OSSPAC MINUTES
May 12, 2020

The meeting was called to order at 9:00 PDT virtually

OSSPAC Members Present:
Jeffrey Soulages, Chair Public member
Tiffany Brown, Vice Chair Stakeholder: local government
Matt Crall State agency: DLCD
Rep. David Gomberg Legislative member
Dacia Grayber Stakeholder: first responder
Joe Karney Stakeholder: utilities
Christina LeClair State agency: ODOT
Ed MacMullan Stakeholder: banking
Bonnie Magura Stakeholder: schools
Walter McMonies Stakeholder: multi-family housing
Trent Nagele Stakeholder: structural engineer
Althea Rizzo State agency: OEM
Sen. Arnie Roblan Legislative member
Susan Romanski Public member
Aeron Teverbaugh State agency: DCBS
Adam Pushkas Stakeholder: building owners
Katie Young Public member

OSSPAC Members Absent:
Yumei Wang State agency: DOGAMI

Others in Attendance:
Mike Harryman State Resilience Officer
Tyler Janzen Chief of Staff, Rep. David Gomberg
Janiele Maffei Presenter, CEA Chief Mitigation Officer
Evan Reis Presenter, PEER/CEA Co-Project Director
Amelia Eveland Public

1. Administrative Matters

1a. Welcome & Introductions
Chair Jeff Soulages opened the meeting and led introductions. Thank you for everyone’s patience with the new digital meeting.

1b. Review and Approval of Minutes from previous meeting
Jeff Soulages asked if there were any changes to the March meeting minutes. After discussion without any proposed changes the minutes were approved.

1c. Events Notification
Due to COVID-19 most events have been canceled or postponed. May 18 is the 40\textsuperscript{th} anniversary of the Mt. St. Helens eruption. There are several virtual events commemorating the event.

1d. **New Business**
No new business.

1e. **Location for next OSSPAC Meeting**
Due to the ongoing COVID-19 restrictions the July OSSPAC meeting will be virtual. Jeff Soulages asked the committee if people wanted to still meet on July 14. There were no objections so the July 14 meeting will go forward. The invitation to members and interested parties will go out later this week. There will be virtual meetings for the rest of the year.

2. **Reports**

2a. **OEM**
OEM is fully involved with the COVID-19 response. Currently in planning for demobilization and reconfiguration of the COVID-19 response. Putting together the NEHRP grant proposal for next year with $2500 for OSSPAC.

2b. **DOGAMI**
DOGAMI is working with DLCD, the lead agency on the 2020 update of the State Natural Hazard Mitigation Plan, which is a five year update from the 2015 plan. Earthquake hazards and tsunami hazards chapters are updated. Success stories drafted on:
- State Resilience Officer development and activities.
- Seaside School District new hillside campus.
- Oregon State Universities new tsunami vertical evacuation building.
- Coastal Hospital Resilience Project.
- Portland metropolitan region’s use of DOGAMI’s earthquake impact analyses (DOGAMI reports: [https://www.oregoneology.org/pubs/ofr/p-O-18-02.htm](https://www.oregoneology.org/pubs/ofr/p-O-18-02.htm) and [https://www.oregoneology.org/pubs/ofr/p-O-20-01.htm](https://www.oregoneology.org/pubs/ofr/p-O-20-01.htm)).

Forthcoming publications include:
- Tsunami casualty pilot study in five communities.
- Coastal Hospital Resilience Project (final publication and project completed).

Projects likely to be funded by FEMA Fall 2020:
- Earthquake Impact Analysis for the Greater Eugene-Springfield Area, Oregon.
- Natural Hazard Risk Assessments for Benton, Marion, Morrow, and Washington Counties.
2c.
DLCD
Working on the COVID-19 response. There are some interesting parallels between the COVID-19 impact and recovery after a Cascadia event. The lessons learned from the COVID-19 response will be valuable to incorporate into the Cascadia plans.

2d.
ODOT
Spent most of the time working on COVID-19. Currently 40% of ODOT staff is working remotely and keeping everyone (employees and citizens) safe.

2e.
DCBS
DCBS has a new director, Andrew Stolfi, who is awaiting senate confirmation. Still in the search process for other open positions. Lots of COVID-19 work, including insurance, loans and other issues. Previous planning has been parallel and useful for this pandemic. Not sure where in the process the building codes staff opening process is. As with most things it has taken a back seat to the response. The staff of the building codes section is, to the best of their abilities, still doing their work.

2f.
SRO
Governor's disaster cabinet was activated in February for the COVID-19 response. Also activated the economic recovery council at the same time. Currently the response is in the continuity of government phase. Having the Incident Management Team (IMT) working the response at DPSST has been very beneficial. It showed that DPSST will work for the governor's Continuity of Operations Plan (COOP). All six of Oregon’s IMTs have been used for this response (fire marshal and forest service). There have been lots of lessons learned. Fire Marshal and Forest Service are working on COVID-19 and planning for fire season at the same time which is very impressive. There was discussion about what and where DPSST is: Department of Public Safety and Standards Training which is the training campus for all public safety officers located in SE Salem.

Contracting has been done for the creation of an after-action plan. The biggest difference between the COVID-19 disaster and a Cascadia disaster is that the infrastructure is not broken. Due to the long duration of the COVID-19 response it is expected that three to four after-action reports will be produced in the next 12-18 months.

All but three Oregon counties have applied to do the Phase I opening. The Governor has issued 19 executive orders regarding COVID and another is coming soon to consolidate the current orders.
Too early to talk about next session but budget for next year will be shocking and critical decisions need to be made. It is expected that there will be a one-day special session, possibly in June, for the legislature to work through a lot of the budget and COVID-19 issues that are pressing. The future of DOGAMI will also be on the agenda and it should be funded through the rest of the fiscal year. There was discussion about the new possible budget and the competition for dollars that will be coming. There was discussion about overwhelmed state agencies and the need to focus on resiliency for everyone in the State.


   Jeff Soulages asked who has specific comments and then the committee will discuss each. Susan Romanski had one on page 11, the paragraph on tsunami mapping inundation line. In the fifth sentence, wanted to make sure it is shown there were differing views on this issue. Discussion commenced regarding wording of the edit, and historical letter process, content, multiple discussion sessions about the letter and the future. Change was proposed (adding “by Chair and Vice-Chair”) to the sentence in question, voted on and approved. Ed MacMullan and Katie Young had previously pointed out editorial changes and Jeff went through them with the committee. A couple more were found and changed. The document was voted on to accept with all changes made and was approved. It will be given to OEM for posting on website and the resilience website. The SRO agreed to make hard copies to distribute to all Commission members.

4. **PEER/CEA: Quantifying the Performance of Retrofit of Cripple Walls and Sill Anchorage in Single Family Wood-frame Buildings: Evan Reis, Co-Project Director**

   The study created analytical models of various single family home types to test the damage various types of earthquakes can produce. California single family homes were the focus. The home types were chosen to match what modelers currently use to develop insurance rates. The home types were tested both in an unmodified state as well as retrofitted with bolting to the foundation and bracing of the cripple walls. The results showed that there was a significant difference in loss between unmodified and retrofitted single family homes. The final results of the study will be published within the month. The presentation is attached as a separate document as Appendix A.

   Althea Rizzo asked what it would take to do a similar study in Oregon. Evan Reis answered that a similar modeling processes should be used after identifying the common types of housing in Oregon including siding, foundation and interior finishes. A university should be engaged to define conditions and unknowns. This would allow the creation of a set of index buildings used and the definition of specific testing conditions for Oregon.

   There was discussion about how this study highlights the importance and benefits of retrofitting in a quantifiable way.
Trent Nagele asked what the feedback there has been from the insurance companies and the modelers. Evan Reis answered that they have had several meetings with modelers and they have accepted the data quality and results well. Most data the modelers get about this subject is very coarse. The modelers appear to be eager to modify their models with this new data.

5. **QuakeGrade and FEMA P-50: Janiele Maffei, CEA Chief Mitigation Officer**

FEMA P-50 is a checklist procedure to give homeowners information on the earthquake resilience of a home. QuakeGrade is an app that follows FEMA P-50 and gives homes an earthquake resilience “grade” and actionable items that can be done to improve the grade. An initial grade is given based on the location and soil type of the house site and then penalty points are applied based on house condition and features that lead to damage. QuakeGrade is currently only available in California to licensed contractors and engineers, but CEA is hoping to expand the user base soon. More information can be found at [www.quakegrade.com](http://www.quakegrade.com). The presentation is attached as a separate document as Appendix B.

Jeff Soulages asked if there is there a fee to use QuakeGrade. Janiele Maffei answered there is no charge for use. Jeff Soulages asked if Oregonians can use the current version of QuakeGrade. Janiele Maffei answered she was not sure and will look into it, noting that the answer could change. Jeff Soulages asked who is doing the training for QuakeGrade. Janiele Maffei answered that ATC is doing the training program.

Althea Rizzo asked how Oregon would gain a “train the trainer”. Janiele answered that because FEMA paid for the training itself is should be publicly available but there might be a cost for the trainer to come out and train. This answer was affirmed by Jeff.

Sen. Roblan asked if the app uses address information for current hazard information. Janiele Maffei answered yes and the information is available in the paper forms of FEMA P-50. QuakeGrade’s current default is California but Janiele will look into a possible expansion. Sen. Roblan asked if QuakeGrade covers the mandatory disclosure requirement. Janiele Maffei answered yes it does.

6. **Legislative Look-ahead**

Probably too early to do a look ahead due to the uncertain financial outlook.

7. **Public Comment**

No public comment.
At the end of the meeting it was suggested to do a summary or short report of the information presented in the last two meetings on single family homes as it might be helpful and useful. There was discussion on what policy changes or legislation could be proposed from these presentations. There was a call for commissioners to volunteer to put together a proposal for the meeting in July. Althea Rizzo, Jeff Soulages, Trent Nagele, Katie Young, Susan Romanski and Bonnie Magura volunteered. The meeting will be the second Tuesday in June and Jeff Soulages will send out a poll to find a good time.

The meeting was adjourned at 12:03 PM PDT.
Appendix A:
PEER/CEA: Quantifying the Performance of Retrofit of Cripple Walls and Sill Anchorage in Single Family Wood-frame Buildings
Comparative Study of PEER-CEA Woodframe Project Results with Catastrophe Loss Models

Evan Reis, SE

January 17, 2020
Objectives

- Review PEER-CEA analysis process with cat modelers
- Compare selected results with modelers
- Provide damage functions that can be incorporated into the models
- PEER objective NOT to determine insurance premium discounts
Cat modelers use “Primary” and “Secondary” modifiers to categorize buildings.

Typically these modifiers need to be observable by the underwriters’ agents.

“Hidden” characteristics that are not observable but affect vulnerability are not considered by modelers.

Cat modelers are protective of their IP.
Index buildings – Model Comparison

- The PEER-CEA team identified a subset of its index buildings that could be matched to the cat models
- We provided the modelers with four locations we specifically chose to compare results
- Each modeler ran the index buildings through their models
- Ground up loss at 250yr RP and Average Annual Loss were provided to PEER
# 48 Index Building compared to cat modelers

<table>
<thead>
<tr>
<th></th>
<th>1-Story</th>
<th>2-Story</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Existing</td>
<td>Retrofit</td>
</tr>
<tr>
<td></td>
<td>Raised</td>
<td>Stem Wall</td>
</tr>
<tr>
<td>Pre 1945</td>
<td>Wood</td>
<td></td>
</tr>
<tr>
<td>Lath + Plaster</td>
<td><img src="image1" alt="Diagram" /></td>
<td><img src="image2" alt="Diagram" /></td>
</tr>
<tr>
<td>Stucco</td>
<td><img src="image5" alt="Diagram" /></td>
<td><img src="image6" alt="Diagram" /></td>
</tr>
<tr>
<td>1945-55 Average</td>
<td><img src="image9" alt="Diagram" /></td>
<td><img src="image10" alt="Diagram" /></td>
</tr>
<tr>
<td>Wood</td>
<td><img src="image13" alt="Diagram" /></td>
<td><img src="image14" alt="Diagram" /></td>
</tr>
<tr>
<td>Gypsum</td>
<td><img src="image17" alt="Diagram" /></td>
<td><img src="image18" alt="Diagram" /></td>
</tr>
<tr>
<td>Stucco</td>
<td><img src="image21" alt="Diagram" /></td>
<td><img src="image22" alt="Diagram" /></td>
</tr>
</tbody>
</table>
Results Presentation

- PEER-CEA – Modeler results were presented to each modeler after initial run of 12 buildings
- Comments, questions and suggested revisions were proposed
- PEER team revised models based on comments and ran remaining 36 buildings
- Comparison of all 48 buildings were presented to modelers
Results: 1 story, wood

San Francisco
@250 yr

San Bernardino
@250 yr
Results: 1 story, stucco
Results: 2 story, wood

San Francisco @250 yr

San Bernardino @250 yr

2 story, <=1945, Wood, Raised, Average, Retrofit
2 story, <=1945, Wood, Raised, Average, Unretrofit
2 story, <=1945, Wood, Stem Wall, Average, Retrofit
2 story, <=1945, Wood, Stem Wall, Average, Unretrofit
2 story, 1945-1955, Wood, Raised, Average, Retrofit
2 story, 1945-1955, Wood, Raised, Average, Unretrofit
2 story, 1945-1955, Wood, Stem Wall, Average, Retrofit
2 story, 1945-1955, Wood, Stem Wall, Average, Unretrofit
2 story, 1955-1970, Wood, Stem Wall, Average, Retrofit
2 story, 1955-1970, Wood, Stem Wall, Average, Unretrofit

PEER, Modeler 1, Modeler 2
Results: 2 story, stucco

San Francisco @250 yr

San Bernardino @250 yr
One relatively clear result appears to be that the PEER-CEA models predict a greater difference in damage between the retrofitted and existing conditions than do the modelers.
Key Findings

- For unretrofitted raised (2-ft) cripple-wall conditions the PEER-CEA Project models consistently and significantly estimated more significant damage than the modelers.

- Both the Modelers and PEER-CEA Project predicted greater damage for the two-story, raised cripple-wall homes versus the one-story homes.

- For unretrofitted stem-wall conditions the Modelers consistently estimated lower damage than the PEER-CEA Project models.

- For retrofitted conditions, the PEER-CEA Project and Modelers’ results compared significantly better than unretrofitted conditions.

- The PEER-CEA Project results showed a consistent improvement in performance with age. The Modelers results showed consistent improvement from the 1945–1955 age range over the pre-1945 age range, but poorer performance from the 1955–1970 age range over the 1945–1955 age range.

- The PEER-CEA Project models show distinctly better performance for stucco over wood siding in the unretrofitted condition, unlike the Modelers.
Appendix B:
QuakeGrade and FEMA P-50
It could happen today.

FEMA P-50 and QuakeGrade™

Janiele Maffei
Chief Mitigation Officer
May 12, 2020
Earthquake coverage is excluded from homeowners insurance policy

However, insurance companies are required to offer a separate earthquake insurance policy at time of homeowner policy sale.
NORTHRIDGE EARTHQUAKE

January 17, 1994

Los Angeles Times

33 Die, Many Hurt in 6.6 Quake
L.A. Area Freeways Buckle, Buildings Topple

Sylmar Jolted by Ghosts of Horror Past

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CEA: PUBLICLY MANAGED AND PRIVATELY FINANCED
A not-for-profit provider of residential earthquake insurance

GOVERNING BOARD:
Governor
Insurance Commissioner
State Treasurer

Non Voting:
Assembly Speaker and Senate Rules Chair

PRIVATELY FINANCED:
1,115,040 Policyholders

MISSION:
Educate
Mitigate
Insure
CEA: PARTICIPATING INSURERS
Since 1990, CA State Law Requires Seller to Inform Buyer of Known Weaknesses

Real Estate agents required to give this book to a buyer of houses built before 1960
CA REAL ESTATE HAZARD REPORT
Required since 1990

Seller must provide hazard (fault rupture, liquefaction, landslide) information

But...

Can check “don’t know” about structural weaknesses
EARTHQUAKE WEAKNESSES

Some houses may have more than one weakness

- Crawlspace (Cripple wall)
- Living-space-over garage
- Hillside house
- Chimney
- Water Heater
Simplified Seismic Assessment of Detached, Single-Family, Wood-Frame Dwellings

FEMA P-50 / May 2012

FEMA

nehrp
SEISMIC PERFORMANCE GRADE
Combination of hazard and structural scores

Earthquake Hazard

Structural Weaknesses
SEISMIC PERFORMANCE GRADE

Seismic hazard score – location and soil type

Liquefaction Zone

Landslide Zone
## SEISMIC PERFORMANCE GRADE

**Structural score – house characteristics**

### House characteristics:
- Foundation
- Superstructure
- General Condition
- Non-structural, Age, and Size
- Local Site Conditions

Start with 100 and take off penalty points

### Foundation checklist from FEMA P-50

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Penalty</th>
</tr>
</thead>
</table>
| A-1  | The exterior footing is:  
| &nbsp;&nbsp;&nbsp;&nbsp;&nbsp;a. continuous concrete or reinforced masonry | 10 |
| &nbsp;&nbsp;&nbsp;&nbsp;&nbsp;b. other footing conditions | 4.2 |
| A-2  | The lowest floor of the dwelling is:  
| &nbsp;&nbsp;&nbsp;&nbsp;&nbsp;a. slab-on-grade | 10 |
| &nbsp;&nbsp;&nbsp;&nbsp;&nbsp;b. wood framed over crawl space or basement | 2.9 |
| &nbsp;&nbsp;&nbsp;&nbsp;&nbsp;c. combination of slab-on-grade and wood framed floor over crawl space or basement | 2.9 |
| A-3  | At the dwelling crawlspace or basement interior, the lowest floor framing is supported on:  
| &nbsp;&nbsp;&nbsp;&nbsp;&nbsp;a. continuous stem walls or a combination of continuous stem walls and beams on posts bearing on concrete footings/piers | 0 |
| &nbsp;&nbsp;&nbsp;&nbsp;&nbsp;b. beams on posts bearing on pier/pad footings | 0.8 |
| &nbsp;&nbsp;&nbsp;&nbsp;&nbsp;c. beams on posts supported directly on soil | 3.5 |
| &nbsp;&nbsp;&nbsp;&nbsp;&nbsp;d. not applicable: slab-on-grade | 0 |
| A-4  | For a foundation on a slope of 3 horizontal to 1 vertical or steeper, the top of the footing or foundation stem wall on which wall studs or posts are supported is:  
| &nbsp;&nbsp;&nbsp;&nbsp;&nbsp;a. sloped parallel to the ground slope | 3.7 |
| &nbsp;&nbsp;&nbsp;&nbsp;&nbsp;b. stepped | 1.8 |
| &nbsp;&nbsp;&nbsp;&nbsp;&nbsp;c. at a constant elevation with no steps | 0.6 |
| &nbsp;&nbsp;&nbsp;&nbsp;&nbsp;d. not applicable | 0 |

Total penalty = 0
# SEISMIC PERFORMANCE GRADE

Table 5. Seismic Performance Grade Based on Structural Score and Regional Seismic Hazard Score

<table>
<thead>
<tr>
<th>Seismic Hazard Score</th>
<th>0 - 1</th>
<th>2 - 3</th>
<th>4 - 5</th>
<th><strong>6 - 7</strong></th>
<th>8 - 10</th>
<th>11 - 12</th>
</tr>
</thead>
<tbody>
<tr>
<td>Structural Score</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.0 - 45.9</td>
<td>B-</td>
<td>C+</td>
<td>C</td>
<td>D</td>
<td>D-</td>
<td>D-</td>
</tr>
<tr>
<td>46.0 - 64.9</td>
<td>B+</td>
<td>B</td>
<td>C+</td>
<td>D+</td>
<td>D</td>
<td>D-</td>
</tr>
<tr>
<td>65.0 - 74.9</td>
<td>A-</td>
<td>B+</td>
<td>B</td>
<td>C</td>
<td>C-</td>
<td>D+</td>
</tr>
<tr>
<td><strong>75.0 - 84.9</strong></td>
<td>A-</td>
<td>A-</td>
<td>B+</td>
<td><strong>B-</strong></td>
<td>C</td>
<td>C</td>
</tr>
<tr>
<td>85.0 - 100</td>
<td>A</td>
<td>A</td>
<td>A-</td>
<td>B+</td>
<td>B</td>
<td>B-</td>
</tr>
</tbody>
</table>

G. Determination of Seismic Performance Grade

1. Structural Score
   a. Foundation (Section A)
   b. Superstructure Framing and Configuration (Section B)
   c. General Condition Assessment
   d. Nonstructural Elements, Age, and Size (Section D)
   e. Local Site Conditions (Section E)

   Total Penalty Points (a to e): [3.7] [7.3] [2.4] [5.0] [1.3] = **19.7**

2. Seismic Hazard Score (from Section F): [6]

3. Seismic Performance Grade (from Table 5)
   Note: insert this grade, including + or -, if applicable in box on page 1

4. Anticipated Seismic Performance
   Following anticipated seismic events.

   **Grade A, A-**: Excellent Performer
   (Potential minor structural and finish damage, earthquake damage ratio of 0%-10%, continued occupancy is likely)

   **Grade B, B+**: Good Performer
   (Potential moderate structural and finish damage, continued occupancy likely following minor structural repairs, earthquake damage ratio of 0%-50%, seismic retrofit measures are encouraged)

   **Grade C, C+**: Fair Performer
   (Potential moderate to major structural and finish damage, structural repairs may be required prior to continued occupancy, earthquake damage ratio of 10%-60%, seismic retrofit measures are strongly encouraged)

   **Grade D, D+**: Poor Performer
   (Potential severe structural and finish damage requiring significant repairs prior to re-occupancy, earthquake damage ratio of 20% – 100%, significant seismic retrofit measures are strongly encouraged)
# Seismic Performance Grade

Combination of hazard and structural scores

## Table 5. Seismic Performance Grade Based on Structural Score and Regional Seismic Hazard Score

<table>
<thead>
<tr>
<th>Seismic Hazard Score</th>
<th>0 - 1</th>
<th>2 - 3</th>
<th>4 - 5</th>
<th>6 - 7</th>
<th>8 - 10</th>
<th>11 - 12</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.0 - 45.9</td>
<td>B-</td>
<td>C+</td>
<td>C</td>
<td>D</td>
<td>D-</td>
<td>D-</td>
</tr>
<tr>
<td>46.0 - 64.9</td>
<td>B+</td>
<td>B</td>
<td>C+</td>
<td>D+</td>
<td>D</td>
<td>D-</td>
</tr>
<tr>
<td>65.0 - 74.9</td>
<td>A-</td>
<td>B+</td>
<td>B</td>
<td>C</td>
<td>C-</td>
<td>D+</td>
</tr>
<tr>
<td>75.0 - 84.9</td>
<td>A-</td>
<td>A-</td>
<td>B+</td>
<td>B-</td>
<td>C</td>
<td>C</td>
</tr>
<tr>
<td>85.0 - 100</td>
<td>A</td>
<td>A</td>
<td>A-</td>
<td>B+</td>
<td>B</td>
<td>B-</td>
</tr>
</tbody>
</table>

Seismic Performance Grade Table from FEMA P-50
SEISMIC PERFORMANCE GRADE

Improving the seismic performance grade through retrofit

H. Improving the Seismic Performance Grade

The Structural Score and Seismic Performance Grade may be altered as a result of seismic retrofit or by a more in-depth seismic evaluation of the dwelling and the site by a qualified licensed design professional. Guidance on these issues is provided in Chapter 8.

If seismic retrofit is being considered, the Structural Score could be increased (and the Seismic Performance Grade potentially increased) by retrofitting conditions that would allow the elimination or reduction in penalties, if any, for the following items:

<table>
<thead>
<tr>
<th>Item</th>
<th>Retrofit Description</th>
<th>Points (circle applicable number)</th>
<th>Priority Retrofit</th>
</tr>
</thead>
<tbody>
<tr>
<td>A-1</td>
<td>Provide continuous reinforced concrete foundation</td>
<td>4.2</td>
<td></td>
</tr>
<tr>
<td>A-3</td>
<td>Provide foundation pads under interior posts</td>
<td>1.4</td>
<td>Yes</td>
</tr>
<tr>
<td>A-5</td>
<td>Add anchor bolts or retrofit anchors</td>
<td>1.7 4.6 10.0 15.0</td>
<td>Yes</td>
</tr>
<tr>
<td>B-2</td>
<td>Add bracing walls at dwelling exterior</td>
<td>3.2</td>
<td></td>
</tr>
<tr>
<td>B-3</td>
<td>Install lighter roofing</td>
<td>1.6 3.5</td>
<td></td>
</tr>
<tr>
<td>B-4</td>
<td>Install plywood/OSB or steel frame at garage front</td>
<td>3.0</td>
<td>Yes</td>
</tr>
<tr>
<td>B-5</td>
<td>Change exterior wall finish</td>
<td>1.0 2.5 3.5</td>
<td></td>
</tr>
<tr>
<td>B-8</td>
<td>Improve bracing at perimeter walls below lowest floor</td>
<td>4.0 7.0 14.0</td>
<td>Yes</td>
</tr>
<tr>
<td>C-2</td>
<td>Repair cut structural framing</td>
<td>1.5</td>
<td></td>
</tr>
<tr>
<td>C-3</td>
<td>Repair deteriorated stucco</td>
<td>1.0 2.0</td>
<td></td>
</tr>
<tr>
<td>C-4</td>
<td>Repair deteriorated foundation</td>
<td>0.6 1.3</td>
<td></td>
</tr>
<tr>
<td>D-1</td>
<td>Strap exterior chimney to roof and floors</td>
<td>1.0</td>
<td></td>
</tr>
<tr>
<td>D-2</td>
<td>Provide bracing and flexible water and gas connections for water heater</td>
<td>1.0</td>
<td>Yes</td>
</tr>
<tr>
<td>D-3</td>
<td>Provide earthquake-activated gas shut-off valves</td>
<td>1.0</td>
<td>Yes</td>
</tr>
<tr>
<td>D-4</td>
<td>Anchor exterior stairs, deck and porch roof</td>
<td>1.0</td>
<td>Yes</td>
</tr>
<tr>
<td>E-3</td>
<td>Repair footing cracks</td>
<td>1.0 2.7</td>
<td></td>
</tr>
<tr>
<td>E-6</td>
<td>Improve rain water routing away from foundations</td>
<td>1.3 2.6</td>
<td>Yes</td>
</tr>
</tbody>
</table>

Priority Retrofits: For this dwelling, the Structural Score can be increased by as many as 3.3 “Priority Retrofit” points (insert sum of points for circled items in rows with “Yes” in Priority Retrofit column). This will increase Structural Score to 89.4 (Section G, Item 1f Structural Score plus “Priority” retrofit points). This will result in an improved Structural Grade of B+ (from Table 5, using improved Structural Score).

All Retrofits: For this dwelling, the Structural Score can be increased by as many as 7.5 retrofit points (insert sum of ALL points for circled items). This will increase the Structural Score to 93.6 (Section G, Item 1f structural score plus ALL points circled above). This will result in an improved Structural Grade of B+ (from Table 5, using improved Structural Score).

Improving the grade table from FEMA P-50
Crawlspace (Cripple Wall) Weakness
House shifted and dropped

2014 South Napa M6.0 Earthquake Damage to a House
EARTHQUAKE BRACE + BOLT
Typical crawlspace (cripple wall) retrofit

Crawlspace **Before** Retrofit

Crawlspace **After** Retrofit

- Plywood brace
- Foundation plate
FEMA P-50 App for computer, smartphones, and tablets
QuakeGrade™ currently requires a contractor or engineering license

- CEA currently requires that a QuakeGrade™ user have a contractor or engineering license
- CEA is working on adding architects and trained home inspectors
• CEA is working with the Applied Technology Council and the California Real Estate Inspection Association (CREIA) to train CA home inspectors in the use of FEMA P-50

• CEA plans to have an inspector directory on the website
QuakeGrade™ short report for CEA hazard reduction discount

- CEA Policyholders with a code-compliant retrofit can receive a discount of up to 25% with a signed Dwelling Retrofit Verification (DRV) Form
- QuakeGrade™ can produce a DRV short report
QuakeGrade™ is live at QuakeGrade.com
It could happen today.

EarthquakeAuthority.com