Quick Reconnaissance Report about Housing and Concrete Buildings from Field Investigations on September 10, 2014

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On Wednesday September 10, 2014 five EERI interns travelled to Napa, California to conduct reconnaissance on impacts from the August 24, 2014 South Napa earthquake. The goals of this post-earthquake reconnaissance trip were to (1) continue field tests of various EERI data collection, archiving, dissemination, and upload tools, (2) gather field data on three specific types of structures that had been under-documented by other reconnaissance efforts to date, and (3) prepare a synthesis report summarizing the principal findings of the reconnaissance effort.

To achieve their first goal, the interns used three different uploading tools developed by EERI, which allow users to easily submit photos with proper documentation. Two of these tools are intended for desktop use while the third can be used through a web-enabled phone. The first tool “EERI Photo Upload Tool (for non-geotagged photos)” is best for photos that are not geolocated. It allows to easily add up to 4 photos per location to a map by entering an address or just clicking on the location on a street map. The second tool "EERI Batch Photo Upload Tool (for geotagged photos)” is a quick way to batch upload geolocated photos (i.e. taken on your web-enabled phone) and easily batch assign captions, photographers and other metadata to each photo. Finally The Clearinghouse Fieldnotes Tool (for Geo-tagged Photos with Field Data Collection Tool) is a web-application that facilitates field data collection and photo documentation using a web-enabled phone. Find out more and watch the short instructional videos for each tool at: http://www.eqclearinghouse.org/2014-08-24-south-napa/how-to-contribute/

STRUCTURAL INVESTIGATIONS & DATA COLLECTION

During their field investigation, the interns investigated three types of structures: multi-residential soft story buildings, non-ductile concrete buildings, and residential housing near fault rupture. These structures are of particular importance since they are more susceptible to damage or are located in proximity of the epicenter and then subjected to near-fault ground motions characterized by a large high-energy pulse and by a fault-normal component of the motion more severe than the fault-parallel component. These three types of buildings had been under-documented by other reconnaissance efforts to date.

Each building was evaluated from the exterior and, if possible, from the interior to assess how it performed during the earthquake and to identify design shortcomings. The analysis had been conducted
taking advantage from the general evaluation form for all building types developed by Structural Engineers Association of California (SEAOC) Post-Disaster Performance Observation Committee (PDPOC) which conducts the Earthquake Performance Evaluation Program (EPEP). A copy of this form is included in the Appendix.
Multi-Residential Soft Story Buildings

The goal of this study of multi residential buildings was to look for damage that may have occurred to soft story apartments and condominiums. They represent some of the most susceptible structures to shaking damage as revealed by the many ordinances issued by cities threatened by earthquakes which addressed the identification, screening and retrofitting of soft-story multi-unit buildings vulnerable to collapse.

The approach used was based on a careful analysis of the soft story, aimed at identifying forerunners of the possible activation of the “Soft Story Mechanism” failure type which is characterized by the development of plastic hinges at column ends accompanied by excessive story drift. When possible, local people or owners were interviewed and helped in identifying anomalies in the building with respect to the pre-event configuration.

Three apartment building complexes were identified during the field investigation, and are described below. To access the photos for each building, go to http://www.eqclearinghouse.org/map/?eventid=29. On the right hand side, towards the bottom of the page in the text box under “enter a street address including city and country,” enter the address of each apartment complex, which is listed below. From there you will see multiple red points, each containing a photo of the location.

**Silverado Apartments**
Address: 1 Winding Way, Napa, USA

This was the best example of a soft story. There was parking underneath the housing, with slender square columns. There was some damage to the columns.
**Riverwood Apartments**  
Address: 2942 Soscol Ave., Napa, USA

This was not exactly a soft story. While it looks like a soft story, there are shearwalls running along the apartment complex in both directions (according to a worker at the apartment complex). There was no damage in this building.

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**Olive Tree Apartments**  
Address: 2020 Kathleen Dr., Napa USA

This was not a soft story either. There was parking underneath a 2nd story patio, which was attached to the apartments. There were large circular timber columns, which had large vertical cracks. No clear paint traces were seen inside cracks which would possibly indicate their existence prior to the earthquake.
Non Ductile Concrete Buildings

The purpose of this part of the reconnaissance effort was the evaluation of a list of pre-90’s buildings that were constructed prior to ductility requirements in the design codes.

24 buildings were identified as pre-1980 concrete buildings, based upon an earlier inventory study for the Concrete Coalition Project of EERI. The Concrete Coalition Project is a network comprised of individuals, governments, institutions, and agencies with an interest in assessing and mitigating the risk associated with dangerous non-ductile concrete buildings. The Concrete Coalition has taken initial steps in addressing this deficiency by using volunteers to conduct inventories in California communities. The building inventory in Napa had been compiled by engineer Chris Jonas sidewalk survey based on what he saw on microfiche of Sanborn maps, Google Earth, and personal knowledge.

The team of interns split in two groups to maximize the efficiency of the evaluation, each group had GPS enabled cameras able to take geo-tagged photos used to capture significant details of the damages observed. In addition to pictures, the PDPOC forms were filled and used as guide for the reconnaissance effort. These modules guided the identification of the building configuration and the evaluation of the performances drawn by the observation of the overall damage for the structural and nonstructural systems. Local people were interviewed as needed to help identify building framing systems (where not clear), damage, and building anomalies.

Based upon the intern field inspection, not all of the buildings on the concrete building list from Concrete Coalition were made out of concrete. Some were made out of timber. Of the ones that were made out of concrete, the newer buildings performed much better in the earthquake, as compared to the older buildings. The older buildings experienced more significant cracking, and some were still not open to public access. The concrete buildings observed are described below in more detail.

Library:

The library experienced limited cracking on the interior walls. In the children’s section of the library there was a crack in the floor. The library is open to the public.
Parking Structure on 5th and Main:

The parking structure is green tagged and has no damage.

Department of Corrections: 1125 3rd st

This building is not open to the public. There is cracking on the exterior (a) and nets have been installed to collect falling pieces of the exterior (b). There is some separation between the walls and ceiling (c).
Post Office: 1226 3rd st

The post office is open to the public (a). There is a crack on the exterior of the north wall (b). On the interior there are ceiling panels missing. The building consists of a masonry wall on the north end, and a timber roofing frame. There doesn’t appear to be any significant structural damage.
The uptown theater is not open to the public (a). There was some exterior damage to the building, particularly cracking. There are shear cracks near most windows (b). The cracks have been filled with some type of resin or epoxy (c). The building inspector tag noted that there was significant damage in the interior, specifically to the stage.
Napa Valley Register: 1615 2nd st.

This building is open and there were workers inside. This building consists of square concrete framing with masonry infill (a). There were lots of cracks on the columns (b), however the building owner stated that these existed before the earthquake.

Subway and Annette’s Chocolate: 1315 1st st, and 1321 1st st respectively

These two buildings looked newer and performed very well. We went into Annette’s chocolate (a-b) and talked to the building owner. He said that the building is made out of concrete, and that there was little to no damage. None of the windows broke, and according to the owner, many of the surrounding buildings had broken windows after the earthquake. We were not sure if the subway building is made out of concrete, but we believe it is. Regardless, there is no damage to this building (c).
595 Soscol Ave

Unclear if concrete structure. Looks to be timber, with masonry wall separation between adjacent building. There were only minor cracks observed in walls.

796 Soscol Ave

Timber, it performed well. There were only minor cracks observed in windows.
901 Main Street - Wells Fargo

Green tagged structure, seemed to be a masonry infill building (a). Had some minor masonry damage in corner (b).

2nd Street Garage

No visible damage. It is a concrete structure that seemed to perform very well.
931 Parking Mall

No visible damage from outside of this RC frame building. It appeared to be the same structure for multiple addresses. Mostly used for administrative offices. This building was yellow tagged.

1149 First Street

This was the same structure for multiple businesses. It was green tagged. The building type was unknown. No visible damage except for a wall crack inside the restroom.
**1116 1st Street**

This building was an RC frame (a). It was green tagged, though some ceiling tiles fell, and it suffered from 2.5 days of business interruption. Some minor cracking was observed on the exterior walls (b) and on the roof (c).

![Kohl's Storefront](image1)

![Interior Wall](image2)

![Roof Damage](image3)

**Pearl Street Garage**

This 3-story parking structure is reinforced Concrete. There was no visible damage and it is unknown if it has been retrofitted. It was being active used.

![Garage Entrance](image4)

![Garage Exterior](image5)
1300 Clay Street – AT&T

This building appeared to be a concrete frame, but it also looked like steel frame with cladding potentially. It seems to comprise of two different structures and there was a red tag on the west side of the building though there was not much visible damage except for some cracks near the columns.

Parking garage (Corner of Franklin and Clay)

This was a 4-story reinforced concrete parking garage. There was damage observed on the bearing plates of simply supported bridge connected to neighboring building. On the side of parking structure there was a popped out post-tensioning tendon. It was being actively used.
Merrill’s Prescriptions

Tag on front door labeled this as an “unreinforced masonry” although no masonry visible. It seemed to be an RC frame structure with damage mostly in interior of the buildings and shattered glass. It is unknown if it was retrofitted in the past.
Residential Housing near Fault Rupture

The purpose of this study was the evaluation of the residential housing performance subjected the near-fault ground motions located in the neighborhood of Browns Valley Elementary School near the north end of the observed fault rupture. The neighborhood primarily consisted of single-family wood-frame buildings. In particular, the data collected focused on the typical damage suffered by structures and infrastructures located near-by the fault rupture due to a more severe fault-normal component of the motion than the fault-parallel component and permanent ground displacements. Typical damage included collapsed chimneys, warped garage doors, and shifts in the sidewalk. Damage of houses varied. Many of these houses were yellow tagged and a few being red tagged but a specific trend explaining the differences could not be identified.

To access the photos for each building, go to [http://www.eqclearinghouse.org/map/?eventid=29](http://www.eqclearinghouse.org/map/?eventid=29). On the right hand side, towards the bottom of the page in the text box under “enter a street address including city and country,” enter the name “Browns Valley Elementary School”. From there you will see multiple red points in the neighborhood of the school, each containing a photo of the damaged houses.

Collapsed Chimneys
Damaged Roofs and front porch overhang
Shifted and displaced sidewalks (in the observed instances the ground failure didn’t reach the houses which didn’t show any visible damage)

Warped Garage Doors (out of plane) and cracks:
Appendix

SEAOC EARTHQUAKE PERFORMANCE EVALUATION PROGRAM
PHASE I GENERAL EVALUATION FORM FOR ALL BUILDING TYPES

Observer(s) Initials: __________________ Date: ______ Time: ______ Bldg. ID#: __________ Recommended for Phase II: ☐ Y ☐ N
Jurisdiction: __________________________ Address: __________________ Cross Street: __________ Name of Bldg: __________________

Source(s) or Folder With Additional Data: __________________________ Bldg Instrumented: ☐ Y ☐ N ☐ UNK

Building Size/Occupancy:
Number of Stories Above grade (including Mezzanines): ______ Mezzanine(s): ☐ Y ☐ N ☐ UNK No.___ No. of Basement Levels: ______
Occupancy Type: __________________________ Floors: ______ Additional Occupancy Type: __________________________ Floors: ______
No. of Housing Units in Residential Buildings: ______
Comments: ____________________________________________________

Building Framing Systems: Seismic Retrofit: ☐ Yes ☐ No ☐ UNK
Describe Subsystems if More
Than One Building System Present:
________________________________________________

Configuration Irregularities: Comments: _________________________
Plan Irregularities: Torsion: ☐ Y ☐ N ☐ UNK Vertical Irregularities: Soft Story/Open Front: ☐ Y ☐ N
☐ UNK
Reentrant Corners ☐ Y ☐ N ☐ UNK Weight (Mass) Irregularity: ☐ Y ☐ N ☐ UNK
Diaphragm Discontinuity: ☐ Y ☐ N ☐ UNK Vertical Geometric Irregularity (Setback): ☐ Y ☐ N ☐ UNK
Out-of-plane Offsets of Vertical Elements: ☐ Y ☐ N ☐ UNK In-Plane Discontinuity in Vertical Elements: ☐ Y ☐ N
☐ UNK
Nonparallel Systems: ☐ Y ☐ N ☐ UNK Weak Story or Discontinuity in Capacity: ☐ Y ☐ N ☐ UNK
Pounding With Adjacent Bldg(s): ☐ Y ☐ N ☐ UNK Discontinuous Walls above Columns: ☐ Y ☐ N ☐ UNK
Structural Separation Joints Between Portions of Building: ☐ Y Size: _____ ☐ N ☐ UNK

Overall Damage Classification for Entire Building - Structural and Nonstructural Systems:
☐ None ☐ Insignificant ☐ Minor ☐ Moderate ☐ Heavy ☐ Unknown (UNK)
☐ 0 1 2 3 4 5 6 7 8 9 10 Damage Rated on a scale of 0 to 10
Comments: __________________________________________________________________________

Safety Assessment Program (SAP, ATC 20) Placard Posted by Others: ☐ Red ☐ Yellow ☐ Green ☐ None
Yellow Restricted Access Description on the Placard: ______________________________________
________________________________________________

Foundation/Geotechnical Response: None Observed ☐
Exterior Non-building Damage: ☐ Y ☐ N ☐ UNK Lateral Ground Movement: ☐ Y ☐ N ☐ UNK Sloped Site: ☐ Yes
☐ No
Buckled Sidewalks: ☐ Y ☐ N ☐ UNK ☐ NA Ground Settlement: ☐ Y ☐ N ☐ UNK Inches:
Liquefaction Indicators: ☐ Y ☐ N ☐ UNK ☐ NA Separation Betw. Building & Ground: ☐ Y ☐ N ☐ UNK Inches: Vert ___ Hor ___
Foundation Cracks or Otherwise Damaged: ☐ None ☐ Insignificant ☐ Minor ☐ Moderate ☐ Heavy ☐ UNK
Slabs-on-Grade Cracked or Otherwise Damaged: ☐ None ☐ Insignificant ☐ Minor ☐ Moderate ☐ Heavy ☐ UNK ☐ NA
Comments: __________________________________________________________________________
________________________________________________________________________________
**General Damage Classifications:**

- **None**: No damage is visible, either structural or nonstructural.
- **Insignificant**: Damage requires no more than cosmetic repair. No structural repairs are necessary. For nonstructural elements this would include spackling partition cracks, picking up contents, putting back fallen ceiling tiles, and righting equipment.
- **Minor**: Minor repairable structural or nonstructural damage has occurred. The existing elements can be repaired in place without significant disruption to the majority of the occupants.
- **Moderate**: Moderate repairable structural damage has occurred. The existing structural elements can be repaired in place, without substantial demolition or replacement. For nonstructural elements this could include significant disruption and likely replacement of damaged partitions, ceilings, contents, or equipment.
- **Heavy**: Damage is so extensive that repair of elements is either not feasible or requires major demolition or replacement. For nonstructural elements this would include major or complete replacement of damaged partitions, ceilings, contents, or equipment.

Information Below For Entire Building: □ Y □ N  For Only Floor/Roof Level: ____________ Bldg. ID: ____________

See Supplemental Form □ Y □ N

**STRUCTURAL SUBSYSTEMS - DESCRIPTIONS & RESPONSE:**

Overall Structural Damage Classification: □ None □ Insignificant □ Minor □ Moderate □ Heavy □ UNK

<table>
<thead>
<tr>
<th>Component</th>
<th>Classification</th>
<th>Damage</th>
<th>Repair</th>
<th>% Complete</th>
<th>Building ID: ____________</th>
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<tbody>
<tr>
<td>Roof Collapse</td>
<td>□ Y □ N □ UNK</td>
<td>__</td>
<td>____</td>
<td>____</td>
<td>Bldg. ID: ____________</td>
</tr>
<tr>
<td>Floor Collapse</td>
<td>□ Y □ N □ UNK</td>
<td>__</td>
<td>____</td>
<td>____</td>
<td>Bldg. ID: ____________</td>
</tr>
<tr>
<td>Damage to Structural Members</td>
<td>□ Y □ N □ UNK</td>
<td>__</td>
<td>____</td>
<td>____</td>
<td>Bldg. ID: ____________</td>
</tr>
<tr>
<td>Building off Foundation</td>
<td>□ Y □ N □ UNK</td>
<td>__</td>
<td>____</td>
<td>____</td>
<td>Bldg. ID: ____________</td>
</tr>
<tr>
<td>Fire Damage</td>
<td>□ Y □ N □ UNK</td>
<td>__</td>
<td>____</td>
<td>____</td>
<td>Bldg. ID: ____________</td>
</tr>
<tr>
<td>Story Out-of-Plumb</td>
<td>□ Y □ N □ UNK</td>
<td>__</td>
<td>____</td>
<td>____</td>
<td>Bldg. ID: ____________</td>
</tr>
<tr>
<td>Parapet Damage</td>
<td>□ Y □ N □ UNK</td>
<td>__</td>
<td>____</td>
<td>____</td>
<td>Bldg. ID: ____________</td>
</tr>
<tr>
<td>Plumb:</td>
<td>□ Y □ N □ UNK</td>
<td>__</td>
<td>____</td>
<td>____</td>
<td>Bldg. ID: ____________</td>
</tr>
</tbody>
</table>

**Structural Subsystem Descriptions:**

_______________________________________________________________________________
_______________________________________________________________________________
_______________________________________________________________________________
_______________________________________________________________________________

**Failure Modes, Severity, Extent:**

_______________________________________________________________________________
_______________________________________________________________________________
_______________________________________________________________________________
_______________________________________________________________________________

**Deterioration:**

_______________________________________________________________________________
_______________________________________________________________________________
_______________________________________________________________________________
_______________________________________________________________________________

**Quality Issues in Original Design or Construction:**

_______________________________________________________________________________
_______________________________________________________________________________
_______________________________________________________________________________
_______________________________________________________________________________

**Alterations to Original Construction:**

_______________________________________________________________________________
_______________________________________________________________________________
_______________________________________________________________________________
_______________________________________________________________________________

**Additional Structural Comments:**

_______________________________________________________________________________
_______________________________________________________________________________
_______________________________________________________________________________
_______________________________________________________________________________
Sketches & Notes: (At a minimum, please sketch a plan showing the building footprint, configuration, locations of images. Where applicable, describe setbacks, penthouses, partial mezzanines, locations of instruments, and extent of damage. Where desired, describe key elevations and notable details).
Nonstructural Subsystems & Equipment - Descriptions & Response:

Exterior Cladding/Glazing Type(s): 

Partitions Type(s): 

Ceiling System Type(s): 

Other Systems: 

Overall Nonstructural Damage Classification: □ None □ Insignificant □ Minor □ Moderate □ Heavy □ UNK

Overall Nonstructural Response Description:

Cladding Separation or Damage: ___% of wall area □ UNK □ NA  
Roofing System Damage: □ Y □ N □ UNK  □ DS1 □ DS2  
Window System Damage: ___% of windows □ UNK □ NA  
Lights and Ceiling System Damage: □ None □ Insignificant □ Minor □ Moderate □ Heavy □ UNK □ NA □ DS1 □ DS2  
Partition Damage: □ None □ Insignificant □ Minor □ Moderate □ Heavy □ UNK □ NA □ DS1 □ DS2 □ DS3  
Water, Sprinkler Lines Damage: □ None □ Insignificant □ Minor □ Moderate □ Heavy □ UNK □ NA  
Gas System Damage: □ None □ Insignificant □ Minor □ Moderate □ Heavy □ UNK □ NA  
HVAC Duct Damage: □ None □ Insignificant □ Minor □ Moderate □ Heavy □ UNK □ NA  
Chimney Damage: □ None □ Insignificant □ Minor □ Moderate □ Heavy □ UNK □ NA

Overall Equipment Damage Classification: □ None □ Insignificant □ Minor □ Moderate □ Heavy □ UNK

Equipment Response:

Damage to Boilers, Chillers, Fans, Pumps, etc.: □ None □ Insignificant □ Minor □ Moderate □ Heavy □ UNK □ NA  
Damage to Tanks: □ None □ Insignificant □ Minor □ Moderate □ Heavy □ UNK □ NA  
Elevator Eqt. Damage (Car & Counterweight Rails, Cars, Penthouse Eqt.): □ None □ Insignificant □ Minor □ Moderate □ Heavy □ UNK □ NA  
Electrical Equipment Damage Including Backup Generators: □ None □ Insignificant □ Minor □ Moderate □ Heavy □ UNK □ NA

Contents – Descriptions & Response – Describe Unusual Contents:

Overall Contents Damage Classification: □ Insignificant □ Moderate □ Minor □ Heavy □ UNK

Hazardous Materials: □ Y □ N □ UNK

Casualties:

No. of Minor Injuries: ___ □ UNK  No. of Major Injuries: ___ □ UNK  No. of Fatalities: ___ □ UNK

Functions:

Percent Usable Space Immediately: ___% □ UNK  Percent Usable Space in 1-3 Days: ___% □ UNK  
Percent Usable Space within 1 Week: ___% □ UNK  Percent Usable Space within 1 Mo.: ___% □ UNK  
Percent Usable Space in 1-6 Months: ___% □ UNK  Time Until Full Occupancy: ___________ □ UNK □ NA

Shoring, Temporary Bracing, Barricading, Post-EQ Repairs – Observations Only:______________________________