OSSPAC MINUTES
March 10, 2020

The meeting was called to order at 9:00 PDT at the Capitol.

OSSPAC Members Present:
Jeffrey Soulages, Chair Public member
Tiffany Brown, Vice Chair Stakeholder: local government
Rep. David Gomberg Legislative member
Dacia Grayber Stakeholder: First responder
Joe Karney Stakeholder: utilities
Christina LeClair (via phone) State Agency: ODOT
Ed MacMullan Stakeholder: banking
Bonnie Magura Stakeholder: schools
Walter McMonies (via phone) Stakeholder: multi-family housing
Trent Nagele Stakeholder: structural engineer
Althea Rizzo State agency: OEM
Sen. Arnie Roblan Legislative member
Susan Romanski (via phone) Public member
Aeron Teverbaugh (via phone) State Agency: DCBS
Yumei Wang (via phone) State agency: DOGAMI
Katie Young (via phone) Public member

OSSPAC Members Absent:
Adam Pushkas Stakeholder: building owners
Matt Crall State agency: DLCD

Others in Attendance:
Colin Blaine (via phone) Speaker – Buehler Engineering
Mike Harryman (via phone) State Resilience Officer
Lawrence Magura Public, ASCE Legislative Committee Chair
Meg Reed (via phone) State agency: DLCD
Steve Robinson (via phone) Cascadia Prepared
Tyler Janzen Chief of Staff, Rep. David Gomberg

1. Administrative Matters

1a. Welcome and Introductions
Chair Jeff Soulages opened the meeting and led introductions.

1b. Review and Approval of Minutes from previous meeting
Jeff Soulages asked if there were any changes to the January meeting minutes. After discussion there was a change proposed to the last line in Item 4. The amended minutes were approved. There was discussion regarding when minutes should be provided to members. It was proposed that once the minutes are in final draft form they will be sent to members, this was seconded and approved. There was discussion on when the minutes should be posted to the website. It
was seconded and approved that minutes should be posted after they are voted on by a quorum of the Commission.

1c. **Events Notification**
Althea Rizzo announced that Office of Emergency Management (OEM) is having Oregon Prepared next week in Sunriver (March 16-20, 2020). This workshop will have Emergency Managers and Health all in one place to meet and collaborate. The workshop is put on jointly by OEM and Oregon Health Authority (OHA).

Yumei Wang announced that last week (week of March 2) at the National Earthquake Conference, OHA received a national recognition award on mitigation from the Western States Seismic Policy Council for their leadership on the Coastal Hospital Resilience Project.

There is a new podcast by Sabina Roan, Candidate, Master of Urban and Regional Planning Portland State University, at: [https://anchor.fm/seismicairwaves](https://anchor.fm/seismicairwaves).

There will be an Earthquake Preparedness Event at Portland State University April 7 from 5-8 pm.

The ASCE Infrastructure Resilience Division (IRD), in partnership with the University of California at Los Angeles (UCLA), is pleased to announce the San Fernando Earthquake Conference – 50 Years of Lifeline Engineering (Lifelines2021), focusing on “Understanding, Improving & Operationalizing Hazard Resilience for Lifeline Systems.” This will be held February 7-10, 2021 in Los Angeles California, [https://samueli.ucla.edu/lifelines2021](https://samueli.ucla.edu/lifelines2021). There is a call for abstracts for sessions, talks and posters which are due March 24, 2020. Yumei and Mike Harryman will be doing a presentation.

Jeff Soulages announced that work continues on ATC 137-2 and 150, about functional recovery which is required due to NEHRP reauthorization. More about this in the second half of the year. Shifting from life safe code to a functional recovery focus for both buildings and lifelines.

1d. **New Business**
Next meeting, we are working on securing two more speakers. First is a presentation on the recent PEER/CEA project on cost benefit analysis of seismic retrofit of single-family homes. The second is a California Earthquake Authority (CEA) program called QuakeGrade aimed at home inspectors to do a better job of giving homeowners data on the expected earthquake performance of their home rather than just a simple disclosure. The goal is to make a report for the legislature with more details than the insurance report or direct legislation. There was discussion about what the goal is and other resources available.

Rep. Gomberg wanted to make sure that OSSPAC needs to show up and support the legislation that is felt to be important. Discussion about this topic was held. It was noted several times that lead time is an issue due to how the
legislature works. Several proposals were made about special meetings or a subgroup/subcommittee to track and push legislation (including testifying) during the legislative session. More discussion on this topic will need to take place.

1e. **Location for next OSSPAC Meeting**
A discussion regarding holding the meeting at the capitol or remotely ensued due to COVID-19. Agreed to proceed with in person meeting in the capitol in Room F and the situation will be monitored and this discussion will be revisited if needed.

2. **FEMA P-1100: Colin Blaney, Co-Project Director**
FEMA P-1100 is a national vulnerability-based seismic assessment and retrofit pre-standard for one- and two-story family dwellings and is available in full from FEMA for no cost, [https://www.fema.gov/media-library/assets/documents/175158](https://www.fema.gov/media-library/assets/documents/175158). The presentation has been converted to PDF and is attached at the end of the minutes as Attachment A.

Addressing earthquake retrofit of one and two story single family homes is important because they are the most common dwellings in US and have known vulnerabilities that can be mitigated to improve earthquake resilience. Pre-standards will be going through ANSI and then become standards, but they are available for use right now. These will replace Appendix A.3 of the IEBC codes. Chapters 4-7 are of main interest and includes both assessment and retrofit methods.

Jeff asked about who at FEMA will take this to become a standard. Colin responded that it will be taken to IEBC, not ASCE. Jeff asked if shelter readiness after an event was discussed in the scope of this process. Colin responded yes, these were crafted with the idea that this would increase the chance of habitability of homes after an event. Jeff asked about the different kinds of homes and their definitions. Colin’s response went into more detail about definitions of home types covered in the document. Jeff asked about using chemical anchors and if that would need a special inspection. Colin responded that if chemical anchors are used in retrofit no special inspection would be needed but it is recommended to use other kinds of anchors. Jeff clarified that a home owner only needs to know three things: siding type, roof type and inside finishing to roughly calculate the buildings weight to know what type of retrofits to do on a specific house type. Colin agreed for the proscriptive plan set.

Discussion regarding lack of current uniform retrofit standards for home owners and contractors to use and how these pre-standards will help. Question was asked if it had been studied how the implementation with contractors is going to work in using these pre-standards. Colin responded that the plan sets have been around for a while and some contractors have been using them and this particular plan set has been well received. Jeff asked now that the pre-standards are out and available for free, once these are approved as standards, will any subsequent changes go through the same process as any other code document. Colin responded that yes, they are free and available on the FEMA website (see
link above) and yes to changes after they become standards. Trent asked about this being based on California seismicity and how applicable are these standards for Oregon and other parts of the country. Colin responded that is should be applicable to all parts of the United States due to various seismic levels used.

3. **FEMA P-530: Colin Blaney, Project Technical Director**

FEMA P-530 is a national earthquake safety at home guide and is available in full from FEMA for no cost, [https://www.fema.gov/media-library/assets/documents/186094](https://www.fema.gov/media-library/assets/documents/186094). The presentation has been converted to PDF and is attached at the end of the minutes as Attachment B.

This is an update of the old P-530. The audience is people living or visiting earthquake areas. It addresses in a conceptual way the same kinds of information that P-1100 does as well as other home hazards and actionable advice in six different sections. It was prepared with professional writers and layout folks and uses compelling graphics to aid the causal user.

Tiffany asked when and where this will be available in print. Colin said that it is in the current FEMA catalogue. Colin recommends downloading the document to have access to the links that are throughout both P-1100 and P-530.

4. **Reports**

4a. **OEM**

OEM is running a limited ECC for the COVID-19 support for the extend future (no known end date). Continuing preparation for Cascadia 2022. Work continuing on Be 2 Weeks Ready for the roll out next year. ShakeAlert roll out WEA in house test this summer, live on October 15. Tsunami debris webinar series continues; next one in June.

4b. **DOGAMI**

Bob Houston is DOGAMI's new interim program manager for the Geological Survey and Services program.

2019 DOGAMI publications that relate to geologic hazards:
- O-19-01, Summary report on the Oregon Coastal Hospital Special Leadership Event
- O-19-02, Resilience guidance for Oregon hospitals
- O-19-03, Columbia River simulated tsunami scenarios
- O-19-04, Comparison of Oregon tsunami hazard scenarios to a probabilistic tsunami hazard analysis (PTHA)
- O-19-05, Tsunami evacuation analysis of Newport, Lincoln County, Oregon
- O-19-06, Tsunami evacuation analysis of Lincoln City and unincorporated Lincoln County: Building community resilience on the Oregon coast
- O-19-07, Tsunami evacuation analysis of communities surrounding the Coos Bay estuary: Building community resilience on the Oregon coast
- O-19-08, Tsunami evacuation analysis of some unincorporated Tillamook County communities: Building community resilience on the Oregon coast
- O-19-09, Coseismic landslide susceptibility, liquefaction susceptibility, and soil amplification class maps, Clackamas, Columbia, Multnomah, and Washington Counties, Oregon: For use in Hazus: FEMA’s methodology for estimating potential losses from disaster
- SLIDO-4.0, Statewide Landslide Information Database for Oregon, release 4.0 (SLIDO-4.0)
- GMS-123, Geologic map of the Poison Creek and Burns 7.5; quadrangles, Harney County, Oregon
- GMS-124, Geologic map of the Biggs Junction and Rufus 7.5' quadrangles, Sherman and Gilliam Counties, Oregon

Due to legislative activities, DOGAMI does not have an agency budget starting July 1, 2020. This is being worked on by DOGAMI management and other State leadership.

4c. DLCD
Tillamook County has adopted a tsunami regulation in December and more coastal communities are working on it.

4d. ODOT
ODOT continuing to respond to NE Oregon due to damage from recent flooding in Umatilla County. Continuing to support OHA with PIOs for the JIC for the COVID-19 response.

4e. DCBS
Employee searches for multiple positions are in process. Doing lots of outreach for the Umatilla floods and COVID-19.

4f. SRO
DCBS will have two listening sessions to find a new director of the building codes division; they have OSSPAC information will be reaching out soon.

The OSSPAC CEI HUB report has been distributed. The governor has read it and she is will sign a letter regarding the report. Both the report and the letter will be sent to Portland and Metro commissioners. OEM is working with Portland
State University (PSU) to do a risk abatement study. The City of Portland and Multnomah County are also working on a study that is independent of the OEM/PSU study.

In the short session the house bills that included ShakeAlert, dams and the resilience plan update passed out of committee but there was no vote so all three are dead. The Emergency Board did approve $2.7 million for 7 temporary positions for OEM including an all hazard response team and liaison positions within the regions. The ShakeAlert system needs a funding plan and it is still being worked on.

Mike would like to be part of any legislative planning and actions. This is to ensure everything stays within the commission rules and regulations.

The three reports that OSSPAC has produced (Mass Care, Seismic Insurance and CEI Hub) are being used and talked about.

There was discussion about bills and the legislative process.

Andrew Phelps (OEM Director) and Mike want to elevate resilience with the BRIC grant (once a year grant for 5 years). The money is for premitigation. They want to bring together a wide group of people who are working with or around the issue of mitigation. When the grant guidance comes out, it will be distributed through the usual grant information channels. Meeting of the group is in June; chair and vice-chair of OSSPAC have been invited.

5. **Review of 2019 OSSPAC Year-End Report**
   Second draft sent out. Discussion about the report commenced. Due to lack of time it was decided that it will be discussed at the May meeting.

6. **Wrap up of 2019-20 Legislative Session**
   Only three bills got through this session. Governor proposed a 100 year water plan that did not get through this year. It includes the entire region because it is a regional issue. It is possible it will be funded if there is a special session. Building codes in tsunami zones died in this session. Hopefully it will have a better outcome in the next session.

7. **Public Comment**
   Lawrence Magura is an ASCE member and spoke about his work as a professional engineer, what he has done legislatively, and his willingness to assist OSSPAC.

The meeting was adjourned at 12:02 PM PDT.
Appendix A

FEMA P-1100 Presentation by Colin Blaney
Vulnerability-Based Seismic Assessment and Retrofit of One- and Two-Family Dwellings

March 10th, 2020

Colin Blaney S.E. Buehler
Learning Objectives

Develop an overall understanding of the FEMA P-1100 Prestandard and related documents.

Learn why we believe it will be a valuable resource for seismic mitigation.
Agenda

- Prestandard purpose, scope, and documents
- Why vulnerability-based, and what’s covered
- Looking ahead, next steps
- Performance objective
- Introduction to evaluation and retrofit methods
- Prescriptive and simplified engineering retrofits
- Leveraging prescriptive solutions
- Permitting and building department approval
- Introduction to (Ch.4, 5, 6 and 7)
- Preview of updates to FEMA 530
Acknowledgements

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Funding provided by

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Marianne Knoy, Mitigation Program Manager
Badie Rowshandel, Senior Research Analyst

FEDERAL EMERGENCY MANAGEMENT AGENCY
Michael Mahoney, Project Officer
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Members (8)

Working Group(s)
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Doug Thompson
Taylor Vincent
Dave Welch
Why a Prestandard for One and Two-Story Residential Buildings?

- Most Common Type of Dwelling in the United States
- There continues to be well known vulnerabilities that have repeatedly led to significant damage and dwellings being uninhabitable
Purpose

To provide a simple and systematic procedure to identify and retrofit known vulnerabilities in wood light-frame dwellings.

Use of the provisions is anticipated to improve earthquake performance but is not intended to prevent earthquake damage.
Scope

- One and two-story wood light-framed dwellings
- Town houses and single family dwellings divided into multiple dwelling units (R-3)
- Seismic Design Category (SDC) B through E
What is Vulnerability-Based?

- Focused on the critical risk
- Not intended to directly address other possible deficiencies
What’s Included

- Crawlspace dwellings
- Living space over garage
- Hillside homes
- Chimneys and masonry surrounds
- Combinations!
Available Documents

- Plan sets
- General Contractor training materials
- Engineering implementation tool.
- Design examples

VOLUME 1 - Prestandard

VOLUME 2 – Implementation Material (Summer 2019)
Under Development

Volume 3: (Researchers)
- Background information
- White papers
- Past presentations
- Archived data
Looking Ahead

Prestandard → ANSI-Approved Consensus Standard’s Process → Standard
Looking Ahead

Ch. 4: Crawlspace Dwellings
Ch. 5: Living Space over Garage
Ch. 6: Hillside Homes
Ch. 7: Masonry Chimney....

Appendix A3
New Resource
Performance Objective

- Probability of Collapse
  - Approximately 10%-20% under the Maximum Considered Earthquake
Prestandard - Big Picture

Chapter 1 Scope and Administration provisions

Determine eligibility for use of the prestandard: Section 1.8

Assess one or more vulnerabilities:
- Crawlspace dwelling
  - Cripple wall bracing and anchorage: Chapter 4
- Living-space-over-garage dwelling
  - Ground story bracing: Chapter 5
- Hillside dwelling
  - Anchorage to foundation and cripple wall bracing: Chapter 6
- Brick masonry chimney: Chapter 7
- Anchored masonry fireplace surround: Chapter 7

Retrofit one or more vulnerabilities:
- Crawlspace dwelling
  - Cripple wall bracing and anchorage: Chapter 4
- Living-space-over-garage dwelling
  - Ground story bracing: Chapter 5
- Hillside dwelling
  - Anchorage to foundation and cripple wall bracing: Chapter 6
- Brick masonry chimney: Chapter 7
- Anchored masonry fireplace surround: Chapter 7

Use Chapter 2 definitions, notations, and abbreviations as required.
Use Chapter 8 detailed

Use Chapter 2 definitions, notations, and abbreviations as required.
Use Chapter 3 minimum construction

Figure C.1.4-1 Flowchart of intended use of prestandard provisions.
Assessment & Retrofit

Assessment Methods
- Simplified vulnerability-based assessment
- Detailed vulnerability-based assessment
- Engineered vulnerability-based assessment
- General engineered assessment

Retrofit Methods
- Prescriptive vulnerability-based retrofit
- Simplified engineered vulnerability-based retrofit
- General engineered retrofit
FEMA P-1100 Prestandard

Chapter 1: Scope and Administration
Chapter 2: Definitions
Chapter 3: Minimum Construction Provisions
FEMA P-1100 Prestandard

Chapter 4 thru 7: Assessment and Retrofit Provisions
   – Crawlspace Dwellings
   – Living-Space-Over-Garage Dwellings
   – Hillside Dwellings
   – Masonry Chimneys and Fireplace Surrounds

Chapter 8: Detailed Assessment Checklists

Commentary:
What is a Prescriptive Retrofit?

- Engineering is embedded
- Intended to apply to a wide range of dwelling but has limitations
- Prescriptive procedures include many assumptions which leads to some conservatism.
What Retrofits can be Done Prescriptively?

- Crawlspace Dwellings
- Living Space over Garage
- Chimneys

- Plan Sets
  - Implementation tool that includes instructions, commentary and other useful information
  - Deemed to comply with Prestandard
When is a Design Professional Needed?

- When actual conditions fall outside of prescriptive assumptions
When is a Design Professional Needed?

- When retrofit details provided are not compatible with actual construction.
When is a Design Professional Needed?

- Where the prescriptive solutions do not fit

Prescriptive assumptions are listed within the Prestandard commentary
Leveraging Prescriptive Solutions

4.4  Prescriptive Vulnerability-Based Retrofit

4.4.1  Scope

Where a dwelling’s actual conditions require modification of the vulnerability-based prescriptive retrofit solutions identified within this section, additional or modified details may be generated by a registered design professional and used to supplement the prescriptive procedures of this section. These supplemental details shall be stamped and signed by a registered design professional and approved by the building official.
Permitting and Building Department Approval

- Compliance with the Prestandard requires approval by the Building Official.
- Building Official has discretion over similar conditions.
- **Visual** Inspections required for foundation anchor bolts, installation of blocking, plywood, metal hardware and any tie-downs
Permitting and Building Department Approval

- Self-certification required where tie-downs are required.
- Torque tests used as indicator of concrete quality and installation.
Permitting and Building Department Approval

- No testing of tie-downs for crawlspace dwellings
Chapter 4
Crawlspace Dwellings
Chapter 4 Crawlspace Dwellings

Chapter 4
Vulnerability-Based Assessment and Retrofit of Crawlspace Dwellings

4.1 General

This chapter contains provisions for vulnerability-based assessment and retrofit of wood-frame crawlspace dwellings supported on crawl space walls and foundation systems (Figure 4.3-1, Configuration A) or supported directly on a foundation system (Figure 4.3-2, Configuration B). Where both occur in a single dwelling, dwellings shall be assessed for both configurations A and Configuration B. Vulnerabilities addressed by this chapter are:

- Cripple walls and foundation systems (Configuration A)
  - Connection to the framing above (A)
  - Cripple wall sheathing (B)
- Foundation of plate anchors to the foundation (C)
- Foundation of plate anchors to the foundation (D)
- Connection to the dwellings above (A)
- Foundation of plate anchors to the foundation (B)

The primary purpose of this chapter is to reduce earthquake-induced damage to wood-frame crawlspace dwellings.
Crawlspace Dwellings
Major Components

Add new plywood or oriented strand board sheathing to the inside face of the existing cripple wall studs. The amount necessary will vary based upon an actual home’s size and construction.

Add new framing anchors to connect the first level floor to the top of the cripple wall.

Add new anchors bolts to connect the existing foundation sill to the existing foundation.

Condition where cripple walls exist

Add new framing anchors to connect the first level floor to the top of the foundation sill.

Proprietary anchors may be required where it is impractical to install new anchor bolts vertically.

Condition where floor framing rest directly on the footing or stem wall.
Crawlspace Dwellings
Previous Work

- IEBC A3
- Standard Plan A, LA plan set, FEMA Plan Set, Seattle Plan Set, others......
Crawlspace Dwelling Retrofitting
Unanswered Questions

- What seismic retrofit criteria was needed to achieve performance goals?
- If we strengthen cripple wall, will damage propagate up? (zero sum game)
Overarching Retrofit Design Criteria

- Develop Prestandard using best available tools
- Simplified engineering approach
- Prescriptive retrofits derived from engineering criteria
- Cripple wall collapses do not pose a large LS risk
Overview of Plan Set - Eligibility

Table C-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 townhouse.
   The dwelling unit is a townhouse and assessment and retrofit will occur for all attached townhouse dwelling units at the same time.

2. The dwelling is a wood one-story dwelling that is two stories or less.

3. The dwelling is a perimeter (not):
   a. Cripple walls
   b. Foundation
   c. Post and piers
   d. Cripple walls

4. The dwelling has a continuous perimeter foundation (not including porches or other appendage), concrete stem walls or will be retrofitted to have a continuous perimeter foundation.

5. Cripple walls, where they occur, do not exceed 7'-0" in clear height.

6. The maximum slope is as measured from the top of foundations along one edge of the hom to the other edge does not exceed 5 to 1 (horizontal to vertical) or 20%

7. Weight of roofing material shall not exceed 12 psf except for one-story crawl-space dwellings with clay tile roofing as described in footnote 1 below.

8. Weight of exterior wall finish shall not exceed 10 psf, except that Masonry wainscots supported on concrete or Masonry foundations are permitted to extend up to four feet above the top of foundation.

9. Weight of interior wall finish shall not exceed 8 psf, except that veneer fireplace surrounds of not more than 4" thick and of up to 100 square feet of vertical surface are permitted to exceed this weight.

10. Weight of floor finish shall not exceed 6 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.

11. Floors in each story are at the same level and not split level, excluding slab on grade portions.

12. The maximum square footage of the dwelling, excluding areas supported on slabs on grade, does not exceed 3000 square feet for one story dwellings and 4,000 square feet for two-story dwellings.

13. No part of the foundations is constructed of unconfined masonry or stone.

14. Clear floor to ceiling heights at any occupied level does not 9'-0".

15. There is no indication that an engineered seismic force-resisting system is present in the dwelling (engineered plans, visible tie-down brackets).

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 plan set, unless a Registered Design Professional addresses the non-compliant issues in accordance with P-1100 FEMA Prestandard, Section 4.5, Differing Conditions.

Footnotes:
1. One story crawl-space dwellings with clay tile that weigh up to 20 psf shall be permitted to be strengthened in accordance with the provisions for two-story heavy construction as noted in the applicable Earthquake Retrofit Tables.

Do you belong in Ch.4 and Prestandard?
Prescriptive Versus Engineered Retrofit

Can you use a prescriptive approach?
Prescriptive Design- Plan Set
Prescriptive Design - Plan Set

I. WOOD STRUCTURAL PANEL SHEATHING
1. Wood structural panels shall be veneer, conforming to US voluntary Product Standard PS-1. Exposure 1 or Exterior Exposure, manufactured with exterior gluel, and minimum 6 ply.
2. Structured面板 (OSB) shall contain as US voluntary Product Standard PS-2 with an exposure rating of Exposure 1 or Exterior Exposure, manufactured with exterior gluel, and minimum 8 ply.
3. Provide 1-1/8-inch minimum gap at all sheathing panel ends and edges.
4. Maintain a minimum edge distance of 1/8" from corner to end of panel, and on all panel edges.
5. See sheet D4 for double stud at sheathing panel.
6. Bracing walls shall be either ends of wall panels shall be located near to the ends as practicable. Braced wall sections may be located from the ends of wall when existing obstructions or limited clearances necessitate such locations.
7. Braced wall sections shall have a minimum length of 10 feet in length and should be equal to or greater in length than the width of the braced wall sections.
8. The length of braced wall sections should not be less than 4 inches. The length of braced wall sections without te-downs should be equal to or exceed twice the height of the cribble wall. Exceptions are permitted when obstructions do not allow braced wall sections of the required length.

J. ADDITIONAL REQUIREMENTS FOR NON-RECTANGULAR DWELLINGS WITH
1. OR "L"-SHAPED PLANS
2. Plan configurations other than rectangular such as "T" or "L" shapes that have offsets in the exterior wall lines, with the interior space plan area greater than 30% of the exterior plan area shall not be required in that direction.
3. Foundation connections to foundation connections along offset wall shall have a maximum spacing of 12" center.
4. Floor joists to foundation connections along offset wall shall have a maximum spacing of 12" on center.
5. Cribble wall sections, where they occur, shall be sheathed with new wood structural panels. The sheathing shall have a minimum thickness of 1/8".

K. FRAMEING
1. There shall be Douglas Fir-Larch, or an approved species having a greater or equal specific gravity.
2. Wiring in contact with foundations or exposed to weather shall be sheathed with treated wood as specified in accordance with ASTM-653. Connectors exposed to contact with foundations or exposed to weather shall be treated in accordance with ASTM-653.
3. Connectors shall be of the type and size specified in these drawings.
4. Connectors required for the Earthquake Resilient Schedule shall be installed equal along the length of the offset wall or within the length of the braced wall sections.
5. Connection spacing may not be less than 6" center.
6. Where the minimum number of connectors cannot be achieved within the length of the wood structural panel bracing, connectors or anchors may be placed outside of, but as close as possible to, the area with wood structural panels.
7. Increase nail or screw length 1/2 inch minimum when installing connectors over wood structural panels.

L. CONNECTION DEVICES
1. Connectors shall be pre-engaged pre-manufactured devices, approved by the building official and installed in accordance with the manufacturer's instructions.
2. Connectors protected from weather shall be provided with a minimum of 300 pounds of coating in accordance with ASTM-653. Connectors exposed to contact with foundations or exposed to weather shall be galvanized coating or coating in accordance with ASTM-653, and fasteners conforming to ASTM 416.
3. Connectors shall be of the type and size specified in these drawings.
4. Connectors required for the Earthquake Resilient Schedule shall be installed equal along the length of the offset wall or within the length of the braced wall sections.
5. Connection spacing may not be less than 6" center.
6. Where the minimum number of connectors cannot be achieved within the length of the wood structural panel bracing, connectors or anchors may be placed outside of, but as close as possible to, the area with wood structural panels.
7. Increase nail or screw length 1/2 inch minimum when installing connectors over wood structural panels.

M. ADHESIVE ANCHORS
1. Pre-installed anchors shall be installed in accordance with the manufacturer's installation instructions.
2. Adhesive anchors shall be Simpson Strong-Tie SET-WP, WELT RE 600 50C, CIA GRC 7500, or approved equivalent.
3. Pre-installed anchors shall be Simpson Strong-Tie SET-WP, WELT RE 600 50C, CIA GRC 7500, or approved equivalent.
4. Pre-installed anchors shall be Simpson Strong-Tie SET-WP, WELT RE 600 50C, CIA GRC 7500, or approved equivalent.

N. PERMITS
1. A work permit required by this plan shall be permitted through the building department.

O. INSPECTIONS
1. Contractor shall coordinate with the building inspector to ensure that work is accessible for building department inspections, and shall complete the registration form as required by the inspector.
2. Inspection schedule shall be coordinated with the building department.
3. Inspection schedule shall be coordinated with the building department.
4. Inspection schedule shall be coordinated with the building department.

P. SPECIAL INSPECTIONS
1. Special inspection by a third-party inspector is not required in the following:
   a. Concrete reinforcing steel for foundations. Design is based on an ultimate compressive strength of 250 psi or less.
   b. Installation of pre-installed anchor bolts.
   c. Installation of anchors for beam and column connections.
   d. Installation of adhesive anchors for beam and column connections.
   e. Nailing of wood structural panel sheathing, provided a building department inspection is performed.
### Prescriptive Design- Plan Set

#### Earthquake Retrofit Schedule (Seismic 1.3, Seismic One-Story)

<table>
<thead>
<tr>
<th>Total Area in Square Feet</th>
<th>Wood Structural Panels</th>
<th>Foundation Sill Anchors</th>
<th>Floor to Cripple Wall Anchors</th>
</tr>
</thead>
<tbody>
<tr>
<td>up to 100</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>101 to 1200</td>
<td>8.0</td>
<td>9.0</td>
<td>8.0</td>
</tr>
<tr>
<td>121 to 1500</td>
<td>8.0</td>
<td>9.0</td>
<td>8.0</td>
</tr>
<tr>
<td>151 to 2000</td>
<td>9.0</td>
<td>10.0</td>
<td>9.0</td>
</tr>
<tr>
<td>201 to 3000</td>
<td>12.0</td>
<td>14.0</td>
<td>12.0</td>
</tr>
</tbody>
</table>

Notes:
1. Floor to Cripple Wall Anchors should be used as an alternative only if joists are blocking on both sides and accessibility makes the use of Type D or E impractical.
2. Any of the connectors listed in a particular group and as shown on sheet S3 may be used for strengthening the particular condition.
3. This plan was developed using the lowest rated manufacturer's capacity within a particular group. Required number of connectors on the Earthquake Retrofit Schedule may be found to have an acceptable space where an alternative connector is used. Any such substitution can only be designed or specified by a Registered Design Professional.
4. A foundation sill anchor types A, B, and C should not be used with cripple walls over 2 feet.

#### Retrofit Summary

- **BRACING, ANCHORS, CONNECTORS, AND TIE-DOWNS**

1. Required length of strengthening wall line (check box if tie-downs will be used on that line):
   - North Wall
   - East Wall
   - South Wall
   - West Wall

2. New Foundation Sill Anchorage to be used (check all that apply):
   - Bolt: Dotted
   - Type A Connector
   - Type B Connector
   - Type C Connector
   - Type D Connector
   - Type E Connector
   - Type F Connector

3. Floor Framing Connectors to Foundation Sill or Top Plate to be used (check all that apply):
   - Type A
   - Type B
   - Type C
   - Type D
   - Type E
   - Type F

4. Check the box if tie-downs and the supplemental technical notes will be used.

---

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

---
Prescriptive Design - Plan Set

**EARTHQUAKE RETROFIT SCHEDULE (S05 = 1.0 Seismic) ONE-STORY**

<table>
<thead>
<tr>
<th>Weight Category</th>
<th>Total Area in Square Feet</th>
<th>1'1'' - 2'0''</th>
<th>2'1'' - 4'0''</th>
<th>4'1'' - 6'0''</th>
<th>6'1'' - 7'0''</th>
<th>7'' Edge Nailing</th>
<th>Foundation Sill Anchors</th>
<th>Floor to Cripple Wall or Floor to Foundation Sill</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Without Tiedowns</td>
<td>Without Tiedowns</td>
<td>Without Tiedowns</td>
<td>Without Tiedowns</td>
<td>Type A</td>
<td>Type B</td>
<td>Type C</td>
</tr>
<tr>
<td><strong>1 Story</strong></td>
<td></td>
<td></td>
<td></td>
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<td></td>
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</tr>
<tr>
<td>up to 800</td>
<td></td>
<td>5.3''</td>
<td>5.3''</td>
<td>8.0''</td>
<td>5.3''</td>
<td>4</td>
<td>7</td>
<td>7</td>
</tr>
<tr>
<td>801 to 1000</td>
<td></td>
<td>6.7''</td>
<td>6.7''</td>
<td>8.0''</td>
<td>6.7''</td>
<td>5</td>
<td>8</td>
<td>8</td>
</tr>
<tr>
<td>1001 to 1200</td>
<td></td>
<td>6.7''</td>
<td>6.7''</td>
<td>9.3''</td>
<td>6.7''</td>
<td>6</td>
<td>9</td>
<td>10</td>
</tr>
<tr>
<td>1201 to 1500</td>
<td></td>
<td>8.0''</td>
<td>8.0''</td>
<td>10.7''</td>
<td>8.0''</td>
<td>7</td>
<td>11</td>
<td>12</td>
</tr>
<tr>
<td>1501 to 2000</td>
<td></td>
<td>9.3''</td>
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<td>13.3''</td>
<td>10.7''</td>
<td>8</td>
<td>14</td>
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<tr>
<td>2001 to 2500</td>
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<td>12.0''</td>
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<td>2501 to 3000</td>
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<td>14.7''</td>
<td>16.0''</td>
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<td><strong>Medium Construction</strong></td>
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<td>up to 800</td>
<td></td>
<td>5.3''</td>
<td>6.7''</td>
<td>8.0''</td>
<td>5.3''</td>
<td>4</td>
<td>8</td>
<td>8</td>
</tr>
<tr>
<td>801 to 1000</td>
<td></td>
<td>6.7''</td>
<td>6.7''</td>
<td>9.3''</td>
<td>6.7''</td>
<td>5</td>
<td>9</td>
<td>10</td>
</tr>
<tr>
<td>1001 to 1200</td>
<td></td>
<td>6.7''</td>
<td>8.0''</td>
<td>9.3''</td>
<td>8.0''</td>
<td>6</td>
<td>10</td>
<td>11</td>
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<tr>
<td>1201 to 1500</td>
<td></td>
<td>8.0''</td>
<td>8.0''</td>
<td>10.7''</td>
<td>8.0''</td>
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<tr>
<td>1501 to 2000</td>
<td></td>
<td>9.3''</td>
<td>10.7''</td>
<td>13.3''</td>
<td>10.7''</td>
<td>8</td>
<td>15</td>
<td>17</td>
</tr>
<tr>
<td>2001 to 2500</td>
<td></td>
<td>10.7''</td>
<td>12.0''</td>
<td>14.7''</td>
<td>12.0''</td>
<td>9</td>
<td>18</td>
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<tr>
<td>2501 to 3000</td>
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<td>13.3''</td>
<td>16.0''</td>
<td>12.0''</td>
<td>10</td>
<td>21</td>
<td>23</td>
</tr>
</tbody>
</table>
Prescriptive Design- Plan Set
Prescriptive Design- Plan Set
Prescriptive Design- Plan Set
Prescriptive Design- Plan Set
Prescriptive Design - Plan Set

EXAMPLE OF CALCULATING TOTAL STRENGTHENING REQUIREMENTS

1. Plan view shows a typical building foundation. Instructions are in italics and should not be included on the working drawings. Refer to Section 3 of the General Notes on Sheet 511.

2. Sample calculations for offset walls as shown above, (See Section 3 of the General Notes on Sheet 1A):

2a. Approximate length of strengthening required for segments "seg1" and "seg2" at the north wall line:
   seg1 = 20' - 1" - 16' - 10" = 3' 4"
   seg2 = 20' - 1" - 16' - 10" = 3' 4"

2b. Length of strengthening required for segments "seg3" and "seg4" at the west wall line:
   seg3 = 20' - 1" - 16' - 10" = 3' 4"
   seg4 = 20' - 1" - 16' - 10" = 3' 4"

3. Required length values are rounded up to the nearest 8" of stud spacing increments.

This example is for a 1411 square foot, 1 story home with a "Light" weight classification in a very high seismic area.

Using the Tu 3.1/3.2 One-Story Earthquake Strengthening Schedule from Sheet 511, the 2015-2016 Total Area now shows that the length of strengthening required is 3' 4" at each of the three 36" high cripple walls and 24' 0" (12' x 2') at the 24' 0" high cripple wall. The wall length of this home allows room length for use of wood structure panels without tie-downs. This example uses a 10" x 10" Anchor Bolt (1), required per wall line, and Type "E" Connectors (25 required per wall line).

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

EA Fema ATC

49
Crawlspace Dwelling
What’s Makes P-1100 Different?

- Assessment provisions
- Cripple walls up to 7’-0”
- Prescriptive plans for SDS of 1.0, 1.2, 1.5 (SDC B-E)
- One-story heavy clay tile
- Simplified engineering criteria
- Provisions to leverage prescriptive designs
Prescriptive Design Assumptions

- Prescriptive design will not cover all conditions
- Lots of assumptions were necessary - conservative
- Assumptions listed in commentary section C4.6
- Engineers can leverage prescriptive design and plan sets
Chapter 5
Living-Space Over Garage
Chapter 5 Living Space over Garage (LOG) Dwellings
Table 5.1-1  Eligibility Criteria for Use of Chapter 5

<table>
<thead>
<tr>
<th>Eligibility Criteria</th>
<th>Compliant</th>
<th>Non-Compliant</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. The dwelling is a detached one- or two-family dwelling or the dwelling is a unit</td>
<td></td>
<td></td>
</tr>
<tr>
<td>in a townhouse and assessment and retrofit will occur for each attached</td>
<td></td>
<td></td>
</tr>
<tr>
<td>townhouse unit (the full townhouse structure).</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. The dwelling is of wood light-frame construction and has a maximum of</td>
<td></td>
<td></td>
</tr>
<tr>
<td>story above the garage story.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. The dwelling is a living-space-over-garage dwelling and satisfies Paragraph 1.2.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. The dwelling perimeter (not including portions) supported on continuous</td>
<td></td>
<td></td>
</tr>
<tr>
<td>concrete foundations, concrete stem walls or thickened slab edge footings.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. The lower (garage) level floor is constructed of a conventionally reinforced</td>
<td></td>
<td></td>
</tr>
<tr>
<td>concrete slab on ground (or at least the portion of the floor that bounds the</td>
<td></td>
<td></td>
</tr>
<tr>
<td>garage).</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Can use Chapter 5
Table 5.1-2  Additional Eligibility Criteria for Use of Prescriptive Retrofit Provisions (Section 5.4)

<table>
<thead>
<tr>
<th>Scoping Statement</th>
<th>Compliant</th>
<th>Non-Compliant</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. The dwelling is located within Seismic Design Category (SDC) B through E as</td>
<td></td>
<td></td>
</tr>
<tr>
<td>noted in Section 1.6.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. The weight of roofing material shall not exceed 12 psf (measured on slope).</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. The weight of exterior wall finish shall not exceed 10 psf, except veneer</td>
<td></td>
<td></td>
</tr>
<tr>
<td>wainscots supported on concrete or masonry foundations that are permitted to</td>
<td></td>
<td></td>
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<tr>
<td>extend up to four feet above the top of foundation.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Weight of interior wall finish shall not exceed 8 psf, except that interior</td>
<td></td>
<td></td>
</tr>
<tr>
<td>wall surrounds not more than 4 inches thick in area are permitted to exceed this</td>
<td></td>
<td></td>
</tr>
<tr>
<td>weight.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Weight of floor finish shall not exceed 10 psf, except that heavier floor</td>
<td></td>
<td></td>
</tr>
<tr>
<td>finishes of up to 10 psf are accepted if limited to 25% of the total floor area</td>
<td></td>
<td></td>
</tr>
<tr>
<td>of each level.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Floors in each story are at the same level, excluding slab on ground portions.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. The building area (determined in Section 5.4.4) shall not exceed 2,000 square</td>
<td></td>
<td></td>
</tr>
<tr>
<td>feet.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. No part of the foundations is constructed of unreinforced masonry or stone.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9. Clear floor to ceiling heights at any occupied level do not exceed 9 feet.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10. The aspect ratio of the full depth of the dwelling at the lowest level to</td>
<td></td>
<td></td>
</tr>
<tr>
<td>width of the garage (plan length to plan width) shall not be greater than 2 1/2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>to 1. See commentary Section C5.4.4.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Prescriptive Design Appropriate
What Dwellings are Included?

GARAGE/UNOCCUPIED
What Dwellings are Included?
What Dwellings are Included?
Overarching Retrofit Design Criteria

- Prescriptive retrofit provisions derived from engineering criteria plus assumptions
- Collapses at the ground floor does pose a large LS risk
Retrofit Preview

Add vertical elements and load path connections

- Locations of element:
  - Front of garage
  - Back of garage
  - Side walls
Retrofit Preview

Types of elements:
- Steel retrofit column
- Proprietary shear wall
- Wood structural panel shear wall
Retrofit Preview

- Required strengthening limited to connections for load path into and out of elements,
Steel Retrofit Column

Note:
See A for items not shown or noted.

1 1/2"

4"

1 1/2"

WF Retrofit column per schedule

T-shaped $\frac{1}{2} \times 4\text{"} \text{grade 50 w/ (6) 3/4\" diam. bolts at Type C2 use (6) 1\" diam. bolts at Type C3}

(E) Floor sheathing

Collector beam

2x solid bilk to match depth of (6) floor joist ea. side of collector beam (4) total

2'-0" MAX.

WF Retrofit column per schedule

2x4 solid bilk at all panel edges (may be installed on edge or flat)

Diaphragm edge nailing, typ.

WF Retrofit column per schedule

NEW CANTILEVERED STEEL COLUMN NEAR GARAGE FRONT

NEW WOOD COLLECTOR AT STEEL COMPLUN

NEW CONCRETE FOUNDATION

CONN. AT TOP OF WF RETROFIT COLUMN
SEE DETAIL 2D7 FOR ALTERNATE CONNECTIONS

OCCUPIED SECOND STORY
Steel Retrofit Column

1. Footing at New Retrofit Column

WF Column, “hung” in place prior to pouring concrete footing.

#3 x 18” adhesive anchors at 18” O.C.

Where slope exceeds 1 vertical to 1 horizontal, contact registered design professional for guidance.

(4) #6 top at btm.

Spread footing.

Existing foundation varies (thickened slab edge footing shown).

NEW WOOD COLLECTOR AT STEEL COMPLUN

NEW CANTILEVERED STEEL COLUMN NEAR GARAGE FRONT

NEW CONCRETE FOUNDATION

Occu pied second story

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

1. Floor Connection at Proprietary Shear Wall
   Floor Framing Parallel to Garage Front

- 2x4 Blocking at all panel edges (may be installed flat or on edge)
- Connector per proprietary shear wall mfr
- (E) Floor ply
- Collector beam per 2"-
- Proprietary shear wall per retrofit schedule
- Shear cups at top of retrofit wall
- Anchor bolts each wall pier
- Tie-down each end each wall pier
- New concrete foundation
- Wall pier is too narrow to colnt for required length
- Occupied second story

Note:
See det. 2/- for items not shown or noted.
2x solid blk to match depth of (E) floor joist ea. side of collector beam (+ total)
A34 ea. end ea. block
Diaphragm. E.N. per retrofit schedule to blk, typ.
(2) Rows of diaphragm E.N. to collector beam, staggered

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

- Proprietary shear wall "hung" in place prior to pouring concrete curb
- Anchors per mfr
- Proprietary shear wall beyond
- Existing slab on grade

Concrete curb width/reinforcing per mfr
- #3 x 10" adhesive anchors, typ. at 18" O.C.
- #4 at 24" O.C. plus additional reinforcing ties per mfr for anchorage reinforcing

1. MINIMUM CLEARANCE PER MFR
2. Embed depth per mfr
3. Width per mfr
4. Depth

1. CONT. FOOTING/ GRADE BEAM AT PROPRIETARY
Chapter 6
Hillside Homes
Chapter 6 Hillside
Why Retrofit?
Overarching Retrofit Design Criteria

- No prescriptive solutions available
- Collapses at the crawlspace level does pose a large LS risk
Hillside Homes—What Included

- Anchorage to uphill foundation
- Crawlspace cripple walls
Seismic Issue
Prestandard-Eligibility for Use

<table>
<thead>
<tr>
<th>Eligibility Criteria</th>
<th>Compliant</th>
<th>Non-Compliant</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 The dwelling is two stories or less above the base-level diaphragm.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4 The dwelling is of wood light-frame construction.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5 Existing perimeter walls below the base-level diaphragm are of wood light-frame,</td>
<td></td>
<td></td>
</tr>
<tr>
<td>or a combination of wood light-frame and concrete construction.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6 Existing perimeter walls below the base-level diaphragm are supported on a</td>
<td></td>
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</tr>
<tr>
<td>continuous concrete foundation or will be retrofit to be supported on a continuous</td>
<td></td>
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</tr>
<tr>
<td>foundation. Continuous foundation includes continuous perimeter spread footing with</td>
<td></td>
<td></td>
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<tr>
<td>stem walls and continuous grade beams.</td>
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<td></td>
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<tr>
<td>7 The clear story is enclosed by a supporting stud wall does not exceed 75% of</td>
<td></td>
<td></td>
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<tr>
<td>the base-level diaphragm.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8 The site slope as measured along the sides of the dwelling, starting from the</td>
<td></td>
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</tr>
<tr>
<td>highest uphill point to the lowest downhill point exceeds 1 to 5 (vertical to</td>
<td></td>
<td></td>
</tr>
<tr>
<td>horizontal).</td>
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<td></td>
</tr>
<tr>
<td>9 The base-level diaphragm is of wood light-frame construction and is entirely</td>
<td></td>
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<tr>
<td>in one plane without vertical offsets, such as a step in the floor or split level.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10 The garage is detached from the dwelling.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11 The exterior framed walls immediately above the uphill foundation sit directly</td>
<td></td>
<td></td>
</tr>
<tr>
<td>above the uphill foundation for not less than 75% of the uphill foundation length.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12 No masonry chimney is attached to the side of the dwelling, extends through the</td>
<td></td>
<td></td>
</tr>
<tr>
<td>dwelling, or sits on any floor level of the dwelling.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Can use Chapter 6
Prestandard-Eligibility for Use

- One- or two-family detached
- Wood light frame
- Unoccupied area below lowest framed floor
Prestandard-Eligibility for Use

- Min. 7 foot downhill crawlspace wall height (Max. 16 feet)
- Grade slope exceeds 1:5
Prestandard-Eligibility for Use

- Perimeter crawlspace walls are wood or concrete stem walls
- Perimeter crawlspace walls are supported on a continuous concrete foundation or foundation will be added
Prestandard-Eligibility for Use

- Max. one or two stories above base-level diaphragm
- Base-level diaphragm is wood framed and in single vertical plane (no steps)
Prestandard-Eligibility for Use

- Exterior framed walls above the uphill foundation sit directly above foundation for at least 75% of uphill length
- No attached garage
- No masonry chimney
What Dwellings are Included?

INCLUDED

INCLUDED
What Dwellings are Included?

DEPENDS ON RETROFIT
What Dwellings are Included?

DEPENDS ON RETROFIT
Simplified Engineered Methodology

Vulnerability-based approach limited to:
- Primary anchors
- Secondary anchors
- Shear clips
- Cripple wall bracing, clips and anchor bolts
Simplified Engineered Methodology

Primary anchors
Primary Anchors
Simplified Engineered Methodology

Secondary anchors

1. Primary anchor concrete element
2. Secondary anchor connection to floor framing
3. Shear anchor
4. Cripple wall with plywood, anchor bolts, and shear clips
Secondary Anchors
Simplified Engineered Methodology

Shear anchors

1. Primary anchor concrete element
2. Secondary anchor connection to floor framing
3. Shear anchor
4. Cripple wall with plywood, anchor bolts, and shear clips

Shear Anchor
Chapter 7
Chimneys and Fireplace Surrounds
Chapter 6 Masonry Chimney’s and Fireplace Surrounds
# Prestandard-Eligibility for Use

## Table 7.1-1 Eligibility Criteria for Use of Prescriptive Chimney Retrofit Provisions (Section 7.4)

<table>
<thead>
<tr>
<th>Eligibility Criteria</th>
<th>Compliant</th>
<th>Non-Compliant</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 The dwelling is a detached one- or two-family dwelling or the dwelling is a unit in a townhouse.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 The dwelling is a wood light-frame dwelling that is three stories or less above grade plane.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3 The chimney is constructed of solid brick masonry.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4 The chimney’s largest plan dimension is not more than 40 inches.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5 The chimney is either an interior chimney, or an exterior chimney engaging only one exterior wall (i.e. not at the dwelling corner).</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
# Simplified Assessment Chimney

## Table 7.3-1: Simplified Structural Assessment for Masonry Chimneys

<table>
<thead>
<tr>
<th>Item</th>
<th>Assessment Statement</th>
<th>Compliance Step if True</th>
<th>Compliance Step if False</th>
<th>Compliance Step if Unknown</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Interior brick masonry chimneys of single-story dwellings that extend no more than twice the least plan dimension of the chimney above the roof, have no portion more than 6 feet tall that is not enclosed by full-height, finished walls on at least three faces, and whose greatest plan dimension does not exceed 40 inches.</td>
<td>Retrofit of chimney is not required.</td>
<td>Provide detailed assessment or retrofit of chimney.</td>
<td>Provide detailed assessment or retrofit of chimney.</td>
</tr>
<tr>
<td>2</td>
<td>Chimneys constructed on or after January 1, 1995.</td>
<td>Retrofit of chimney is not required.</td>
<td>Provide detailed assessment or retrofit of chimney.</td>
<td>Provide detailed assessment or retrofit of chimney.</td>
</tr>
</tbody>
</table>
## Simplified Assessment

### Fireplace Surround

<table>
<thead>
<tr>
<th>Item</th>
<th>Assessment Statement</th>
<th>Compliance Step if True</th>
<th>Compliance Step if False</th>
<th>Compliance step if Unknown</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Masonry surrounds that extend vertically less than 4 feet above the finished floor or horizontally less than 3 feet from the edge of the firebox, OR</td>
<td>Retrofit of masonry surround is not required.</td>
<td>Provide detailed assessment or retrofit of masonry surround.</td>
<td>Provide detailed assessment or retrofit of masonry surround.</td>
</tr>
<tr>
<td>2</td>
<td>Masonry surrounds constructed on or after January 1, 1995.</td>
<td>Retrofit of masonry surround is not required.</td>
<td>Provide detailed assessment or retrofit of masonry surround.</td>
<td>Provide detailed assessment or retrofit of masonry surround.</td>
</tr>
</tbody>
</table>
Chimney Retrofit Options
Exterior

Remove chimney to just above firebox and cap or reconstruct or…

- Chimney is rebuilt from the top of the firebox up
- Chimney is fully rebuilt with wood or steel studs
Chimney Retrofit Options
Exterior

...reuse firebox and install new flue or complete new factory insert
Chimney Retrofit Options

Interior

Remove chimney to just above roof, floor or ceiling and **cap** or...
Chimney Retrofit Options Interior

Reuse masonry firebox and install new flue or complete factory insert or reconstruct
Chimney Retrofit – Plan Set

Table 1: CRITERIA FOR USE OF THIS PLAN SET

<table>
<thead>
<tr>
<th>Chimney Location</th>
<th>Chimney Height</th>
<th>Unbraced Portion</th>
<th>Minimum Requirements for Stability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exterior</td>
<td>Any</td>
<td>9 inches</td>
<td>Conventional</td>
</tr>
<tr>
<td>Interior</td>
<td>Any</td>
<td>3 inches</td>
<td>Conventional</td>
</tr>
</tbody>
</table>

If you checked "Compliant" to each criteria above, proceed to Table 2. If you checked "Non-Compliant" to any of the above, the home is not eligible to apply the plan set. Consult with FEMA P1100 Prestandard.

Table 2: DETERMINATION OF RETROFIT SCOPE

<table>
<thead>
<tr>
<th>Chimney Location</th>
<th>Chimney Height</th>
<th>Unbraced Portion</th>
<th>Minimum Requirements for Stability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exterior</td>
<td>Any</td>
<td>1 story</td>
<td>Conventional</td>
</tr>
<tr>
<td>Interior</td>
<td>Any</td>
<td>1 story</td>
<td>Conventional</td>
</tr>
</tbody>
</table>

If you checked "Compliant" to each criteria above, proceed to Table 2. If you checked "Non-Compliant" to any of the above, the home is not eligible to apply the plan set. Consult with FEMA P1100 Prestandard.
Thank You
EXTRA SLIDES
Performance Objective

- Primary (Probability of Collapse)
  - Approximately 10%-20% under the Maximum Considered Earthquake

- Secondary:
  - Indicator of level of repair – Probability of exceeding 0.75% drift at 0.4 MCER
  - Indicator of safety for continued occupancy – Probability of exceeding 1.5% drift at 2/3 MCER
Appendix B

FEMA P-530 Presentation by Colin Blaney
FEMA P-530
Earthquake Safety at Home
Prepare, Protect, Survive, Respond, Recover and Repair

Colin Blaney S.E.
Project Technical Director
Audience

Written for homeowners, renters, families and anybody who travels to earthquake country

https://www.fema.gov/media-library/assets/documents/186094
Project Vision

Comprehensive national guide to earthquake safety at home
Project Vision

Include introduction on earthquake basics and region-specific facts
Project Vision

Identify and provide guidance for common structural (seismic) vulnerabilities
Project Vision

Address other home hazards
Project Vision

Include actionable advice on earthquake preparation, survival, response, recovery and repair.
Project Vision

Develop simple, easily digestible messages and powerful graphics
Project Vision

Create sections in a logical order but such that they could be distributed independently after disasters.
Primary Influencers

California Seismic Safety Commission
2005

FEMA 2005

Earthquake Safety Guide for Homeowners
FEMA P-530 / March 2020

Earthquake Safety at Home

Earthquake County Alliance
California Earthquake Authority
CalOES

USGS
California Earthquake Authority

FEMA P-530: Earthquake Safety at Home
Secondary Influencers
Earthquakes Across America

Map of Frequency of Damaging Earthquake Shaking in the United States

Source Information courtesy of the United States Geological Survey (USGS)

Expected number of occurrences of damaging earthquake shaking in 10,000 years.

ATC
FEMA P-530: Earthquake Safety at Home
Prepare

No cost, low cost, higher cost tasks

Plan essentials, post-event communication and reunification plan

Risk at Home!
There are many contents within a home that present a potentially significant risk to your safety during and following a major earthquake. The image below shows interior damage following the 1994 Northridge Earthquake that occurred in California.

Primary Communication Safety Contact
Pick a primary communication safety contact outside of the likely affected region of strong shaking.

Disaster Supplies
Essential disaster supplies should include key items such as water, food, medical supplies, safety items, personal and comfort items to ease recovery following a major disaster.
## Protect

### Earthquake Strengthening Projects

<table>
<thead>
<tr>
<th>Project Description</th>
<th>Page</th>
<th>Do it yourself</th>
<th>Contractor may be required</th>
<th>Design professional may be required</th>
<th>&quot;Off-the-shelf&quot; or prescriptive solutions available</th>
</tr>
</thead>
<tbody>
<tr>
<td>Restrain Free-Standing Water heater</td>
<td>28</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Anchor Elevated Decks, Porches, Trellises, and Carports</td>
<td>30</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td><strong>SMALL PROJECTS</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stabilize Weak Crinkle Walls and Anchor Floors</td>
<td>34</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Strengthen Improperly Nailed Plywood Siding</td>
<td>36</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td><strong>MEDIUM PROJECTS</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Strengthen Ridgepole to Roof Joists</td>
<td>38</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td><strong>LARGE PROJECTS</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Strengthen Hillside Home Anchorage to Foundations</td>
<td>40</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Strengthen Space-over-Garage Beams</td>
<td>42</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Brace Movable Structures Supported on Piers and Beams</td>
<td>44</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Strengthen Houses with Unreinforced Masonry Walls</td>
<td>46</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Strengthen Houses with Unreinforced Stone or Masonry Foundations</td>
<td>48</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Retrofit Masonry Chimneys</td>
<td>50</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>
Survive

Drop, Cover, and Hold On!
When the building begins to shake, the immediate actions to take for your safety are:

For earthquake protective actions for people with mobility disabilities, see page 57.

GRAPHIC COURTESY OF EARTHQUAKE COUNTRY ALLIANCE AND SOUTHERN CALIFORNIA EARTHQUAKE CENTER
HTTPS://WWW.SHAKEOUT.ORG

Gas Shut Off
Know where your gas shut off is located and how to turn it off. Turn valve clockwise from vertical (aligned with piping) to horizontal (perpendicular to piping) to shut off gas.

Move away from the exterior walls of your home to an open area to prevent building collapse, such as along a freestanding fence or masonry wall where debris will fall on you.
### Home Safety Checklist Summary

<table>
<thead>
<tr>
<th>Potentially Damaged Area or Condition</th>
<th>OK</th>
<th>Needs Attention</th>
<th>Resolved</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gas</td>
<td>62</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Propane or Other Fuel Tanks</td>
<td>62</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Masonry Chimneys</td>
<td>63</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Masonry Walls and Parapets</td>
<td>64</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Solar Panels</td>
<td>64</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Manufactured (Mobile) Homes</td>
<td>65</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Electrical</td>
<td>66</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Water Leaks</td>
<td>67</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Masonry Window Placement</td>
<td>68</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Racked and Feeding Wells, Gaps, Stack Doors and Windows</td>
<td>69</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sewer Lines</td>
<td>70</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Glass</td>
<td>70</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Water Heaters</td>
<td>71</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Small Appliances</td>
<td>71</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Furniture and Home Contents</td>
<td>72</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Wall Damage</strong></td>
<td>73</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Wall Damage

- **OK**
- **Needs Attention**
- **Resolved**

Check interior and exterior wall finish materials, such as sheetrock, gypsum board, and plaster, for cracks greater than 1/8 inch wide and several feet long. Check for bulging or bulging finish material, or detachment of finish material from the walls (finish material moves when pushed on or gaps between framing and finish material are detectable).

**If Occurs:**

Request a home safety evaluation (see page 74). Where none of the exterior doors are operable, do not occupy home until doors are made operable and the home safety evaluation has occurred. Where one or more doors remain operable, the home can be occupied, but damage and required repairs should be evaluated by an insurance professional or design professional (architect or engineer). This finish material damage is an indicator that repair of damage may require more than just patching and painting.
Repair and Recover

Hiring a Contractor
A contractor offering to provide services should be able to provide the firm’s contractor’s license number. You should be able to confirm that the license is valid and current online or by phone.

Hiring an Architectural or Engineering Firm
An architectural or engineering firm offering to provide services should be able to provide the license or registration number of the architect or engineer having oversight of the work. You should be able to confirm that the license is valid and current online or by phone. If you are not working directly with the person whose name appears on the registration, you are encouraged to contact them by phone to ensure that they are knowledgeable regarding the services being provided.

Building Permits
A building permit will need to be obtained for any repair work beyond painting and similar maintenance activities.
Acknowledgements

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Carol Singer- Carol Singer Design
Mark Benthien- Southern California Earthquake Center
Fred Turner- Alfred E. Alquist Seismic Safety Commission
Questions