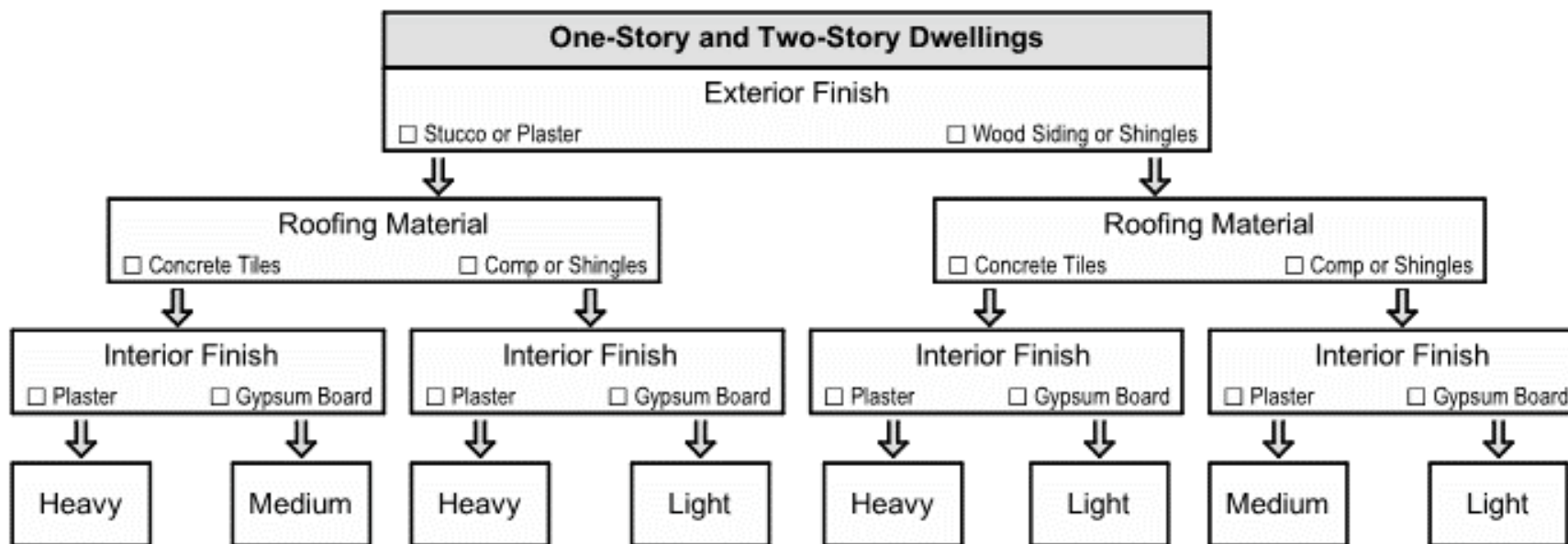
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All S_{DS} Values
Construction Details See Sheets D1 thru D8.1

Figure 1. Earthquake Retrofit Schedules per S_{DS}

Building Weight Classification

Weight Classification



Prescriptive Design Schedule

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 ☒ 8d Nail Spacing	④ MINIMUM REQUIRED LENGTH OF A SINGLE SECTION OF WALL OF WOOD STRUCTURAL PANEL SHEAR WALLS (at each wall line)											⑤ FOUNDATION SILL ANCHORAGE					⑥ FLOOR FRAMING TO WALL CONNECTION		
			No Tie-down		w/ Tie-downs in Existing or New Foundations									Min. No. of Foundation Connectors or Anchors at Each Wall Panel					Min. No. of Connectors at Each Wall Panel		
			8d Nail Spacing	Wall Length	8d at 6" O.C.			8d at 4" O.C.			8d at 2" O.C.			Type "A"	Type "B"	Type "C"	1/2"x Bolt	5/8"x Bolt	Type "D"	Type "E" or "F"	Type "G"
					Wall Length	Tie-down	New Fdn Req'd ?	Wall Length	Tie-down	New Fdn Req'd ?	Wall Length	Tie-down	New Fdn Req'd ?								
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	

Notes:

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

- Locate the section that matches your home's construction. Use the chart on Sheet S3 to determine "Weight Category".
- 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.
 - Approximate floor area _____
- 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.
- 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).
- 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.
- 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.
- 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.
- 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

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

⑧

Supplemental Earthquake Retrofit Schedule

- Check boxes if additional Earthquake Retrofit Schedules 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

FEMA P-1100, Volume 2 - Plan Sets

Issued: SEPT 2019


 Date: _____
 Sheet: **S3.1-1.2**

Prescriptive Design Schedule

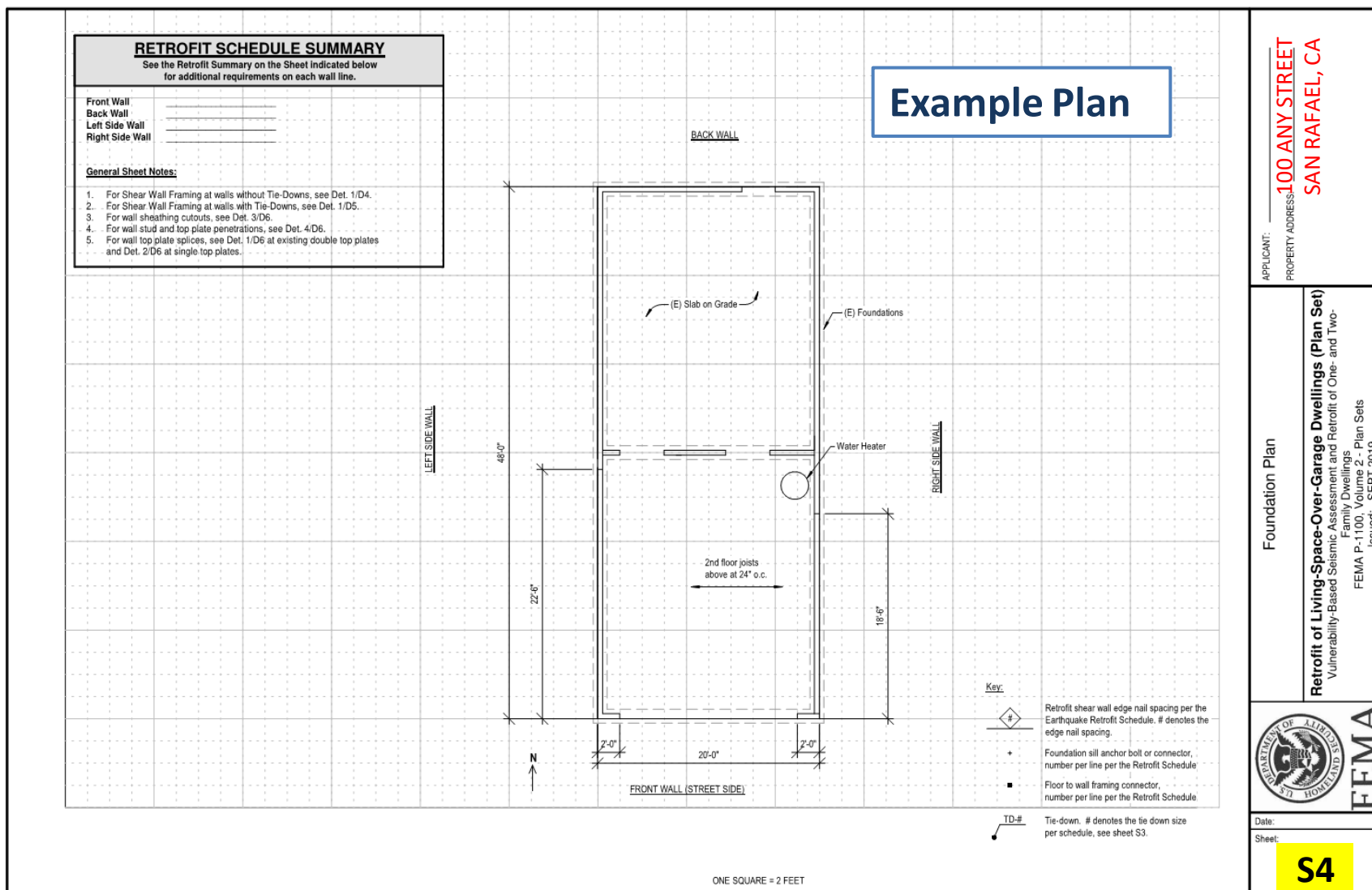
EARTHQUAKE RETROFIT SCHEDULE ($S_{DS} = 1.2$) for Single Section of Wall																						
① WEIGHT CLASSIFICATION	② Floor Area in Square Feet	③ Mark row that applies ☐ 8d Nail Spacing	④ MINIMUM REQUIRED LENGTH OF A SINGLE SECTION OF WALL OF WOOD STRUCTURAL PANEL SHEAR WALLS (at each wall line)										⑤ FOUNDATION SILL ANCHORAGE					⑥ FLOOR FRAMING TO WALL CONNECTION				
			No Tie-down		w/ Tie-downs in Existing or New Foundations										Min. No. of Foundation Connectors or Anchors at Each Wall Panel					Min. No. of Connectors at Each Wall Panel		
					8d at 6" O.C.			8d at 4" O.C.			8d at 2" O.C.			Type "A"	Type "B"	Type "C"	1/2"ø Bolt	5/8"ø Bolt	Type "D"	Type "E" or "F"	Type "G"	
			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 ?									
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	52	

Date: _____
Sheet: _____
S3.1-1.2

Prescriptive Design - Plan Set

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 _____ <u>General Sheet Notes:</u> 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.	Draw Your Plan Here	APPLICANT: _____ PROPERTY ADDRESS: _____
ONE SQUARE = _____ FEET		Foundation and Retrofit Layout Plan 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
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.		Date: _____ Sheet: S4

Prescriptive Design - Plan Set



Prescriptive Design - Details

1 ANCHOR THROUGH FOUNDATION SILL ONLY
Detail applies where (E) foundation sill is the same width as the (E) wall studs

2 ANCHOR THROUGH BLOCKING AND FOUNDATION SILL
Detail applies where (E) foundation sill is wider than the (E) wall studs

3 NEW BLOCKING INSTALLATION FOR WOOD STRUCTURAL PANEL ATTACHMENT

Construction Details

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	
3" screw	Simpson Strong-Tie 1/4" SDS, GRK 3/8" RSS "Climatek", USP Mitek 1/4" WS "Gold Coat", or equivalent.
4" screw	3" long structural wood screw
6" screw	4" long structural wood screw
Wood Structural Panel	15/32" Wood Structural Panel Sheathing, Exposure 1, 5-Ply.
LVL (Laminated Veneer Lumber)	Weyerhaeuser "Microlam", 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

100 ANY STREET
SAN RAFAEL, CA

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

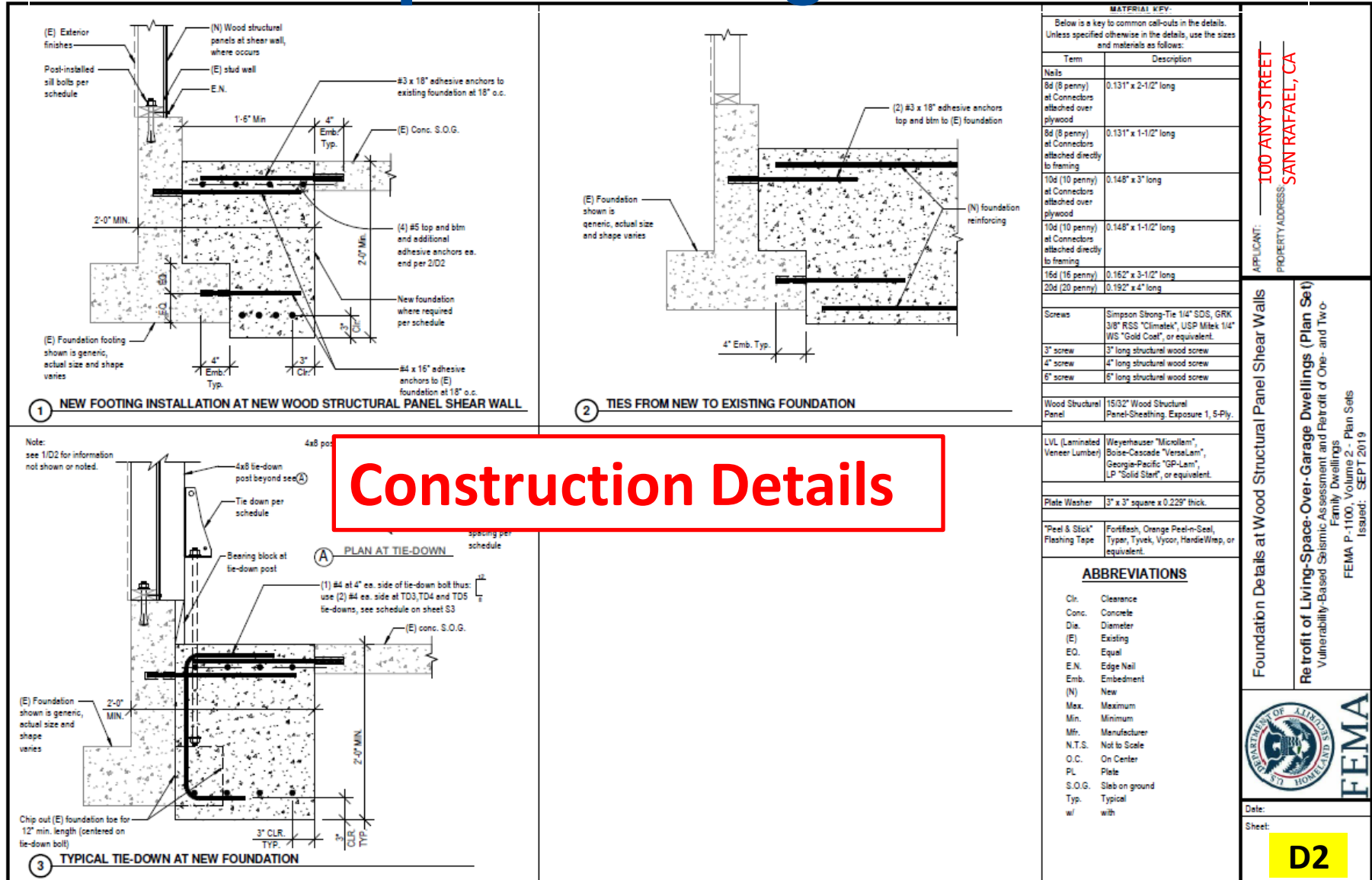
APPLICANT:

DATE:

SHEET:

D1

Prescriptive Design - Details



Prescriptive Design - Details

1 FLOOR-TO-WALL CONNECTION AT PARALLEL JOISTS

2 FLOOR-TO-WALL CONNECTION AT PERPENDICULAR JOISTS

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

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

5 FLOOR-TO-WALL CONNECTION AT FLOOR OVERHANG

6 FLOOR-TO-WALL CONNECTION

Construction Details

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)	Weyerhaeuser "Microlam", Boise-Cascade "Verselam", 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, Vybor, 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: 100 ANY STREET
PROPERTY ADDRESS: SAN RAFAEL, CA

Floor Framing to Wall Connection Details

Re-roof 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

FEDERAL DEPARTMENT OF HOMELAND SECURITY FEMA

Date: _____
Sheet: **D3**

Prescriptive Design - Details

Notes:

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

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	
3" screw	Simpson Strong-Tie 14" SDS, GRK, 3/8" RSS "Climatek", USP Mitek 1/4" WS "Gold Coat", or equivalent.
4" screw	3" long structural wood screw
6" screw	4" long structural wood screw
Wood Structural Panel	15/32" Wood Structural Panel-Sheathing, Exposure 1, 5-Ply.
LVL (Laminated Veneer Lumber)	Weyerhaeuser "Microlam", 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
LVL	Typical
w/	with

Construction Details

Notes:

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

Notes:

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

Install (N) 2x blocking between (E) studs.

(N) 2x blocking with 8d at panel edge nailing on center at each end of each shear wall segment.

(N) Foundation sill anchor bolt See Detail 2/D1

1 FOUNDATION SILL SAME WIDTH AS WALL

2 FOUNDATION SILL WIDER THAN WALL

APPLICANT: **100 ANY STREET**

PROPERTY ADDRESS: **SAN RAFAEL, CA**

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

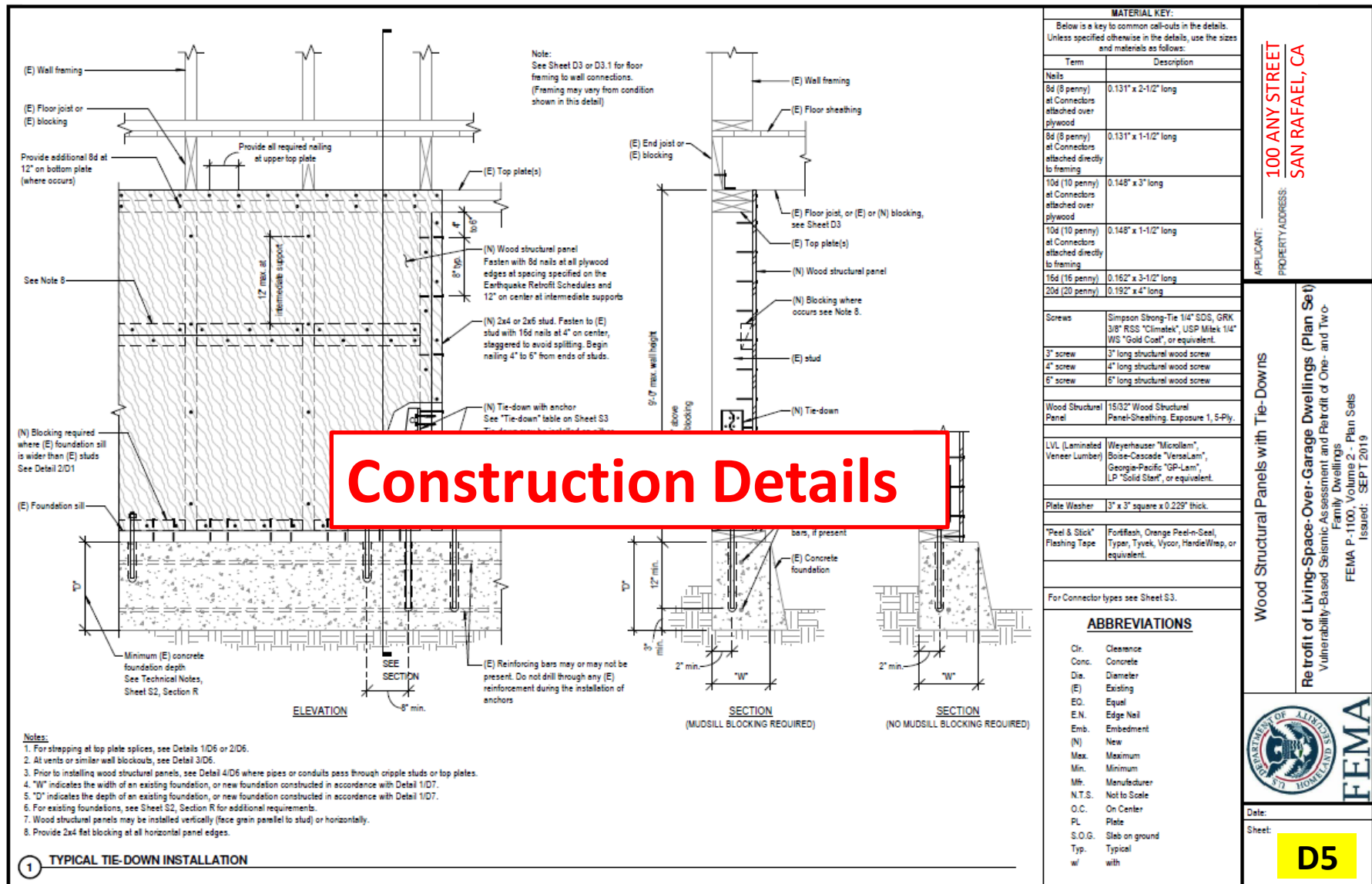
FEMA P-1100, Volume 2 - Plan Sets

Issued: SEPT 2019

Date: _____

Sheet: **D4**

Prescriptive Design - Details



Prescriptive Design - Details

(N) Connector Type "S1" centered at (E) upper top plate splice location. Install with (14) 8d nails each side of the joint (28 total).

If top plate splice is less than 8'-0", install Connector Type "S1".

Joint in (E) upper top plate

Joint in (E) lower top plate

(E) Double wall top plates

(N) Wood structural panel, where required Detail 1/D5, 1/D4 or 2/D4 for installation (Panel not shown)

(E) wall stud

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

1 TOP PLATE SPLICE AT EXISTING DOUBLE TOP PLATES

(N) Connector Type "S1" centered at (E) top plate splice location. Install with (9) 8d nails each side of the joint (18 total). In area of wood structural panels, install step over sheathing.

Joint at (E) top plate

(E) Single wall top plate

(N) Wood structural panel, where required Detail 1/D5 or 2/D5 for installation (Panel not shown)

(E) wall stud

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

2 TOP PLATE SPLICE AT EXISTING SINGLE TOP PLATE

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 "Climax", USP Mikek 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)	Weyerhaeuser "Microlam", Boise-Cascade "VersaLam", Georgia-Pacific "GP-Lam", LP "Solid Star", or equivalent.
Plate Washer	3" x 3" square x 0.229" thick.
"Peel & Stick" Flashing Tape	Fortiflash, Orange Peel-n-Seal, 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

3 CUTOUT REQUIREMENTS IN WOOD STRUCTURAL PANELS

Where (E) blocking is present, install (N) 2x with (2) 16d nails at edge

(N) 8d at 4" on center at edges of wood structural panels

Opening for vents, utility blockouts, etc.

1-1/4" to 1-1/2" radius cut, typ.

(E) wall top plate(s)

(N) Nail stop

(E) wall stud

(E) Cripple stud

2" max notch

Provide (N) strap "S1" where notch depth is greater than 2"

4 ALLOWABLE NOTCHING AND REINFORCING FOR TOP PLATES AND STUDS

Note:
Floor framing not shown.

Construction Details

100 ANY STREET
SAN RAFAEL, CA
 APPLICANT: _____
 PROPERTY ADDRESS: _____

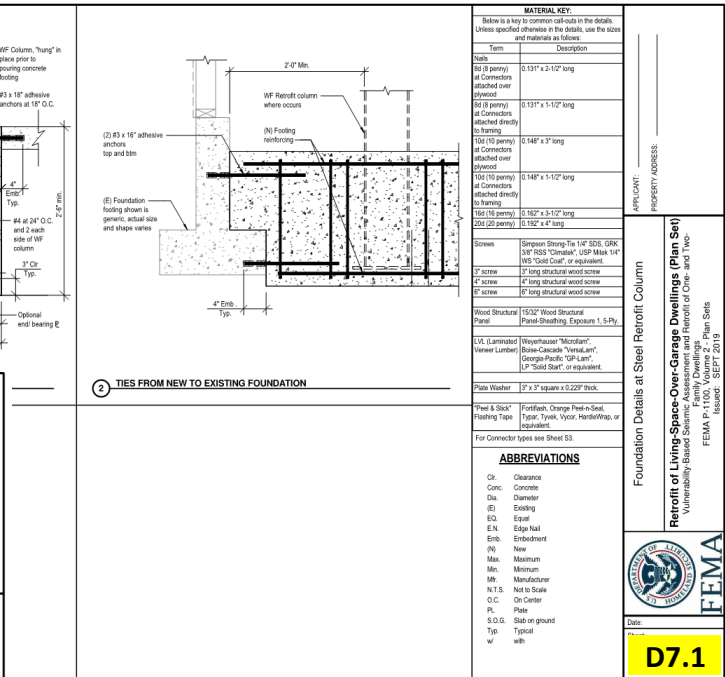
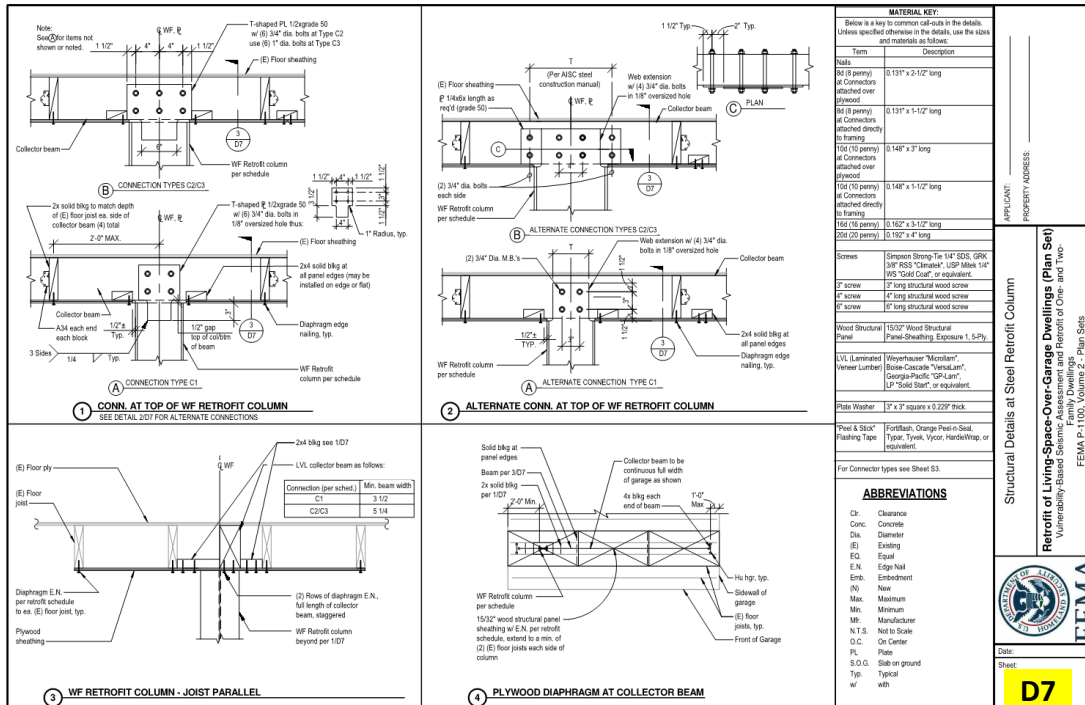
Vent Openings and Top Plate Details
Re retrofit of Living-Space-Over-Garage Dwellings (Plan Set)
 Vulnerability-Based Seismic Assessment and Retrofit of One- and Two-Family Dwellings
 FEMA P-1100, Volume 2 - Plan Sets
 Issued: SEPT 2019

FEMA

Date: _____
 Sheet: D6

Prescriptive Design - Details

Steel Retrofit Column Construction Details



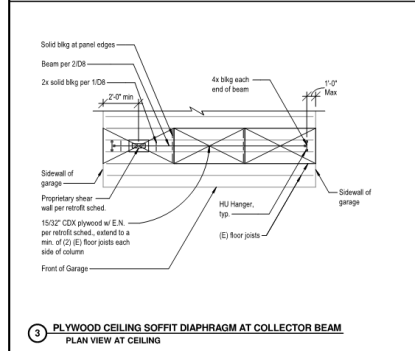
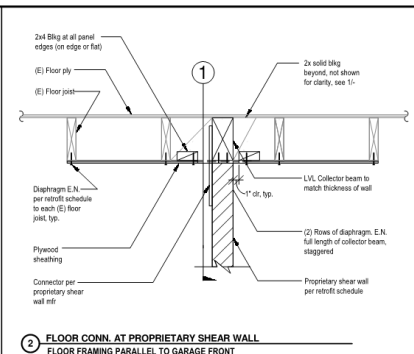
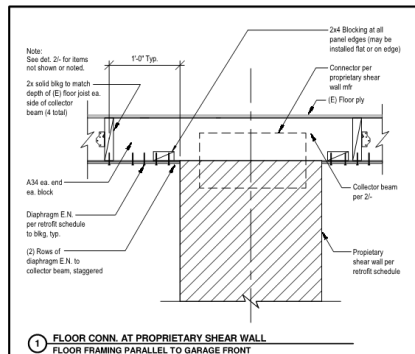
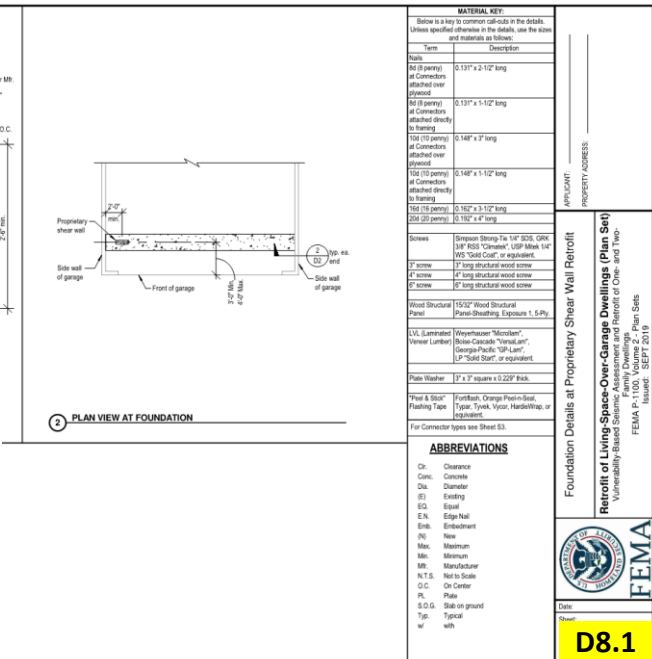
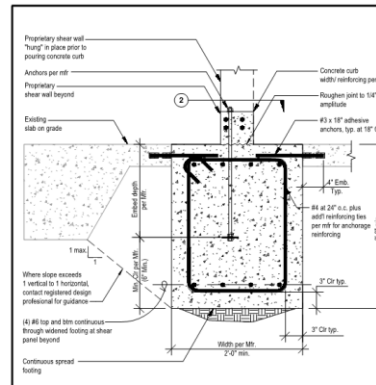
FOUNDATION DETAILS AT STEEL RETROFIT COLUMN



D7.1

Prescriptive Design - Details

Proprietary Shearwall Construction Details



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
Rebar	#4 (8 permy) 0.131\" x 2-1/2\" long
Rebar	#4 (8 permy) 0.131\" x 1-1/2\" long
Rebar	#4 (8 permy) 0.131\" x 3\" long
Rebar	#4 (8 permy) 0.148\" x 3\" long
Rebar	#4 (8 permy) 0.148\" x 1-1/2\" long
Rebar	#4 (8 permy) 0.162\" x 3-1/2\" long
Rebar	#4 (8 permy) 0.192\" x 4\" long
Screws	Simpson Strong-Tie 14\" SDS, GRK 3/8\" RSS \"Concrete\", USP Mitek 14\" WS \"Solid Start\" 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, 5/8\"
LVL Laminated Veneer Lumber	Weyerhaeuser \"Microspan\", Boise-Cascade \"Viralum\", Georgia-Pacific \"Viralum\", L.P. \"Solid Start\", or equivalent.
Plate Washer	3\" x 3\" square x 0.225\" thick
\"Steel & Steel\"	Fortiflash, Orange Peel=Seal, Flashing Tape, Tyvek, Vycor, HardiWrap, or equivalent.

ABBREVIATIONS

Cr.	Clearance
Conc.	Concrete
Dia.	Diameter
Ext.	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



D8

When is a Design Professional Needed?

- When actual conditions fall outside of prescriptive assumptions
- Where the prescriptive solutions do not fit (e.g., not enough wall length)
- When retrofit details provided are not compatible with actual construction
- Refer to Training Module 1C for additional info



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 assessment 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 square 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. A Registered Design Professional has addressed non-compliant issues in accordance with P-1100 Pre Section 5.5. See Differing Conditions section on this sheet.

Date:	
Sheet:	S0

Building Department Approval

- The plan sets are designed to be submitted for permit
- Remove sheets marked “Do Not Submit”
- Remove sheets that are not used
- Fill out sheets that are to be used
- Compile and submit along with permit application

Building Department Approval

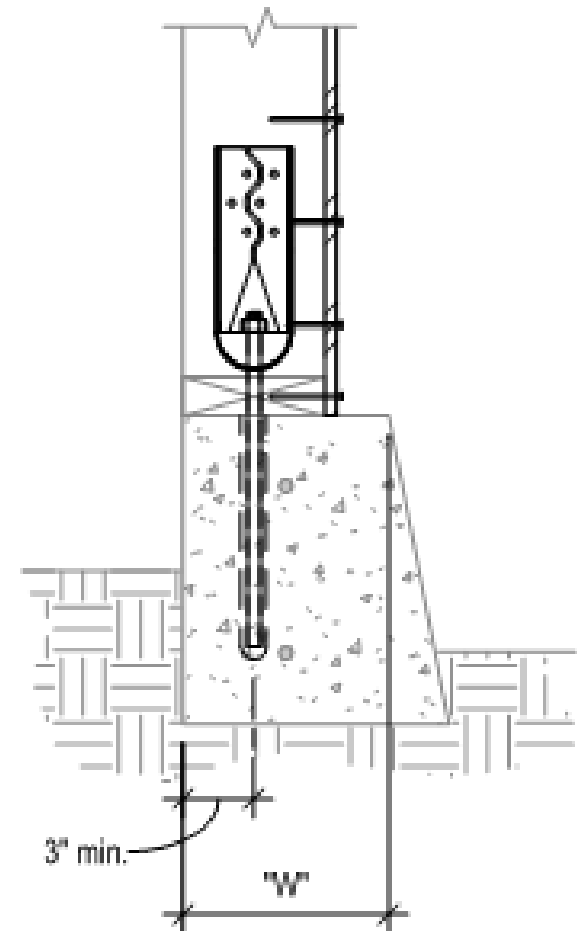
- Compliance with the Prestandard requires approval of the building official
- The retrofit will in most cases be voluntary, so there should not be any limitations on use
- The Building Official has discretion over similar conditions
- Visual inspections are assumed to be provided by the building department for foundation anchor bolts, installation of blocking, plywood, metal hardware and any required tie-downs

Building Department Approval

- Special inspection is not required for installation of new anchor bolts or tie-down anchors, whether cast into new concrete or installed in existing concrete foundations
- In-situ testing is not required for new anchor bolts

Building Department Approval

- In-situ tension testing is not required
- Self-certification required where tie-downs are used
- Torque tests used as indicator of concrete quality and installation



Building Department Approval

Information and forms provided in plan set

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 been verified to be in generally good condition at planned tie-down locations as specified in Section R, Item 3.		_____ Signature
C.1 The capacity of each new tie-down anchor has been verified by passing the torque tests specified in Table R2.		
D.1 All adhesive anchors were installed per the manufacturer's instructions per the minimum steps as noted in Section T.		

Table C-1 : FR-2: Foundation Verification Requirements		
	Screw Anchor	Adhesive Anchor
Diameter ϕ	Torque (ft-lbs)	Torque (ft-lbs)
1/2"	35	15
5/8"	50	20

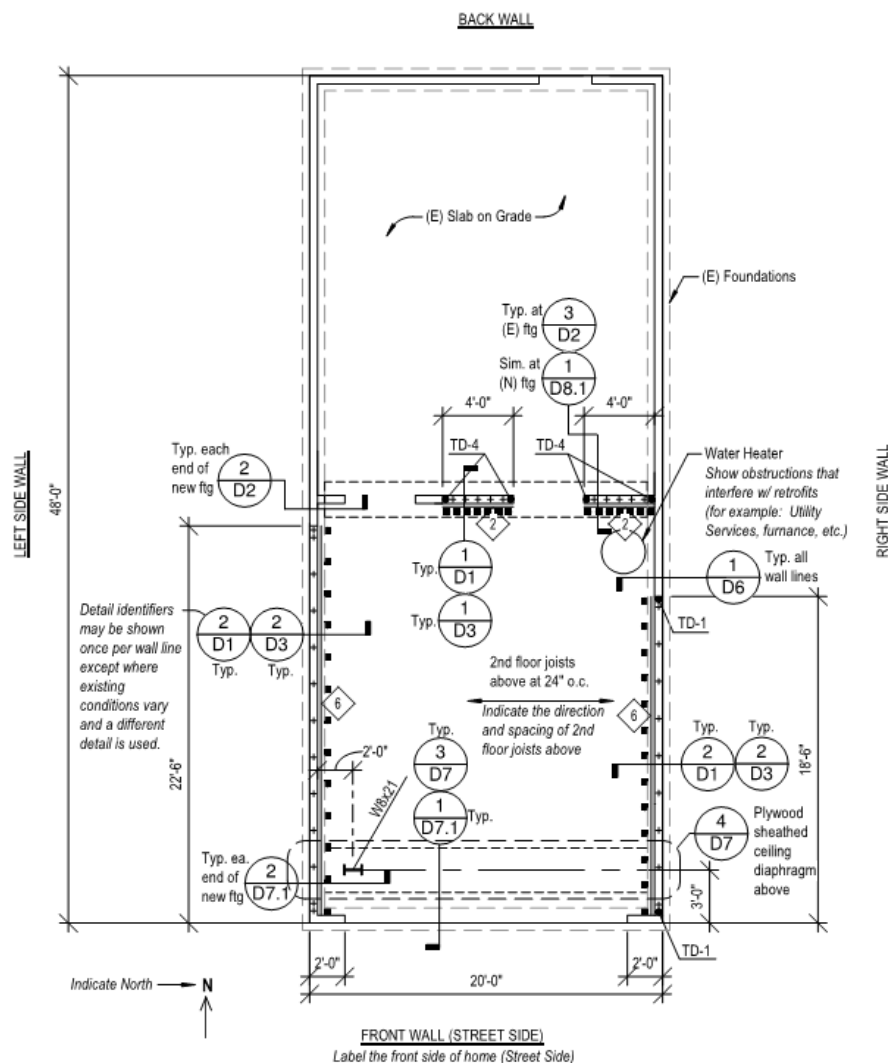
Date:
Sheet:

S2

Module 3C

Application Example

Design Example 1



- *Living-Space-Over-Garage Dwelling with a Ground Floor Residential Unit at the back of the garage*
- Ground level floor area = 960 SF
- Exterior wood siding
- Composition shingles
- Predominantly interior gypsum board
- San Rafael, CA

Instructions

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 ground 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.

A. Before you Begin

FEMA Package Sheet List

Sheet	For Use
S0	Eligibility For Use
S1	General Notes
S2	Supplemental Technical Notes Where Tie-downs are Required at Existing Foundations
S3.1-1.0	Earthquake Retrofit Schedule - Wood Structural Panel with single section of wall
S3.2-1.0	Earthquake Retrofit Schedule - Wood Structural Panel with two sections of wall
S3.3-1.0	Alternate Earthquake Retrofit Schedule (Steel Column or Proprietary Shear Wall)
S3.4-1.0	Earthquake Retrofit Schedule at front of garage only in dwelling with Ground Floor Residential Unit
S3.5-1.0	Earthquake Retrofit Schedule at front of garage only in dwelling with Ground Floor Residential Unit
S3.6-1.0	Alternate Earthquake Retrofit Schedule at front of garage in dwelling w/ Ground Floor Residential Unit
S4	Foundation and Retrofit Layout Plan
* S4-ex	Foundation and Retrofit Layout Plan
D1	Foundation Sill to Concrete Foundation Connection Details
D2	Foundation Details at Wood Structural Panel Shear Walls
D3	Floor Framing to Wall Connection Details
D4	Wood Structural Panel Installation at Shear Walls without Tie-Downs
D5	Wood Structural Panels with Tie-Downs
D6	Vent Openings and Top Plate Details
D7	Structural Details at Steel Retrofit Column
D7.1	Foundation Details at Steel Retrofit Column
D8	Structural Details at Proprietary Shear Wall Retrofit
D8.1	Foundation Details at Proprietary Shear Wall Retrofit
* X1	Example - Living-Space-Over-Garage Dwelling with a wood structural panel shearwall & cantilever column retrofit

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



Date:
Sheet:

01

Before you Begin

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-compliant" answer to any question disqualifies the home from using this Plan Set, unless a Registered Design Professional is involved.

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 assessment and retrofit will occur for each attached to townhouse.	X	
2. The dwelling is a wood light-frame dwelling and has a maximum of one story above the garage story.	X	
3. The dwelling is a living-space-over-garage dwelling as defined in Chapter 2 FEMA P-1100 prestandard	X	
4. The dwelling perimeter (not including porches or other appurtenances) is supported on continuous concrete foundations, concrete stem walls or thickened slab edge footings.	X	
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).	X	
6. Weight of roofing material shall not exceed 12 psf (measure on slope).	X	
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.	X	
8. Weight of interior wall finish shall not exceed 8 psf, except that masonry fireplace surrounds of not more than 4" thick and up to 100 square feet are permitted to exceed this weight.	X	
9. Weight of floor finish shall not exceed 5 psf, except that heavier floor finishes of up to 10 psf are acceptable where limited to 1/3 of the total floor area of each level.	X	
10. Floors in each story are at the same level and not split level, excluding slab on grade portions.	X	
11. The home floor area, calculated as "B" times "L", as defined in figures 3, 4 or 5 shall not exceed 2,000 square feet.	X	
12. No part of the foundations is constructed of unreinforced masonry or stone.	X	
13. Clear floor to ceiling heights at any occupied level does not exceed 9'-0".	X	
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.	X	

Date: _____
 Sheet: **S0**

Instructions

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. Draw 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 ground 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).
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 - 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.

01	Instructions for U
S0	Cover Sheet
S1	General Notes
S2	Supplemental Te
S3	Earthquake Retr

B. Determine Your Seismic Design Category (SDC), Building Configuration/Retrofit Type & Weight Classification

D1	Foundation Deta
D2	Foundation Deta
D3	Foundation Deta
D4	Foundation Deta
D5	Foundation Deta
D6	Foundation Deta
D7	Foundation Deta
D7.1	Foundation Deta
D8	Foundation Deta
D8.1	Foundation Deta
* X1	Example - Living

Note:
Retrofit schedules sheet
See Sheet S3, Figure 1 f

* Sheet for reference only

Sheet
S3

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



FEMA

Date:
Sheet:

01

Determine Your Seismic Design Category & Building Configuration/Retrofit Type

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

- The first two factors taken into consideration for determining the appropriate amount of Earthquake Strengthening:
 - Site seismicity or S_{DS} value
 - Building retrofit/ configuration type
- 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.
 - In your internet browser go to <http://www.atcouncil.org/fema-p-1100>
 - Click on one of the five (5) geographic areas listed to find your location on the appropriate map.
 - Locate your SDC (SDC A-SDC E) by the color contour shown on the map which corresponds to the % g values shown.
 - For SDC A-D, use $S_{DS} = 1.0$.
 - For SDC D₂, use $S_{DS} = 1.2$ unless the site class can be determined as A, B, or D, in which case use $S_{DS} = 1.0$.
 - 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.
- Determine building retrofit/configuration type: Does the dwelling have a ground floor residential unit? See Figures 3 thru 5 on Sheet S0 for guidance.
- 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.

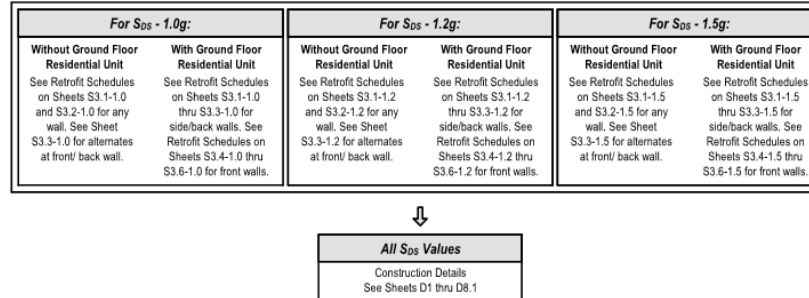


Figure 1. Earthquake Retrofit Schedules per S_{DS}

Weight Classification

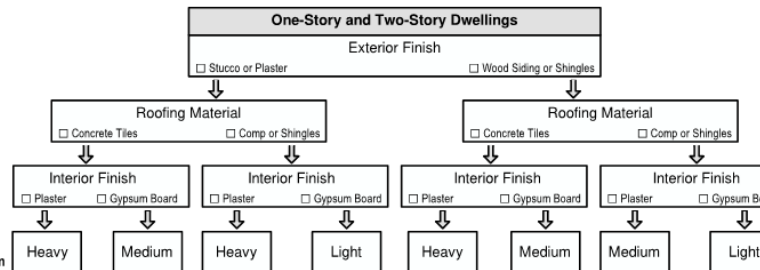
This flowchart is used to determine the general weight classification of your home's construction.

- Check the box of the material that most closely matches your home's finishes.
- 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:

- The 'wood siding or shingles' exterior finish category also includes finishes of similar weight, including but not limited to fiber-cement and aluminum siding.
- 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.
- The 'gypsum board' interior finish category also includes wall finish materials of similar weight, including but not limited to wood board or panel siding.
- 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.

Weight Classification



Connectors

- Manufacturer's model numbers and installation instructions are subject to change. Verify and follow manufacturer's written instructions.
- Connector images are general in nature only. Individual manufacturer's connectors may vary.
- Any of the connectors listed within a particular group (e.g. Type B) may be used for strengthening the particular condition.
- This Plan Set was developed using the lowest listed manufacturer's capacity within a particular group.
- 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	EMBEDDED DEPTH
SCREW-TYPE Simpson Strong-Tie KC Metals Powers Fasteners	Titen HD Kwik-HUS-EZ Wedge-Bolt	3-1/2" 4-1/2" 3-3/8"
ADHESIVE Simpson Strong-Tie Hilti USP Structural Connectors	Threaded Rod with: SET Adhesive HIT-HY 200 CIA GEL 7000C	3-1/2" n/a 3-3/8"

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

TIE-DOWNS (Supplemental Technical Notes, Sheet S2, Section S)			
MARK (kips)	IMAGE	MANUFACTURER	MODEL
TD1		Simpson Strong-Tie KC Metals USP Structural Connectors	HDU2 ADST2 PHD2A
TD2		Simpson Strong-Tie KC Metals USP Structural Connectors	HDU4 ADST5 PHD5A
TD3		Simpson Strong-Tie KC Metals USP Structural Connectors	HDU8 ADG8 PHD5A
TD4		Simpson Strong-Tie KC Metals USP Structural Connectors	HDU8 ADG8 PHD8
TD5		Simpson Strong-Tie KC Metals USP Structural Connectors	HDU11 ADG12 UPHD9

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.

100 ANY STREET
SAN RAFAEL, CA

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

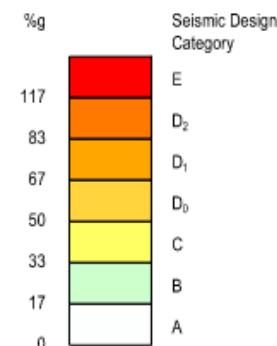
Date: _____
Sheet: **S3**

Determine the Seismic Design Category

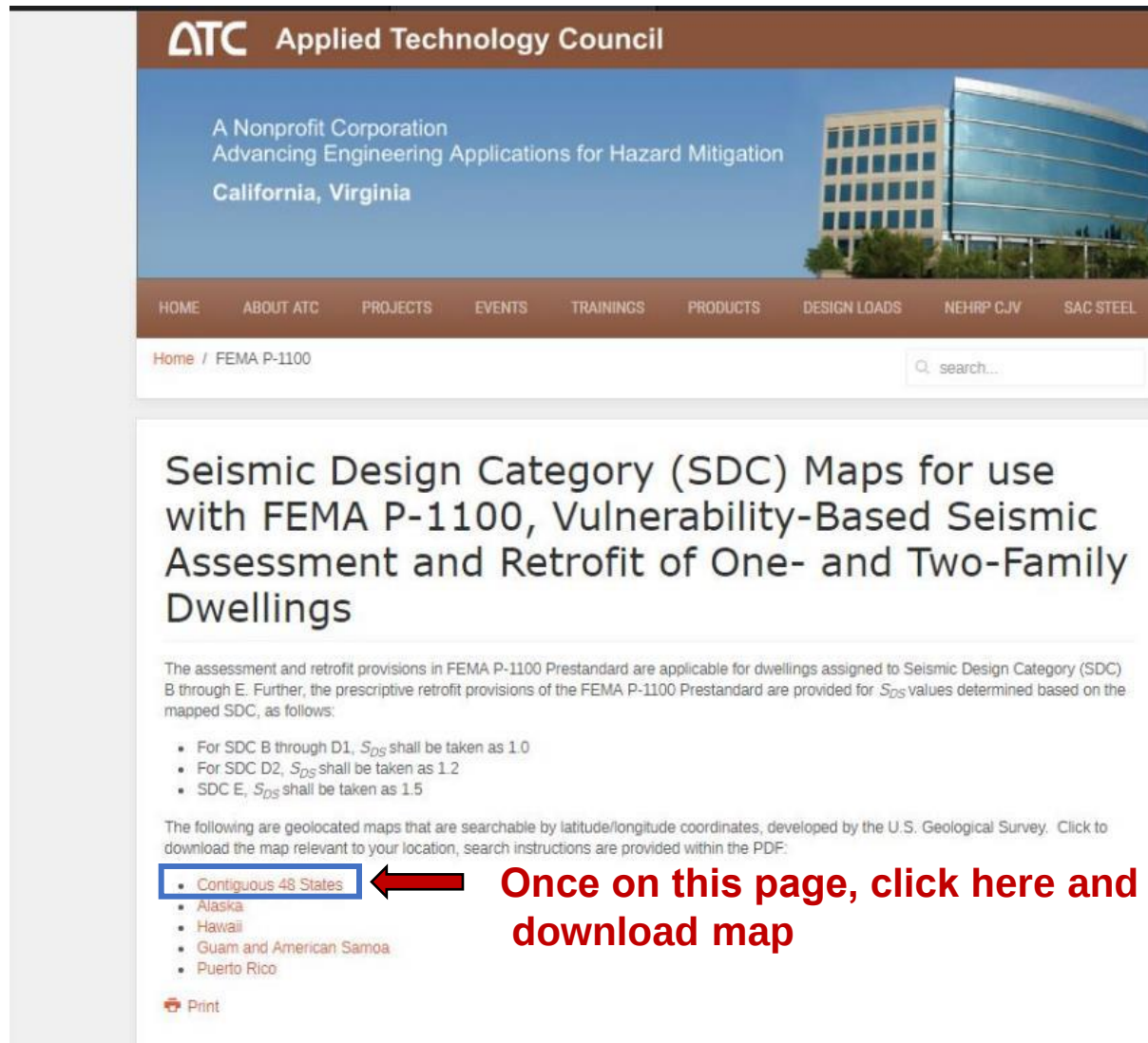
Seismic Design Category (SDC)

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-D₁, use $S_{DS} = 1.0$.
 - e. For SDC D₂, 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.



Determine the Seismic Design Category



ATC Applied Technology Council

A Nonprofit Corporation
Advancing Engineering Applications for Hazard Mitigation
California, Virginia

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Home / FEMA P-1100

Search...

Seismic Design Category (SDC) Maps for use with FEMA P-1100, Vulnerability-Based Seismic Assessment and Retrofit of One- and Two-Family Dwellings

The assessment and retrofit provisions in FEMA P-1100 Prestandard are applicable for dwellings assigned to Seismic Design Category (SDC) B through E. Further, the prescriptive retrofit provisions of the FEMA P-1100 Prestandard are provided for S_{DS} values determined based on the mapped SDC, as follows:

- For SDC B through D1, S_{DS} shall be taken as 1.0
- For SDC D2, S_{DS} shall be taken as 1.2
- SDC E, S_{DS} shall be taken as 1.5

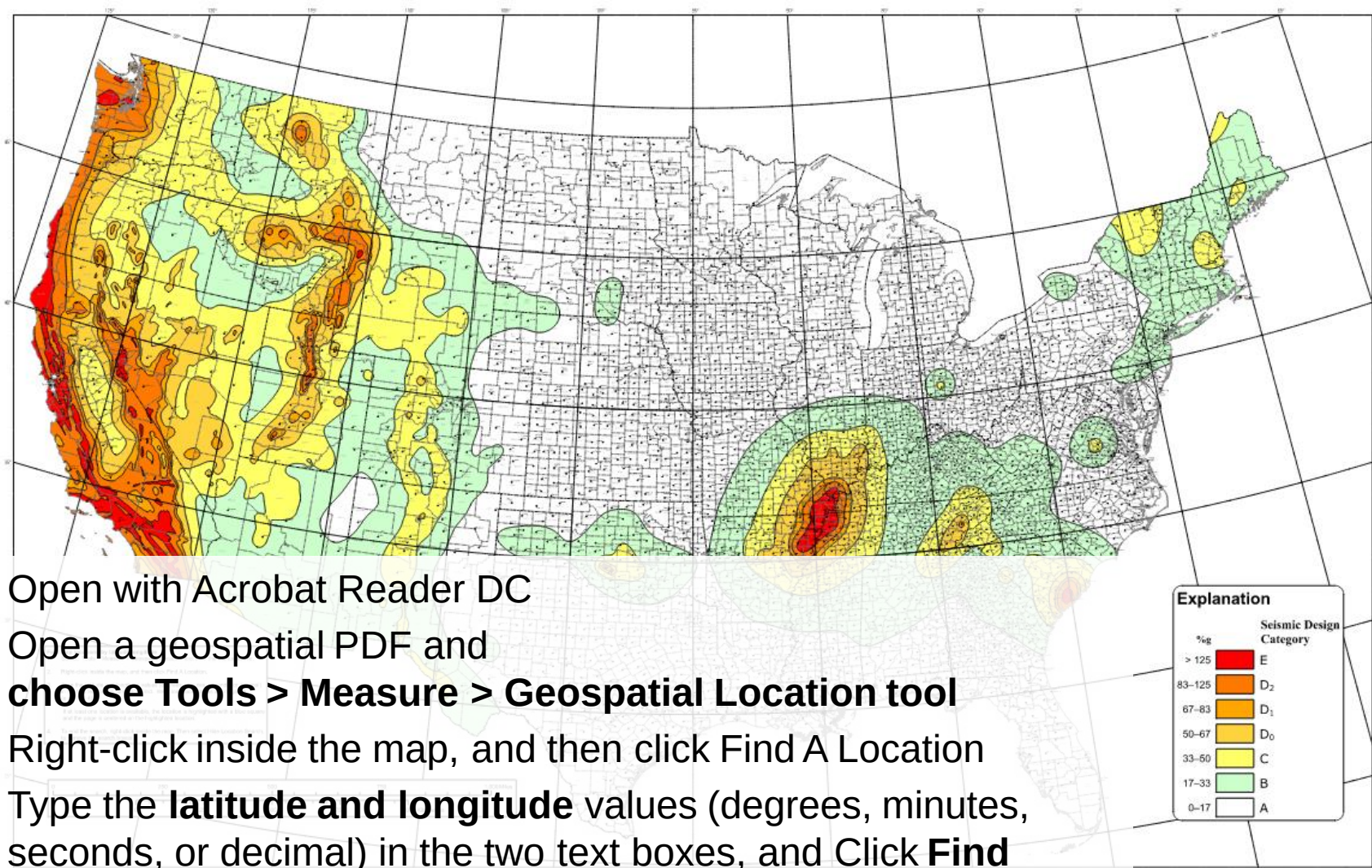
The following are geolocated maps that are searchable by latitude/longitude coordinates, developed by the U.S. Geological Survey. Click to download the map relevant to your location, search instructions are provided within the PDF:

- [Contiguous 48 States](#)
- Alaska
- Hawaii
- Guam and American Samoa
- Puerto Rico

Print

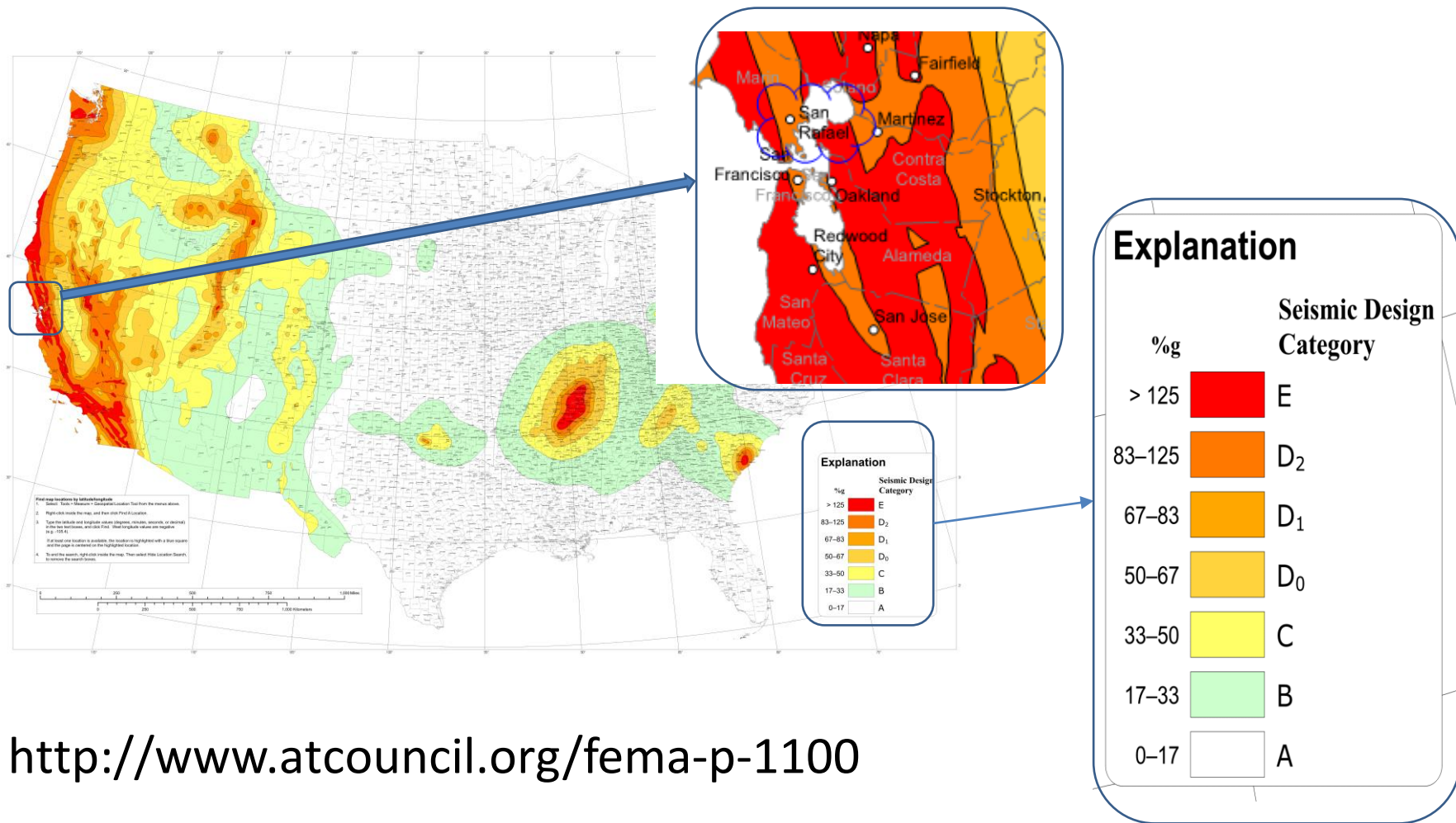
Once on this page, click here and download map

Determine Seismic Design Category



- Open with Acrobat Reader DC
- Open a geospatial PDF and **choose Tools > Measure > Geospatial Location tool**
- Right-click inside the map, and then click Find A Location
- Type the **latitude and longitude** values (degrees, minutes, seconds, or decimal) in the two text boxes, and Click **Find**

Determine Seismic Design Category

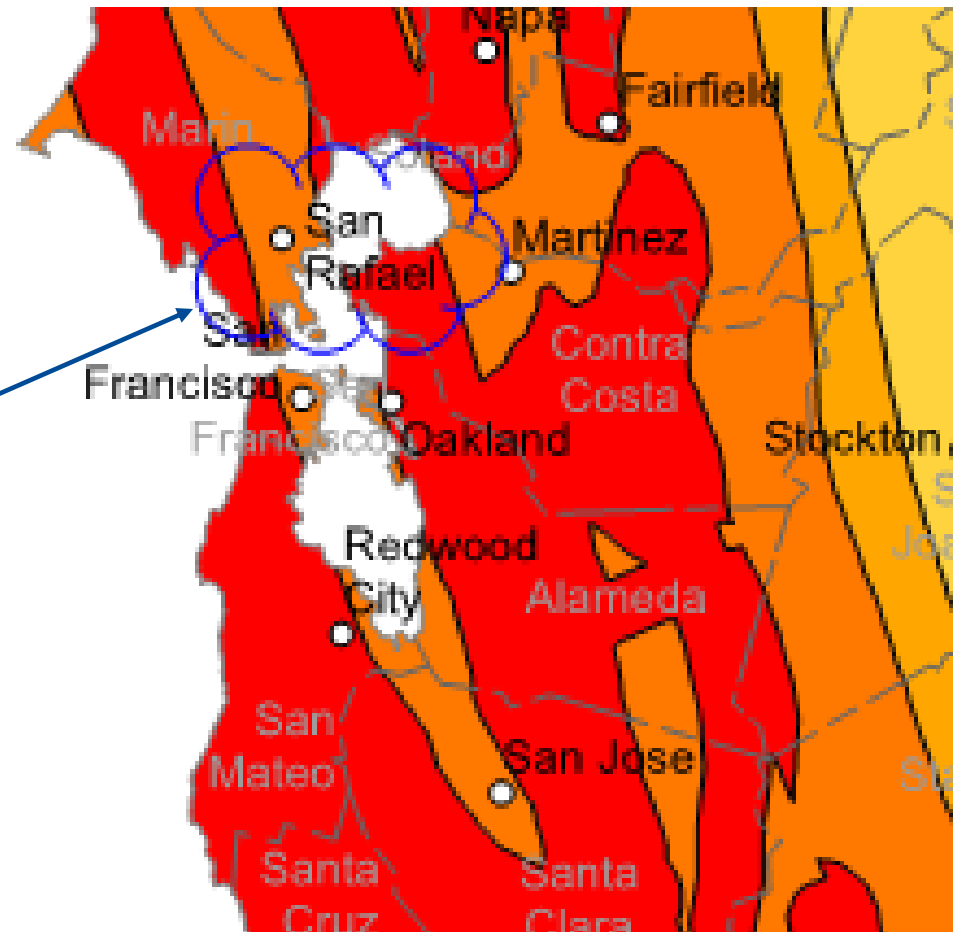


<http://www.atcouncil.org/fema-p-1100>

Determine Seismic Design Category

When the residence lies on or close to the border, it is recommended that you use the higher value

	%g	Seismic Design Category
=1.5	> 125	E
=1.2	83–125	D ₂
	67–83	D ₁
	50–67	D ₀
=1.0	33–50	C
	17–33	B
	0–17	A



Determine Dwelling Configuration/Retrofit Types

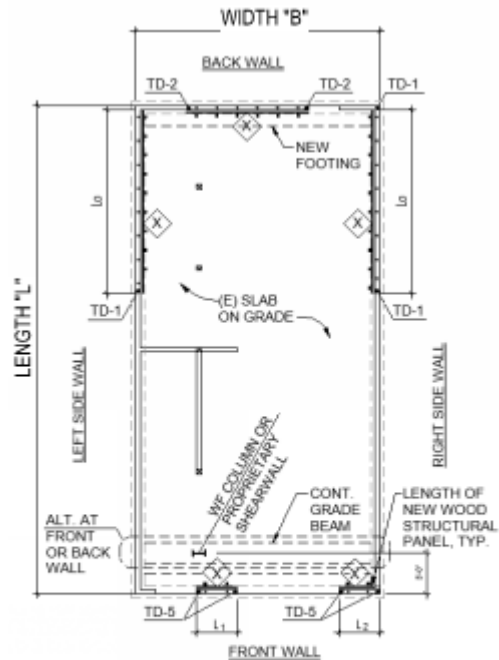


Figure 3

Example of dwelling configuration without Ground Floor Residential Unit

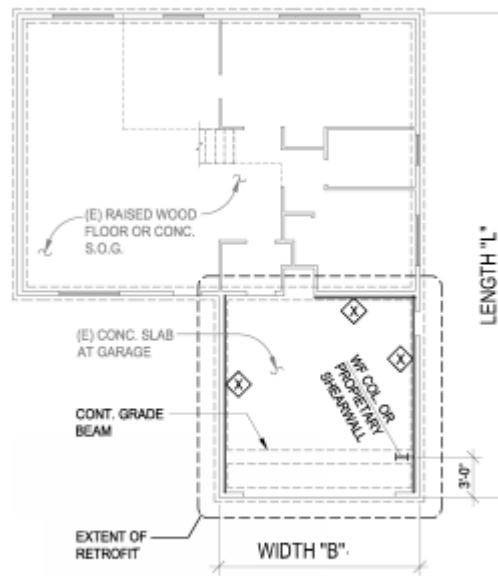


Figure 4

Example of dwelling configuration with Ground Floor Residential Unit

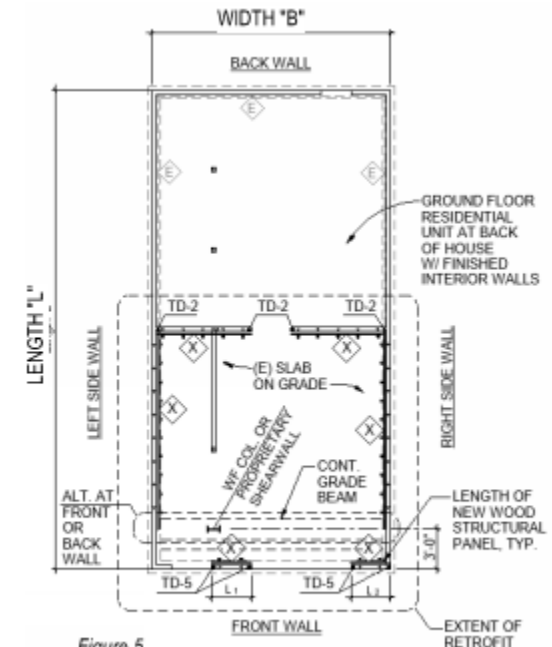


Figure 5

Example of dwelling configuration with Ground Floor Residential Unit

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.

Building Retrofit/Configuration Type

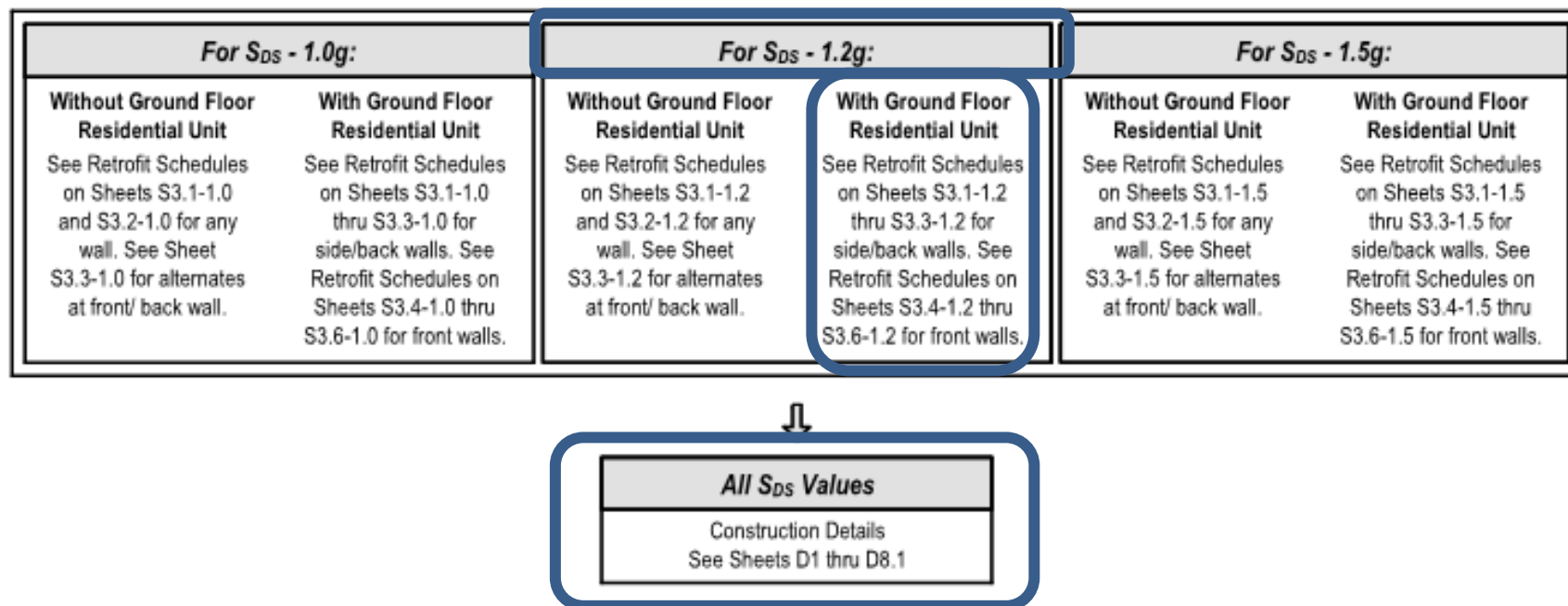


Figure 1. Earthquake Retrofit Schedules per S_{DS}

Determine Seismic Design Category

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				⑥ FLOOR FRAMING TO WALL CONNECTION					
			No Tie-down										w/ Tie-downs in Existing or New Foundations				Min. No. of Foundation Connectors or Anchors at Each Wall Panel				Min. No. of Connectors at Each Wall Panel	
			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" Bolt	5/8" 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	
												TD4	Yes	8	12	16	13	9	21	20	26	
												TD4	Yes	10	15	20	17	11	26	25	32	
												TD4	Yes	13	20	27	22	15	34	33	43	
												TD4	Yes	7	11	14	12	8	18	17	23	
												TD4	Yes	9	13	18	15	10	22	21	28	
												TD4	Yes	10	16	21	17	12	27	26	34	
												TD4	Yes	13	20	26	22	15	33	32	42	
												TD3	Yes	17	26	35	29	20	44	42	56	

For $S_{Ds} = 1.2g$:

Floor Unit	Without Ground Floor Residential Unit	With Ground Floor Residential Unit	Without Residential Unit
See Retrofit Schedules S3.1-1.2 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 S3.1-1.2 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 and S3.2-1.2 for any wall. See Sheet S3.3-1.2 for alternates at front/ back wall.

All S_{Ds} Values

Construction Details See Sheets D1 thru D8.1

Date: _____ Sheet: **S3**

Figure 1. Earthquake Retrofit Schedule

INSTRUCTIONS

- Locate the section that matches your home's construction. Use the chart on Sheet S3 to determine "Weight Category".
- 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 _____
- 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.
- 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).
- 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" or 5/8" anchor bolts. (ø = diameter of the bolts.) See Sheet S3.
- 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.
- 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.
- 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.

RETROFIT SUMMARY

BRACING, ANCHORS, CONNECTORS, AND TIE-DOWNS

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

Supplemental Earthquake Retrofit Schedule

1. Check boxes if additional Earthquake Retrofit Schedules are included.

☐ S3.2-1.2 ☐ S3.4-1.2 ☐ S3.6-1.2

☐ S3.3-1.2 ☐ S3.5-1.2

APPLICANT: **100 ANY STREET**

PROPERTY ADDRESS: **SAN RAFAEL, CA**

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



Date: _____ Sheet: **S3.1-1.2**

Determine the Weight Classification

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.



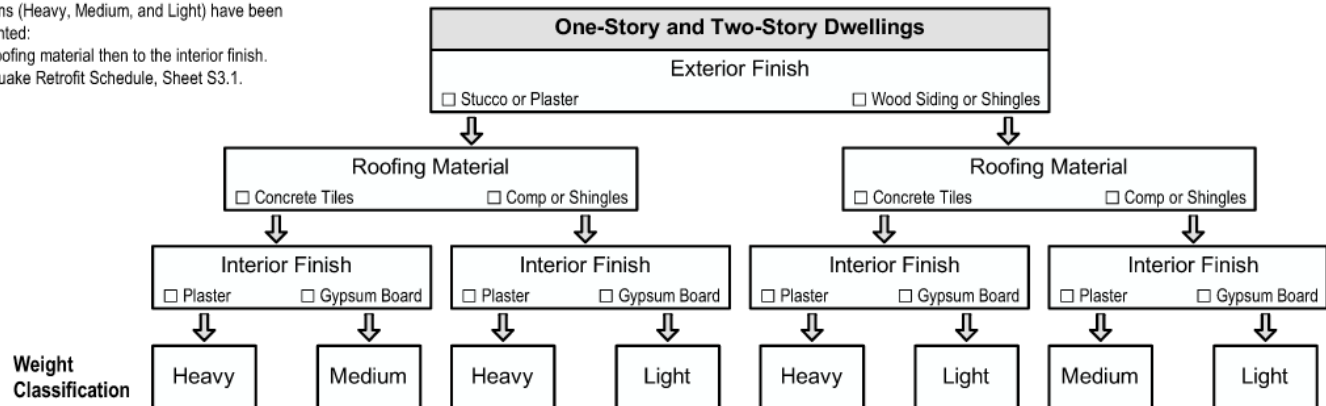
Weight Classification

The next factor used to establish the appropriate amount of earthquake strengthening is the dwelling weight. For the purposes of this Plan Set, three weight classifications (Heavy, Medium, and Light) have been established as described below. Using the flowchart presented:

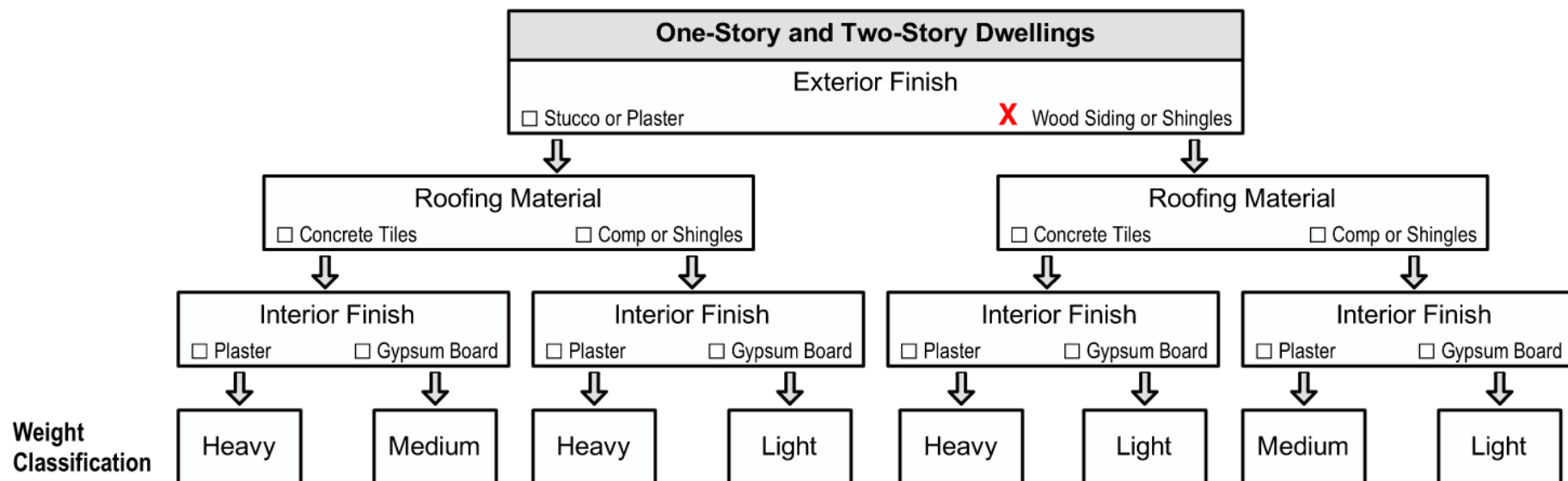
1. Start with the exterior finish and move progressively to roofing material then to the interior finish.
2. Note the weight classification result for use in the Earthquake Retrofit Schedule, Sheet S3.1.

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 the heavier finish type exists within the dwelling.

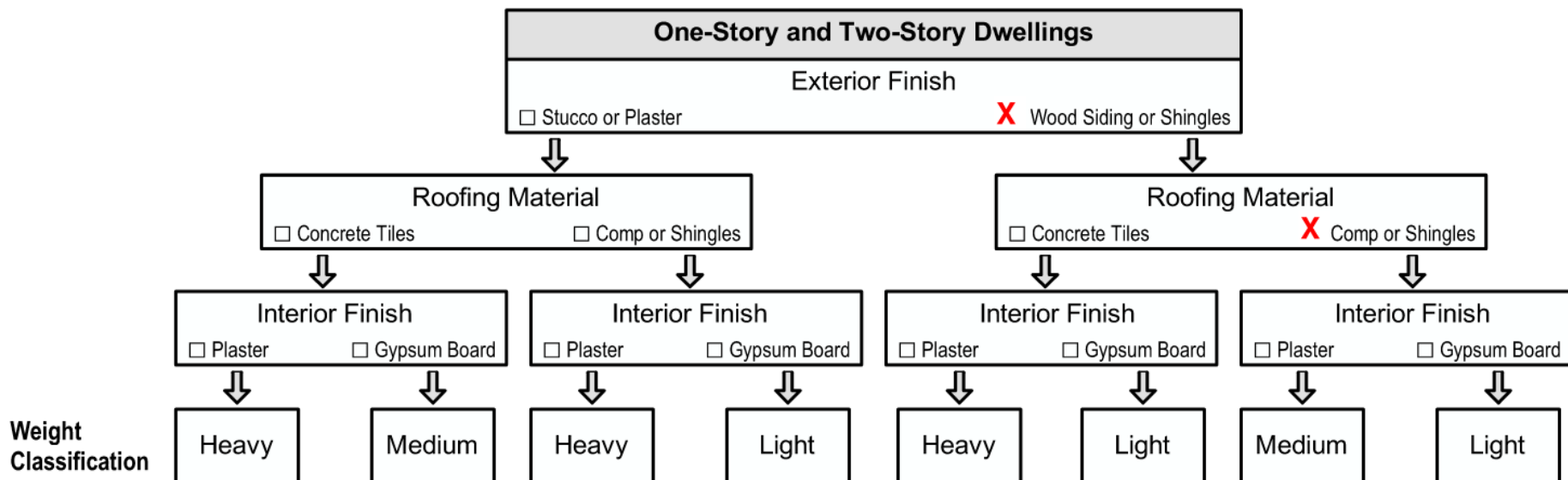


Determine the Weight Classification



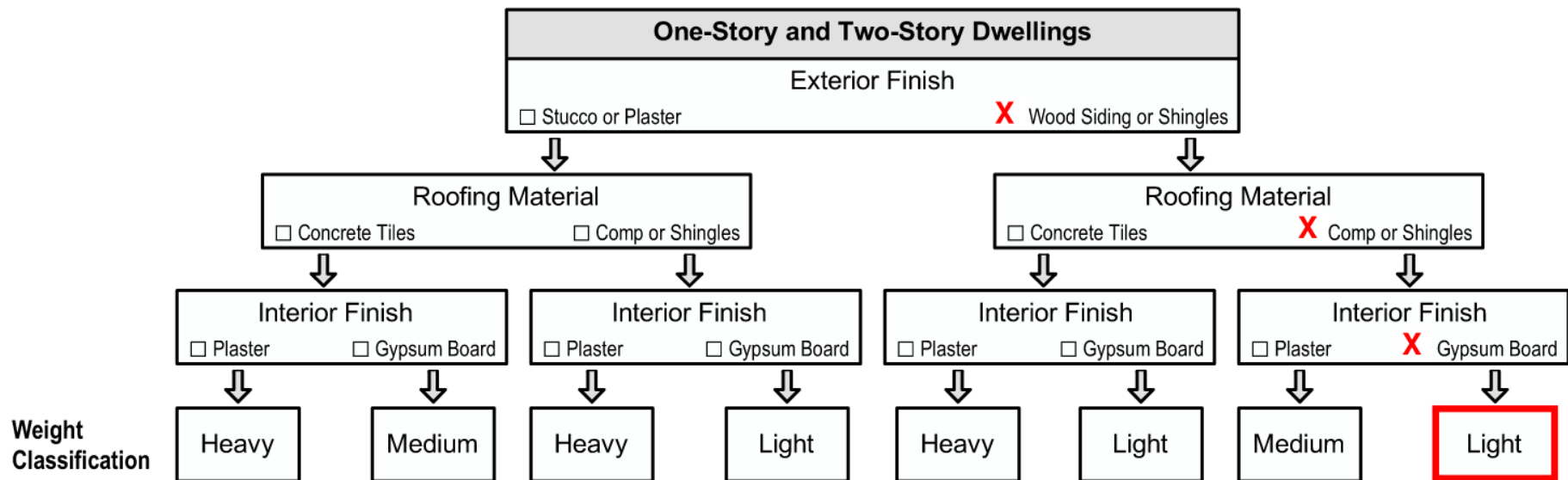
- **Wood Siding**, Composition Roof, Interior Gypsum Board

Determine the Weight Classification



- Wood Siding, Composition Roof, Interior Gypsum Board

Determine the Weight Classification



- Wood Siding, Composition Roof, Interior Gypsum Board

Instructions

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 process. Inquire about:
 - a. fees,
 - b. how many copies of the plans must be submitted, and
 - c. which city inspections are required, see F.3 below.
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-compliant" 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) and Weight Classification:

1. See Sheet S3 and determine the Seismic Design Category (SDC) and Weight Classification for the dwelling. This information will be used to determine which S3.1 sheet is applicable. Note that there are three unique S3.1 sheets for one-story dwellings with differing S_{DS} values and three similar sheets for two-story dwellings. Only one Sheet S3.1 will be applicable to any given dwelling and included within the set of drawings used for submission to the Building Official.

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, or utilities. These areas should be avoided when laying out the required retrofitting work.
 - b. An arrow to indicate the direction of the span of your floor joists plus the spacing such as "floor joists at 16" on center." This will be helpful when selecting the appropriate details shown on Sheets D1 - D6.
 - c. Indicate the height of the tallest cripple wall for each wall line. The minimum required length of retrofitting along each wall line will be based, among other variables, on this height. See the sections in Details 1 and 2 on Sheet D4 for measurement of "cripple wall height."
 - d. Dimensions for each length of perimeter wall segment and overall dimensions of wall lines.
 - e. An arrow pointing to North.
 - f. Label the street side (front) of the home.
 - g. See Sheet X1 for an example of a plan sheet submittal.
 - h. See Sheets X2 and X3 for additional examples and instructions of how certain items are calculated, such as the length of bracing at offset walls of non-rectangular "T" or "L" shaped dwellings, as noted in Section J, General Notes, Sheet S1.
 - i. See Sheets X4 and X5 for illustrations and definitions of terms for retrofit conditions.

C. Prepare your plans

SHEET LIST

01*	Instructions for Use
S0	Cover Sheet
S1	General Notes
S2	Supplemental Technical Notes
S3	Seismic Design Category, Weight Classification, and Connectors
S3.1**	Earthquake Retrofit Schedule - S_{DS} 1.0, One-Story
S3.1**	Earthquake Retrofit Schedule - S_{DS} 1.2, One-Story
S3.1**	Earthquake Retrofit Schedule - S_{DS} 1.5, One-Story
S3.1**	Earthquake Retrofit Schedule - S_{DS} 1.0, Two-Story
S3.1**	Earthquake Retrofit Schedule - S_{DS} 1.2, Two-Story
S3.1**	Earthquake Retrofit Schedule - S_{DS} 1.5, Two-Story
S4	Foundation and Retrofit Layout Plan
D1	Foundation Sill to Concrete Foundation Connection Details
D2	Floor Framing to Foundation Sill Connection Details
D3	Floor Framing to Cripple Wall Connection Details
D3.1	Floor Framing to Cripple Wall Connection Details
D4	Wood Structural Panel Installation without Tie-Downs
D5	Wood Structural Panel Installation with Tie-Downs
D6	Vent Openings and Top Plate Details
D7	Foundation Replacement Details
X1*	Example of Foundation and Retrofit Layout Plan
X2*	Example - Foundation Plan (Dwelling without Tie-Downs)
X3*	Example - Foundation Plan (Dwelling with Tie-Downs)
X4*	Illustration - Cripple Wall Retrofit
X5*	Illustration - Retrofit - No Cripple Wall

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

** Only one "S3.1" sheet will be submitted to the Building Official.

This sheet is for instruction and reference only.
Do not submit to the Building Official.

Instructions for Use

Retrofit of Crawlspace 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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[illegible]

Develop the Basic Plan

RETROFIT SCHEDULE SUMMARY See the Retrofit Summary on the Sheet Indicated below for additional requirements on each wall line. <table border="1"> <tr> <td>Front Wall</td> <td></td> </tr> <tr> <td>Back Wall</td> <td></td> </tr> <tr> <td>Left Side Wall</td> <td></td> </tr> <tr> <td>Right Side Wall</td> <td></td> </tr> </table> General Sheet Notes: - For Shear Wall Framing at walls without Tie-Downs, see Det. 1/D4. - For Shear Wall Framing at walls with Tie-Downs, see Det. 1/D5. - For wall sheathing cutouts, see Det. 3/D6. - For wall stud and top plate penetrations, see Det. 4/D6. - For wall top plate splices, see Det. 1/D6 at existing double top plates and Det. 2/D6 at single top plates.	Front Wall		Back Wall		Left Side Wall		Right Side Wall			APPLICANT: 100 ANY STREET PROPERTY ADDRESS: SAN RAFAEL, CA
Front Wall										
Back Wall										
Left Side Wall										
Right Side Wall										
Foundation Plan 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										
Date: _____ Sheet: S4										

- Create a basic floor plan
- Measure and document all exterior and back of the garage wall lines
- Locate any large obstructions and wall openings
- Note direction of floor framing
- Label front/street, back, side walls
- Add north arrow

Gather Info to Complete Plans

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.

Gather Info to Complete Plans

■ Review sheets S1 and S2 for guidance for materials and installation or work

A. CODE - 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 - 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 the 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 - Contractor shall confirm that existing conditions match plans and details prior to start of work. Notify owner of any discrepancies as required prior to start of work. - Contractor shall verify that existing conditions, 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. - 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 1/8" wide, or low strength concrete tested or tested easily comparable with a metal knife or trowel. Strengthening should be provided 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 with Table C-1. Where torque bolts 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 border="1" style="margin: 10px auto;"> <caption>Table C-1: Foundation Verification Requirements</caption> <thead> <tr> <th></th> <th>Screw Anchor</th> <th>Adhesive Anchor</th> </tr> </thead> <tbody> <tr> <td>Diameter (in)</td> <td>Torque (ft-lbs)</td> <td>Torque (ft-lbs)</td> </tr> <tr> <td>1/2"</td> <td>15</td> <td>15</td> </tr> <tr> <td>3/4"</td> <td>15</td> <td>20</td> </tr> </tbody> </table> D. NOTCHING, BORING AND CUTTING - 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). - 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 alternate hole. Fill original hole with non-shrink grout. E. CONCRETE - 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) - Reinforcing steel shall conform to ASTM A615 Grade 60 or 65, ASTM A996, or ASTM A996 Type II. - Reinforcing steel bend radii and other rebar detailing shall be in accordance with Concrete Reinforcing Steel Institute. - Minimum concrete cover over reinforcing steel: <table border="1" style="margin: 5px auto;"> <tr> <td>Concrete cast against and permanently exposed to soil</td> <td>4 inches</td> </tr> <tr> <td>Formed concrete exposed to weather</td> <td>2 inches</td> </tr> <tr> <td>Concrete not exposed to weather or in contact with soil</td> <td>1-1/2 inch</td> </tr> </table> - Reinforcing steel lap splice lengths: <table border="1" style="margin: 5px auto;"> <tr> <td>Horizontal bars with more than 12 inches concrete below</td> <td>32 inches</td> </tr> <tr> <td>Other bars</td> <td>42 inches</td> </tr> </table> G. STRUCTURAL STEEL - 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. - Both shall conform to ASTM A-307. Threaded rods shall conform to ASTM A-36. H. FASTENERS - General: - All bolts, nails and other fasteners in contact with preservative treated wood or exposed to weather shall be hot dip galvanized or stainless steel. - Nails: - Unless otherwise noted, all nails specified are to be common nails. - Special care is required when installing nails in existing framing. Where required to avoid splitting of framing, predrill to 70% of nail shank diameter. - Fasteners for wood structural panel sheathing shall be full length full common nails (1 1/2" x 1 1/2"). One sheathing nail head flush with face of sheathing. - Do not overdrive, counter-sink, or otherwise damage the substrate of play when installing nails. A nail is over-driven when it breaks the surface ply. Where nails are insensitive to the point that the general owner is fastened, add one nail for every (2) cross-hatched nails. Ignore new nails between existing.		Screw Anchor	Adhesive Anchor	Diameter (in)	Torque (ft-lbs)	Torque (ft-lbs)	1/2"	15	15	3/4"	15	20	Concrete cast against and permanently exposed to soil	4 inches	Formed concrete exposed to weather	2 inches	Concrete not exposed to weather or in contact with soil	1-1/2 inch	Horizontal bars with more than 12 inches concrete below	32 inches	Other bars	42 inches	I. ANCHOR BOLTS - Pre-drill bolt holes to not more than 1/16th inch larger than bolt or anchor bolt to be placed. - At each perimeter wall line, provide a minimum quantity of Foundation SB Anchors as required by the Earthquake Retrofit Schedule. Place new anchors between 1 and 12 inches from the end of each foundation all plate and distribute the remaining anchors as evenly as practical along the wall line. - Provide steel plate washers 0.225 x 3 x 3 inch minimum at all anchor bolts. Certificate of washer should be 1/2" to 2" from face of sheathing. - 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. - For interior 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. - For interior wall sections with tie-downs, provide one additional anchor bolt within 8" minimum and 12" maximum from tie-down as noted on Sheet D5. J. WOOD STRUCTURAL PANEL SHEATHING - Wood structural panels shall be 1/2" plywood sheathing, all veneer, conforming to US Voluntary Product Standard PS-1, Exposure 1 or Exterior Exposure, manufactured with exterior glue, and minimum 4-ply. - Oriented Strand Board (OSB) shall be 1/2" 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. - Provide 1/8-inch minimum gap at all sheathing panel ends and edges. - Station 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. K. WOOD FRAMING - Framing shall be Douglas Fir-Larch, or an approved species having a greater or equal specific gravity. - Framing in contact with foundation or exposed to weather shall be preservative treated in accordance with AIAAPA 121 (Commodity Specification A, Use Category 4B). Field treat all cuts, borer and notches per AIAAPA M-4. L. CONNECTOR DEVICES - Connectors shall be pre-engineered pre-manufactured devices, approved by the Building Official and installed in accordance with the manufacturer's instructions. - Connectors protected from weather shall be provided with a minimum of 600 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 G90 coating in accordance with ASTM A653, and fasteners shall conform to ASTM A193. - Connector devices shall be of the type and size specified in these drawings. - Connectors required by the Earthquake Retrofit Schedule shall be distributed equally along the length of each wall line or within the length of the bracket and panel. - Connector spacing shall not be less than 8" on center. - Increase nail or screw length 1/2-inch minimum when installing connectors over wood structural panels. M. POST-INSTALLED ANCHORS - Post-installed anchors shall be installed in accordance with the manufacturer's installation instructions. - Adhesive anchors shall be Simpson Strong-Tie SET-AP, Hilti HES 500 SD, CMA GEL 7000C, or approved equivalent. - Concrete screws shall be Simpson Strong-Tie Titen HD, KC Metals Tek-Lok-EE, or Power Fasteners Wedge-Bolt, or approved equivalent. - See H-13 for additional anchor bolt requirements. N. PROPRIETARY SHEAR WALLS - Proprietary shear walls shall be precast/precast concrete shear panels or precast/precast cold-formed steel shear panels complying with the requirements of ICC-ES E-308, FEMA P-709, or shall have been tested in accordance with ASTM D7090, in a manner and with documentation acceptable to the building official. - Proprietary Shear Walls shall be installed in accordance with the manufacturer's installation requirements and the provisions of this Plan Set. O. FINISHES - All work required by this Plan Set shall be permitted through the building department. P. INSPECTIONS - 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. Q. SPECIAL INSPECTIONS - Special inspection by a third party inspector approved by the Building Official shall be provided for the following: - Welding of structural steel - Special inspection by a third party inspector is not required for the following: - Concrete or reinforcing steel for foundations. Design is based on an ultimate concrete strength of 2500 psi or less. - Installation of cast-in-place or post-installed anchor bolts. - Installation of adhesive anchors for tie-down devices, provided that each anchor is torque-tested in accordance with Table R-2, Sheet R2. - Nailing of wood structural panel shear walls, provided a building department inspection is performed.	General Notes Retiree of Living-Space-Over-Garage Dwellings (Plan Set) Vulnerability-Based Assessment, Remedial Measures, and Family Dwellings FEMA P-1100, Volume 2: Plan Sets Revised: SEP 2019 APPLICANT PROPERTY ADDRESS DATE SHEET S1
	Screw Anchor	Adhesive Anchor																						
Diameter (in)	Torque (ft-lbs)	Torque (ft-lbs)																						
1/2"	15	15																						
3/4"	15	20																						
Concrete cast against and permanently exposed to soil	4 inches																							
Formed concrete exposed to weather	2 inches																							
Concrete not exposed to weather or in contact with soil	1-1/2 inch																							
Horizontal bars with more than 12 inches concrete below	32 inches																							
Other bars	42 inches																							

required entry a new wall, install minimum anchors into one couple tested in accordance with Table R-2.

Table R-1: Verification of Existing Foundation System		
Requirement	Yes or NA	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 R-2.	☐	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		
Diameter (in)	Screw Anchor Torque (ft-lbs)	Adhesive Anchor Torque (ft-lbs)
1/2"	15	15
3/4"	15	20

Supplemental Technical Notes Where Tie-downs are Required at Existing Foundations Retiree of Living-Space-Over-Garage Dwellings (Plan Set) Vulnerability-Based Assessment, Remedial Measures, and Family Dwellings FEMA P-1100, Volume 2: Plan Sets Revised: SEP 2019 APPLICANT PROPERTY ADDRESS DATE SHEET S2	Retiree of Living-Space-Over-Garage Dwellings (Plan Set) Vulnerability-Based Assessment, Remedial Measures, and Family Dwellings FEMA P-1100, Volume 2: Plan Sets Revised: SEP 2019
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Gather Info to Complete Plans

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				⑥ FLOOR FRAMING TO WALL CONNECTION				
			No Tie-down			w/ Tie-downs in Existing or New Foundations							Min. No. of Foundation Connectors or Anchors at Each Wall Panel				Min. No. of Connectors at Each Wall Panel				
			8d Nail Spacing	Wall Length	Tie-down	8d at 6" O.C.		8d at 4" O.C.		8d at 2" O.C.											
						8d Nail Spacing	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"
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	X	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
Medium Construction	2000		4	36'-0"	37'-6"	None	No	25'-6"	TD2	Yes	15'-0"	TD4	Yes	10	16	21	17	12	26	25	33
	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
Heavy Construction	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
	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

- Locate the section that matches your home's construction. Use the chart on Sheet S3 to determine "Weight Category".
- 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 **48' x 20' = 960 SF**
- 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.
- 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).
- 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.
- 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.
- 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.
- 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:

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

RETROFIT SUMMARY

BRACING, ANCHORS, CONNECTORS, AND TIE-DOWNS

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

Supplemental Earthquake Retrofit Schedule

- Check boxes if additional Earthquake Retrofit Schedules 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
FEMA P-1100, Volume 2 - Plan Sets
Issued: SEPT 2019

 **FEMA**

Date: _____
Sheet: _____

S3.1-1.2

Gather Info to Complete Plans

Side Walls

- ④ **Left Side Wall:** Select 22'-6" wall length w/ 8d nails @ 6" o.c. (no holdown required)

Reason: *Wall available/Most economical choice*

Right Side Wall: Select 18'-6" wall length w/ 8d nails @ 6" o.c. (holdown IS required but not on a new foundation)

Reason: *Wall available/Most economical choice*

- ⑤ Select (9) 1/2" anchor bolts along each wall line

Reason: *Contractor's preference*

- ⑥ Select (13) Type "E" connectors along each wall line

Reason: *Contractor's preference/Dwelling construction*

	TYPE E Simpson Strong-Tie KC Metals USP Structural Connectors	L90 CA90 AC9
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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 ☒ Light Construction	④ MINIMUM REQUIRED LENGTH OF A SINGLE SECTION OF WALL OF WOOD STRUCTURAL PANEL SHEAR WALLS (at each wall line)										⑤ FOUNDATION SILL ANCHORAGE					⑥ FLOOR FRAMING TO WALL CONNECTION			
			No Tie-down				w/ Tie-downs in Existing or New Foundations						Min. No. of Foundation Connectors or Anchors at Each Wall Panel					Min. No. of Connectors at Each Wall Panel			
			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	
	2000		4	36'-0"	37'-6"	None	No	25'-6"	TD2	Yes	15'-0"	TD4	Yes	10	16	21	17	12	26	25	

Date: Sheet: S3.1-1.2

Date: _____
Sheet: _____
S3.1-1.2

Gather Info to Complete Plans

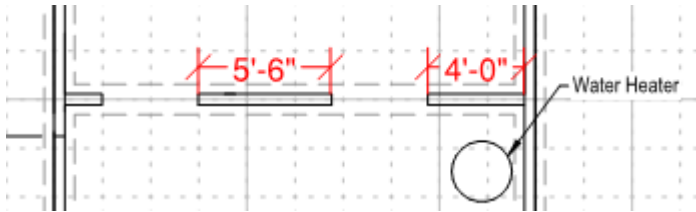
⑦ RETROFIT SUMMARY BRACING, ANCHORS, CONNECTORS, AND TIE-DOWNS		Earthquake Retrofit Schedule single	Type of Living-Space Vulnerability-Based Seismic FEMA P-11 Iss
1. Retrofit requirements per wall line: (check box if tie-down and/or new footing will be used on that line) ☐ Front Wall _____ ft ☐ Nailing: 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 <u>22'-6"</u> ft ☐ Nailing: 8d at <u>6</u> O.C. ☐ Tie-Down Type _____ ☐ New Ftg ☒ Right Side Walls <u>18'-6"</u> ft ☐ Nailing: 8d at <u>6</u> O.C. ☒ Tie-Down Type <u>TD1</u> ☐ New Ftg			
2. New Foundation Sill Anchorage to be used: (check all that apply) Bolts: Diameter <u>1/2"</u> ☐ Adhesive ☒ Screw ☐ Type "A" Connector ☐ Type "C" Connector ☐ Type "B" Connector Minimum required number of Sill Anchors per wall line <u>9</u>			
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 <u>13</u>			
4. ☒ Check this box if tie-downs and the SUPPLEMENTAL TECHNICAL NOTES will be used.		Date: _____ Sheet: _____	
⑧ Supplemental Earthquake Retrofit Schedule		S3.1-1.2	
1. Check boxes if additional Earthquake Retrofit Schedules are included. ☐ S3.2-1.2 ☐ S3.4-1.2 ☐ S3.6-1.2 ☐ S3.3-1.2 ☐ S3.5-1.2			

NOTE:

THIS SECTION WILL BE FILLED OUT/UPDATED THROUGHOUT THE PROCESS

Gather Info to Complete Plan

Back Wall



- ④ **Back Wall:** Select (2) 4' long panels w/ 8d nails @ 2" o.c.
Reason: *Wall available*

- ⑤ Select (5) ½" anchor bolts along each wall line
Reason: *Contractor's preference*
- ⑥ Select (7) Type "E" connectors along each wall line
Reason: *Contractor's preference/Dwelling construction*

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					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		7'-6"	TD1	No	3'-6"	TD4	Yes	2	4	5	4	3	6	5	7
	1000	X	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

Refer to S3.2-1.2 for options for walls with 2 sections

Sheet:
S3.2-1.2

Gather Info to Complete Plan

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 <u>4</u> ft ☒ Nailing: 8d at <u>2"</u> O.C. ☒ Tie-Down Type <u>TD4</u> ☒ 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 <u>1/2"</u> ☐ 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 <u>5</u> 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 <u>7</u> 4. ☒ Check this box if tie-downs and the SUPPLEMENTAL TECHNICAL NOTES will be used.	Earthquake Retrofit Schedu two sect Retrofit of Living-Space-Ov Vulnerability-Based Seismic Asses Family FEMA P-1100, V Issued:
⑧ Supplemental Earthquake Retrofit Schedule 1. Check if this Sheet is supplemental 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	 FEMA Date: _____ Sheet: S3.2-1.2

Gather Info to Complete Plan Front of Garage

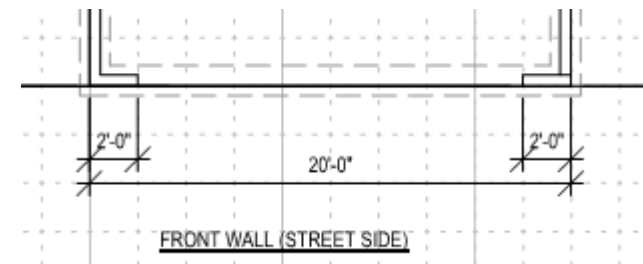
- Front of garage schedule options include S3.4, S3.5 and S3.6
- Due to limited wall availability, use S3.6 Alternates
- Steps 1 thru 3 instructions same as previous

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 **48' x 20' = 960 SF**
- 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.

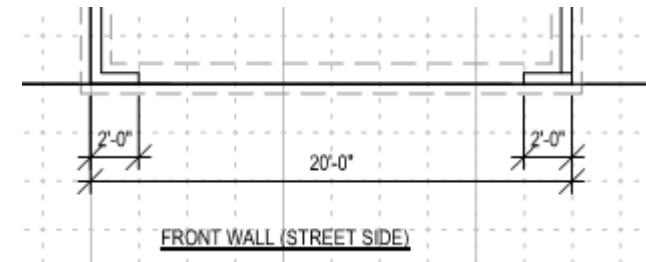
- ④ Determine size of steel column and connection detail or see ⑤.
- ⑤ Determine minimum required allowable shear capacity to be used in selection of a proprietary shear wall. Consult manufacturer's load tables for final selection. Note that more than one shear wall panel may be needed to obtain the 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.



Date:
Sheet:
S3.6-1.2

Gathering Info to Complete Plan Front of Garage

- Steel Column or Proprietary Shear Wall Retrofit
- Choose Steel Column Size and Connection
- Complete Summary



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)
			Steel Column	Column Connection Type (per detail 2 on sheet D7) at Upper Floor	DIAPHRAGM NAILING (3) (5) Edge Nail Spacing (inches on center)
X Light Construction	800		W8x21	C1	1950
	1000		W8x21	C1	2440
	1200		W8x21	C1	2920
	1500		W8x21	C1	3650
	2000		W8x28	C1	4870

Date:
Sheet:
S3.6-1.2

Gather Info to Complete Plans

⑦ RETROFIT SUMMARY check box if selected	Alternate Earthquake Retrofit Schedule in dwelling w/ ground story Retrofit of Living-Space-Over-Garage Vulnerability-Based Seismic Assessment & Family Dwelling FEMA P-1100, Volume 2 Issued: SEPT 2009
<u>Steel Column</u> ☒ At front wall Column Size <u>W8x21</u> Connection <u>C1</u> Diaphragm Nailing <u>6" o.c.</u> ☐ At back wall Column Size _____ Connection _____ Diaphragm Nailing _____ <u>Proprietary Shear Wall</u> ☐ 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 ☐ S3.3-1.2 ☐ S3.5-1.2 ☒ S3.2-1.2 ☐ S3.4-1.2	Date: _____ Sheet: S3.6-1.2

Gather Info to Complete Plans

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 <u>22'-6"</u> ft ☐ Nailing: 8d at <u>6</u> O.C. ☐ Tie-Down Type _____ ☐ New Ftg ☒ Right Side Walls <u>18'-6"</u> ft ☐ Nailing: 8d at <u>6</u> O.C. ☒ Tie-Down Type <u>TD1</u> ☐ New Ftg 2. New Foundation Sill Anchorage to be used: (check all that apply) Bolts: Diameter <u>1/2"</u> ☐ Adhesive ☒ Screw ☐ Type "A" Connector ☐ Type "C" Connector ☐ Type "B" Connector Minimum required number of Sill Anchors per wall line <u>9</u> 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 <u>13</u> 4. ☒ Check this box if tie-downs and the SUPPLEMENTAL TECHNICAL NOTES will be used.	Earthquake Retrofit Schedule single Retrofit of Living-Space Vulnerability-Based Seismic FEMA P-1100 Issued
⑧ Supplemental Earthquake Retrofit Schedule 1. Check boxes if additional Earthquake Retrofit Schedules are included. ☒ S3.2-1.2 ☐ S3.4-1.2 ☒ S3.6-1.2 ☐ S3.3-1.2 ☐ S3.5-1.2	U.S. DEPARTMENT OF HOMELAND SECURITY FEMA Date: _____ Sheet: S3.1-1.2

Add Information to Your Plan

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

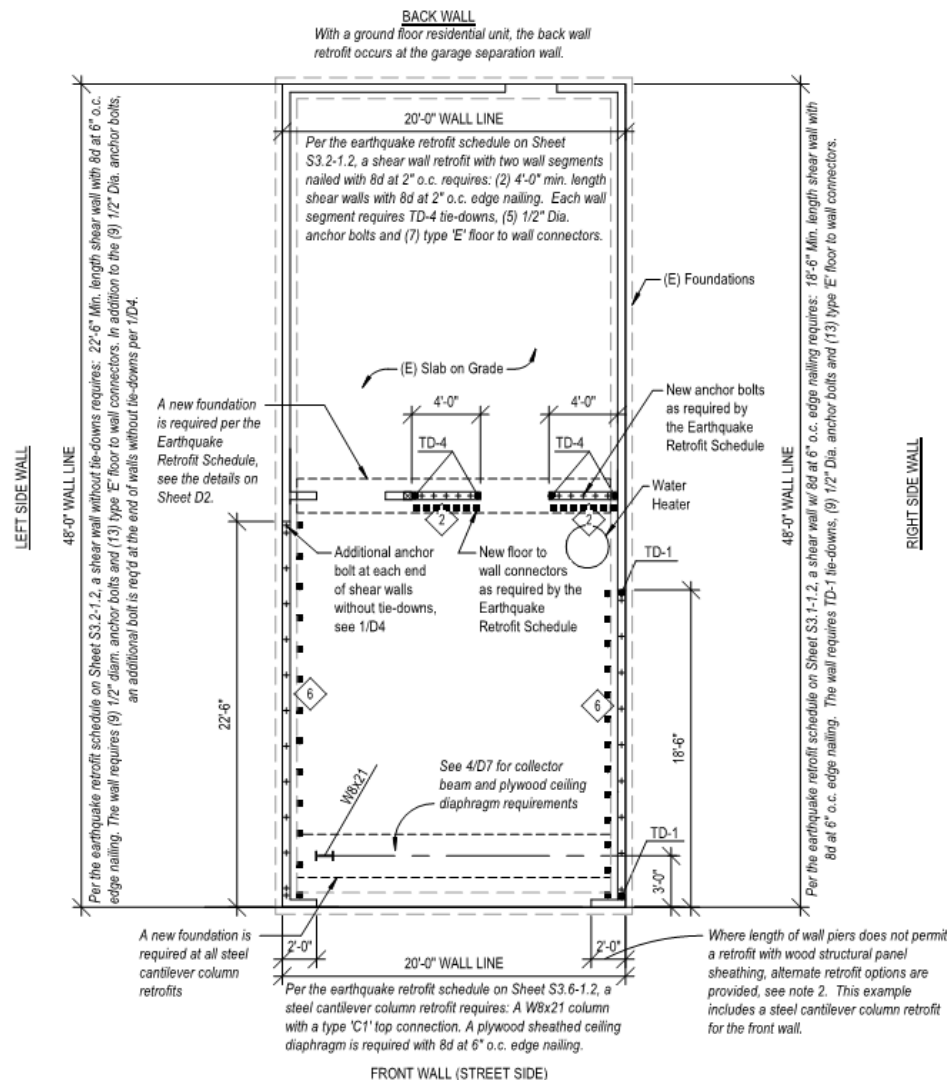
NOTE:
THIS SECTION WILL BE FILLED OUT/UPDATED THROUGHOUT THE PROCESS

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.

- Complete the Retrofit Schedule Summary on Sheet S4
- General Notes provided below the Retrofit Summary also provide references to typical miscellaneous details on sheets D4 thru D6

Add Information to Your Plan

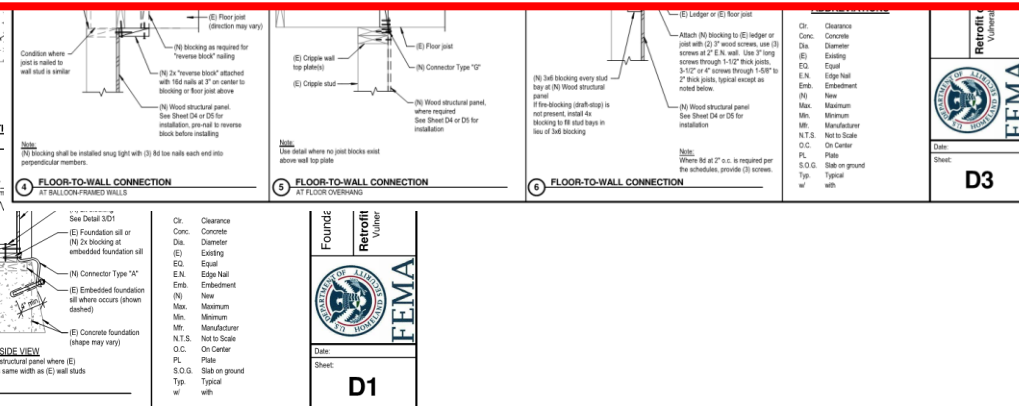
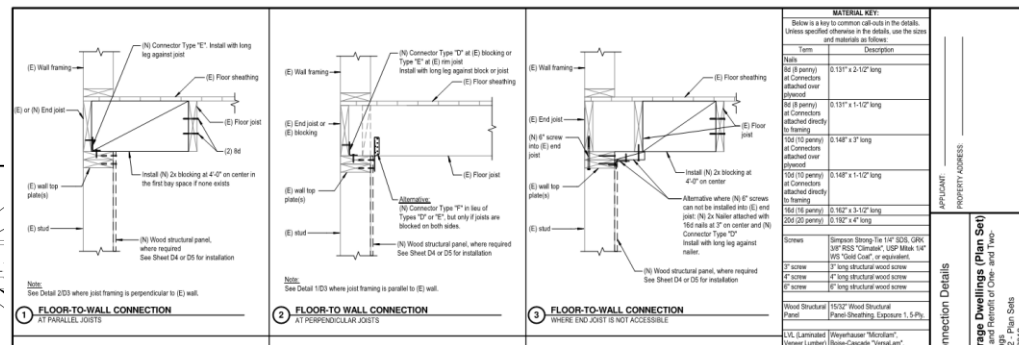
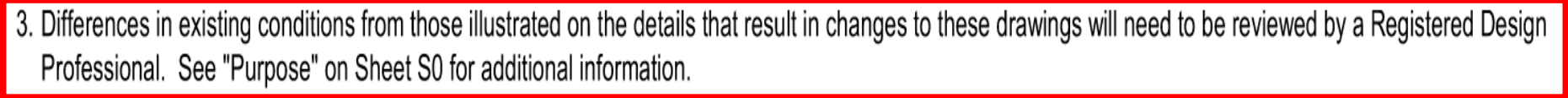


- Indicate the location/length of structural wall sheathing along the back/side walls
- Indicate hold-downs where required
- Indicate size and location of new W8 column at front wall
- Show all new foundations on the plan

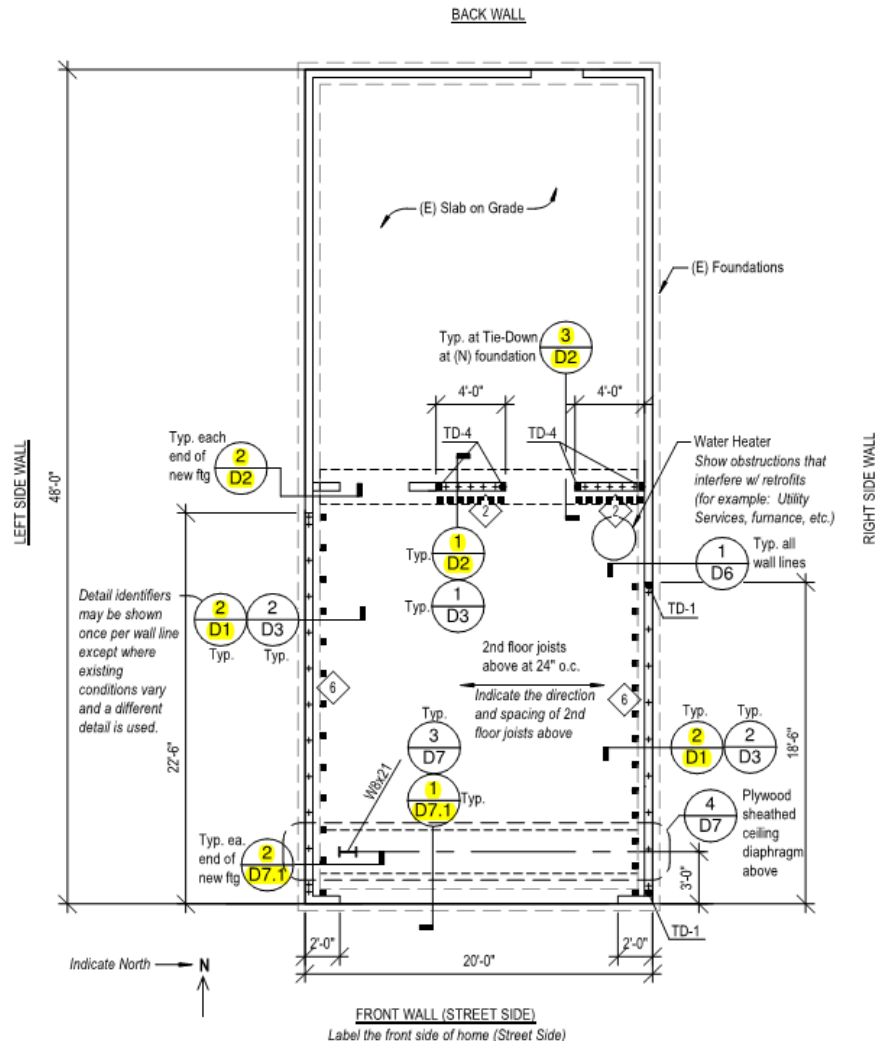
ATC

FEMA P-1100: Vulnerability-Based Assessment and Retrofit of One -and Two- Family Dwellings

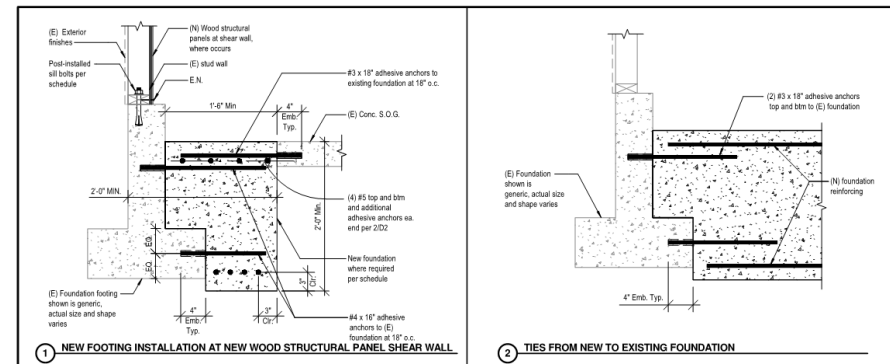
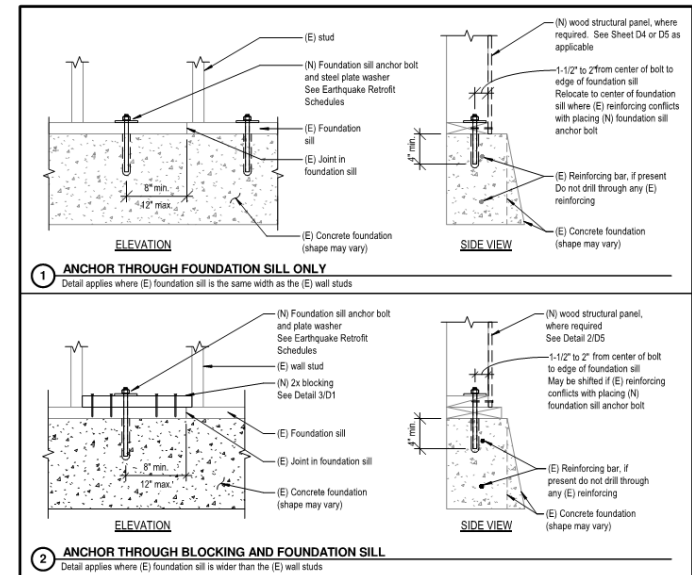
- 97



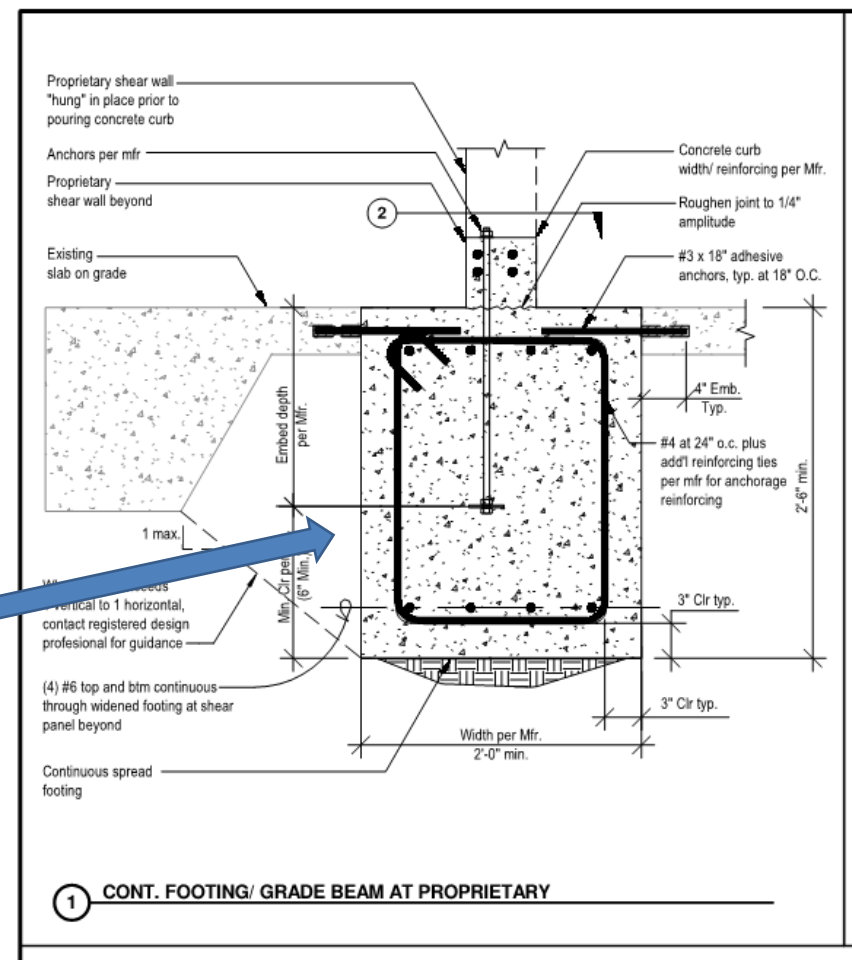
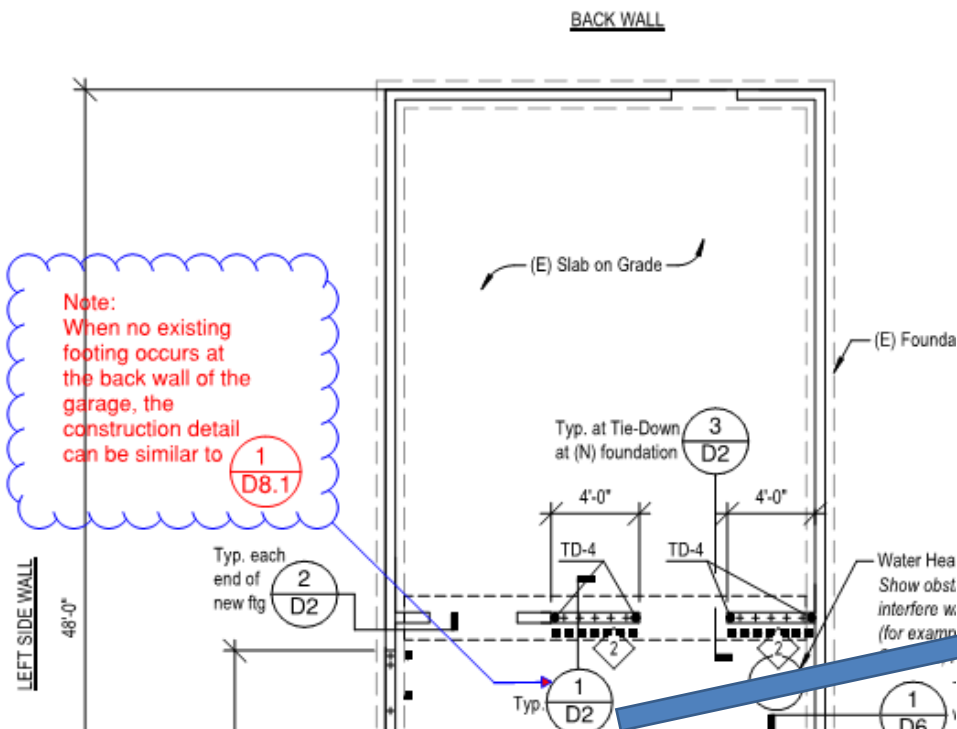
Reference Details on Your Plan



Reference the appropriate details at **Foundation Level**

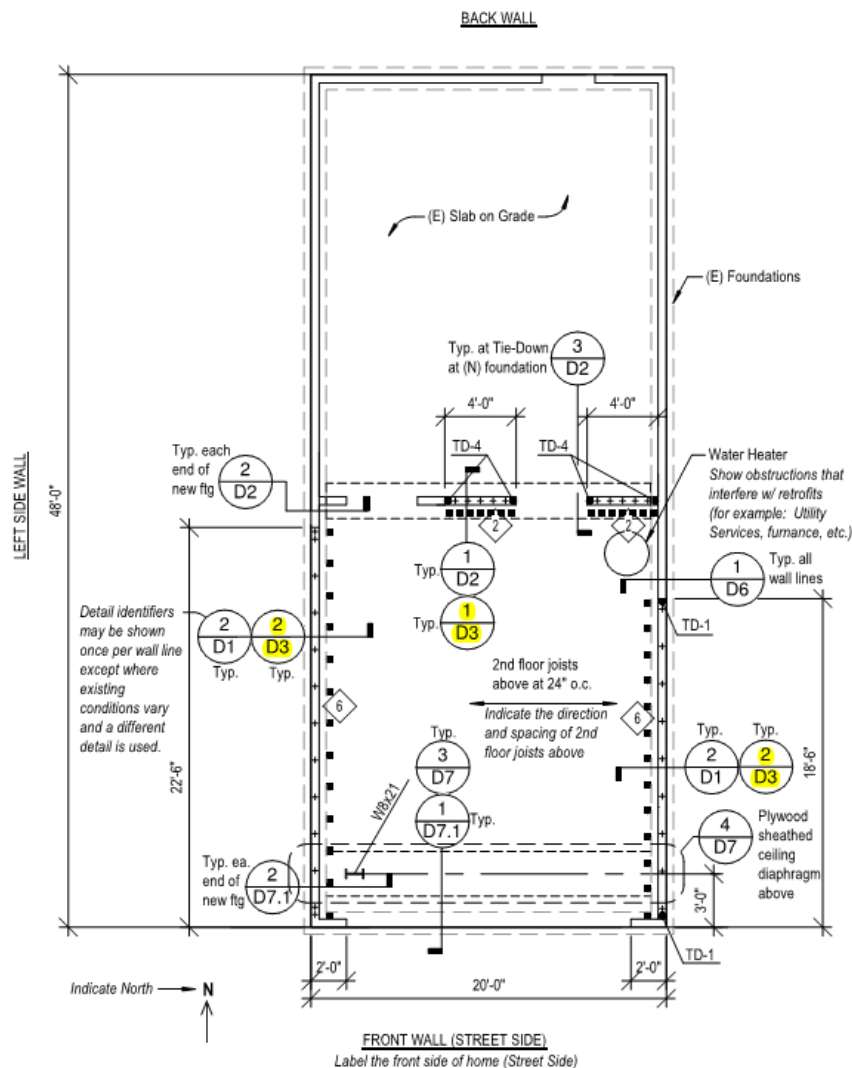


Reference Details on Your Plan

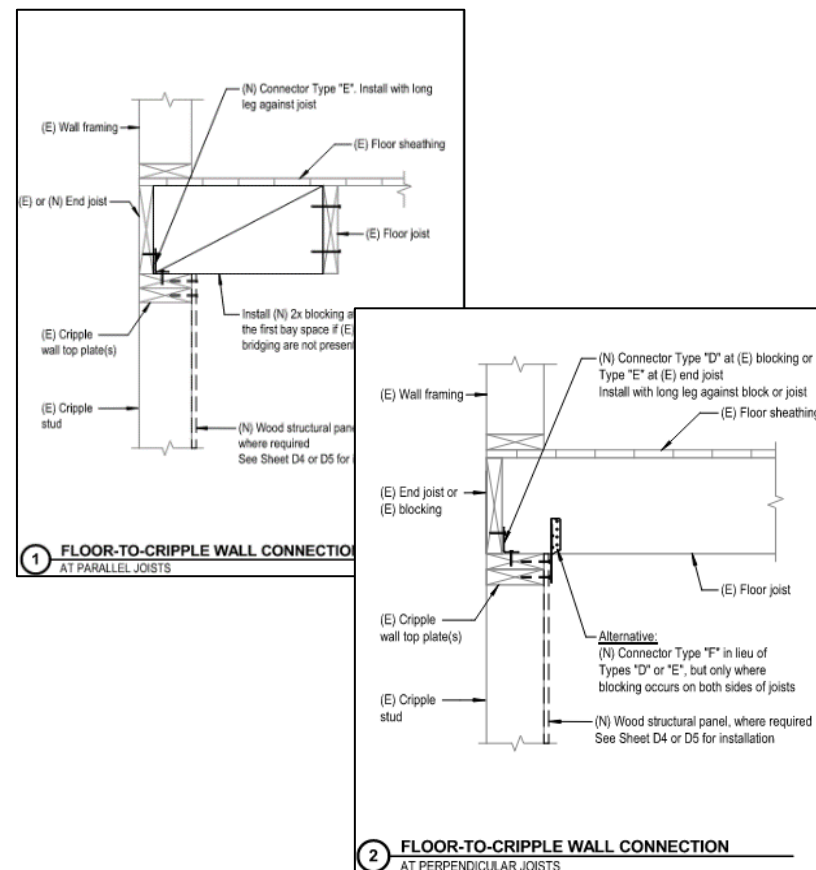


Ground Floor Residential Unit Dwelling
Condition where **no existing footing**
occurs at the back of the Garage

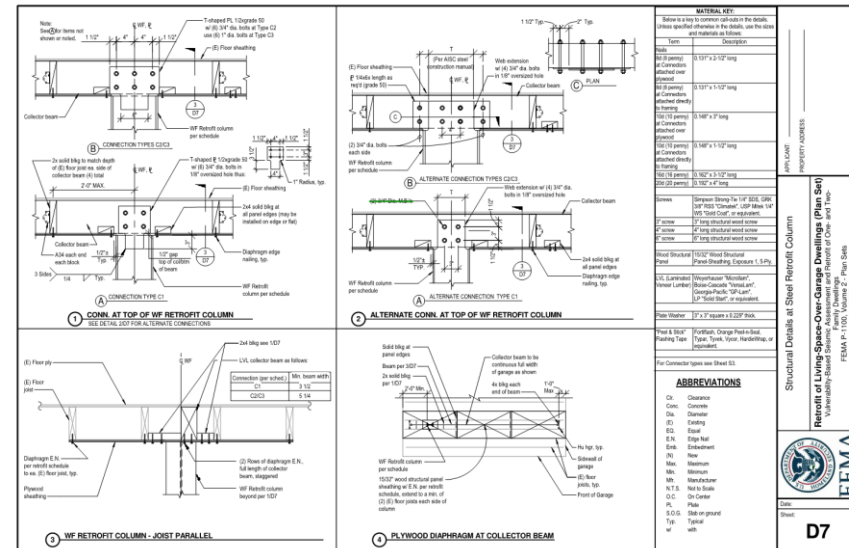
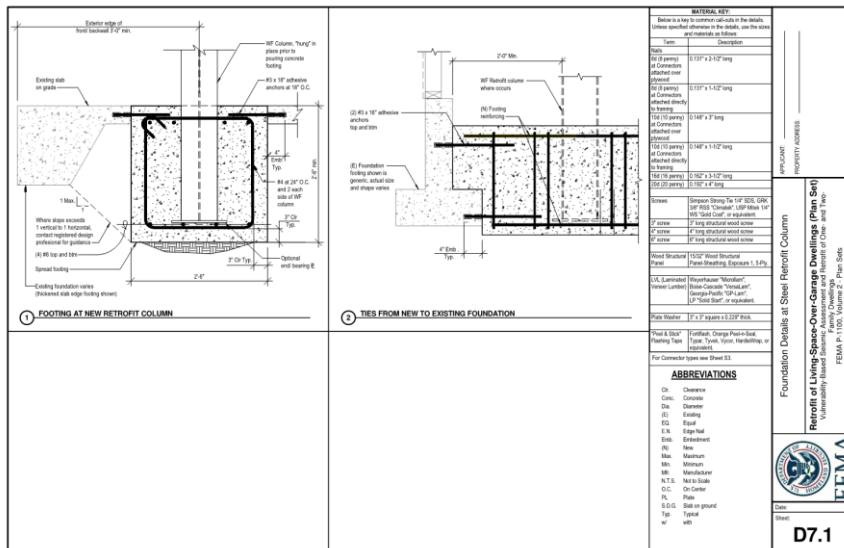
Reference Details on Your Plan



Reference the appropriate details for **Floor to Wall Framing**



- Sheet D7 (at upper floor)
- Sheet D7.1 (at foundations)



Final Submittal Package

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.

- Remove sheets marked "Do Not Submit" and those that are not used
- Photos of Existing foundation sill and second floor framing conditions may assist the plan review process

Application Example

Submittal Sheet Index

S0	Cover Sheet
S1	General Notes
S2	Supplemental Technical Notes Where Tie-downs are Required at Existing Foundations
S3	Earthquake Retrofit Schedule General Instructions, Weight Category, and Connectors
S3.1-1.2	Earthquake Retrofit Schedule - Wood Structural Panel with single section of wall
S3.2-1.2	Earthquake Retrofit Schedule - Wood Structural Panel with two sections of wall
S3.3-1.2	Alternate Earthquake Retrofit Schedule (Steel Column or Proprietary Shear Wall)
S3.4-1.2	Earthquake Retrofit Schedule at front of garage only in dwelling with Ground Floor Residential Unit
S3.5-1.2	Earthquake Retrofit Schedule at front of garage only in dwelling with Ground Floor Residential Unit
S3.6-1.2	Alternate Earthquake Retrofit Schedule at front of garage in dwelling w/ Ground Floor Residential Unit
S4	Foundation and Retrofit Layout Plan
D1	Foundation Sill to Concrete Foundation Connection Details
D2	Foundation Details at Wood Structural Panel Shear Walls
D3	Floor Framing to Wall Connection Details
D4	Wood Structural Panel Installation at Shear Walls without Tie-Downs
D5	Wood Structural Panels with Tie-Downs
D6	Vent Openings and Top Plate Details
D7	Structural Details at Steel Retrofit Column
D7.1	Foundation Details at Steel Retrofit Column
D8	Structural Details at Proprietary Shear Wall Retrofit
D8.1	Foundation Details at Proprietary Shear Wall Retrofit

(*) 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 $S_{DS}=1.5$

FEMA P-1100 Available Training

TOPIC	Primary Audience and Training Modules		
	Building Official	Contractor	Engineer
<i>FEMA P-1100 Introduction</i>	1B	1C	1E
Crawlspace Dwellings		2C	2E
Living-Space-Over-Garage Dwellings		3C	3E
Chimneys and Fireplace Surrounds		4C	
Hillside Dwellings		5C	5C, 5E

End