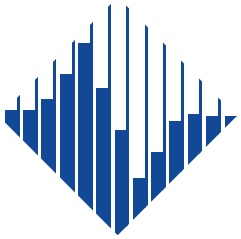

PACIFIC EARTHQUAKE ENGINEERING
RESEARCH CENTER

Earthquake Damage Workshop

A Report for the "Quantifying the Performance of Retrofit of Cripple Walls and Sill Anchorage in Single-Family Wood-Frame Buildings" Project

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PEER Report 2020/23
Pacific Earthquake Engineering Research Center
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ABSTRACT

This report is one of a series of reports documenting the methods and findings of a multi-year, multi-disciplinary project coordinated by the Pacific Earthquake Engineering Research Center (PEER and funded by the California Earthquake Authority (CEA). The overall project is titled "*Quantifying the Performance of Retrofit of Cripple Walls and Sill Anchorage in Single-Family Wood-Frame Buildings*," henceforth referred to as the "PEER–CEA Project."

The overall objective of the PEER–CEA Project is to provide scientifically based information (e.g., testing, analysis, and resulting loss models) that measure and assess the effectiveness of seismic retrofit to reduce the risk of damage and associated losses (repair costs) of wood-frame houses with cripple wall and sill anchorage deficiencies as well as retrofitted conditions that address those deficiencies. Tasks that support and inform the loss-modeling effort are: (1) collecting and summarizing existing information and results of previous research on the performance of wood-frame houses; (2) identifying construction features to characterize alternative variants of wood-frame houses; (3) characterizing earthquake hazard and ground motions at representative sites in California; (4) developing cyclic loading protocols and conducting laboratory tests of cripple wall panels, wood-frame wall subassemblies, and sill anchorages to measure and document their response (strength and stiffness) under cyclic loading; and (5) the computer modeling, simulations, and the development of loss models as informed by a workshop with claims adjustors.

This report is a product of Working Group 6 (WG6): Interaction with Claims Adjustors & Catastrophe Modelers and focuses on a damage workshop effort undertaken to provide repair estimates of representative damaged single-family wood-frame case study buildings to compare the differences in costs between houses with and without retrofits to cripple walls and sill anchorage. At the request of the CEA, 11 experienced claims adjustors from insurance companies volunteered to provide the estimates. Electronic cost estimation files for each case study building were developed by the PEER–CEA Project Team using the Verisk Xactware Xactimate X1 platform and provided to the claims adjustors to complete their estimates. These adjustor estimates served as the baseline for comparison against the *FEMA P-58* [FEMA 2012] methodology used on the project for loss estimation. The term "damage workshop effort" is used to emphasize that the scope of work included not just a successful workshop meeting, but the broader development of a damage description package describing case studies and associated Xactimate descriptions before the workshop meeting and revisions after it, two rounds of estimates and survey question responses by adjustors, interpretation and clarification of the estimates for consistency, and synthesizing of estimate findings and survey responses into conclusions and recommendations.

Three building types were investigated, each with an unretrofitted and a retrofitted condition. These were then assessed at four levels of damage, resulting in a total of 24 potential scenarios. Because of similarities, only 17 scenarios needed unique Xactimate estimates. Each scenario was typically estimated by three to five adjustors, resulting in a final total of 74 different estimates.

Conclusions

- ***We need to be speaking the same language*:** The damage workshop reinforced the observation that cost estimates used by design teams, claims adjustor

estimates, loss estimates such as those from HAZUS [FEMA 2003] or *FEMA P-58*, and insurance catastrophe modeler estimates are all done by different people with different perspectives using different processes and terminology to produce different products. When these different disciplines come together, if representatives from one discipline do not fully understand the assumptions made by the other disciplines, they will not have consistent results or a clear understanding of all facets of the process. The difference in the adjustor estimates before and after the workshop is evidence of this. Revisions in estimating instructions led to meaningful changes in the results. It was also a surprise that some basic assumptions used by some disciplines, such as the use of escalation to adjust estimates to the midpoint of construction, are not part of the practice or even terms used by other disciplines. It is important to try to speak the same language in order to better understand one another's work.

- ***Detailed estimating assumptions are necessary*:** It was well understood before the damage workshop effort that detailed estimating assumptions would be required to define what to include and what not to include in the estimates. Nonetheless, the process still revealed a significant number of refinements and instructions that were needed to achieve improved clarity and consistency. Examples included: (1) when to replace building paper after damaged stucco is demolished and repaired; (2) the extent of repairs to apply for different levels of damaged and racked cripple walls; and (3) how to handle contingencies, utility costs, and additional living expenses during repair work. These were implemented in revised estimates.
- ***Estimate results from adjustors are similar to results using the FEMA P-58 methodology*:** Even though the methods and tools used by claims adjustors and *FEMA P-58* are different, and even though there are cost categories missing in *FEMA P-58* that are used by claims adjustors, the bottom line results at both the building level and at key component levels, such as the cripple wall and foundation, were similar for both methods. As a result, the Project Team concluded that general revisions to the *FEMA P-58* results were not needed beyond adjustments made following careful review of existing *FEMA P-58* functions prior to workshop assessments.
- ***Some key assumptions must be recognized to make comparisons*:** Using the damage workshop results for comparisons with estimates from loss functions used by insurance catastrophe modelers requires recognizing some key assumptions and limitations. These include the following:
    - Demand surge caused by increased labor and material pricing after a major earthquake was deliberately not included in the adjustor estimates because it is understood that catastrophe modelers address demand surge separately from the basic damage functions.
    - There are special features that will increase costs and that are not common in individual buildings but are represented by a portion of the buildings in the community. Adjustors were directed to exclude such features in their estimates for consistency and simplicity. These include buildings with high-

end finishes; concrete foundation damage; sidewalk and driveway damage; possible building code upgrades required by local building officials; damage from liquefaction, lateral spreading, and fault rupture; additional special inspection and testing; legal fees; hazardous materials besides lead paint and asbestos, like mold, soil contamination, and radon; premiums for historic buildings; ADA upgrade costs; increased costs if access and utilities at the site are compromised; construction management costs; and financing costs. If these were included, the median repair cost would likely rise as would the upper end of the estimated range.

- Adjustors reported that abatement of lead paint and asbestos in California can add substantial cost. This had not been appreciated by the Project Team before the workshop. Estimating assumptions were refined as a result. Further study of these costs and the attributes that influence them is needed.
- Costs for repairing brittle finishes (like tile) can be a substantial portion of the repair cost because it is difficult to match original tile. This typically leads many adjustors to recommend full replacement of tile in the room, even if the extent of damage is small. This had not been fully appreciated by the Project Team before the workshop.
- Insurance policy rules, including deductibles, caps, and depreciation assumptions, can impact the amount paid out. Thus, comparing the cost of the total damage with insurance payouts can be difficult and inconsistent.

Recommendations

- The project approach using the *FEMA P-58* methodology should continue with only minor refinements needed on some specific individual components and should address items not well covered by *FEMA P-58*, such as lath and plaster repairs.
- Cost estimates for earthquake damage repair need to be done with very clear and very detailed descriptions of the assumptions that were made, and the results need to be viewed in the context and limitations of those assumptions.
- Because of the significant and increasing cost of lead paint and asbestos abatement in earthquake damage repair in California, more in-depth study of this issue is needed to better understand the cost and policy implications.
- The CEA EDA-02 *General Guidelines for the Assessment and Repair of Earthquake Damage in Residential Construction* [CUREE 2010] provide guidance to claims adjustors on common types of earthquake damage that occur in wood-frame residential construction, how to assess the significance of the damage, and what techniques should be used to repair the damage. The guidelines are a valuable tool used by claims adjustors, but updates are needed, particularly for heavily damaged buildings requiring structural repairs. The CEA has funded a project managed by the Applied Technology Council, which developed updated general guidelines and engineering guidelines: CEA-EDA-01 [CEA 2020a] and CEA-EDA-02 [CEA 2020b]. These documents should be

promoted within the insurance and design communities to improve understanding and consistency of repair assessment and estimating.

- Greater understanding is needed of the issues that trigger moving from (1) repairing damaged cripple walls, to (2) jacking and repairing the wall to, (3) jacking and replacing the wall, to (4) full building replacement. There was no clear consensus between adjustors on what approach to take for heavily damaged conditions. They typically defer to structural engineering advisors; however, there is also no clear consensus among structural engineers. More study is needed.
- Insurance claim payouts remain a highly desirable resource for the engineering and scientific community to improve its analytical loss estimating research, but proprietary considerations limit the availability of the information. Sharing this valuable information, particularly at the detailed component level, as well as detailed inventory data, while finding ways to preserve anonymity and proprietary advantage, would be extremely beneficial to the effort of improving insurance pricing for seismic retrofitting of components such as cripple walls and sill anchorage. For example, insurers could aggregate anonymous claim payout information in the cost estimate categories used in the damage workshop effort. A second step would be to include building characteristics together with the claims payout data but perhaps stripped of identifiable locations.

ACKNOWLEDGMENT AND DISCLAIMER

ACKNOWLEDGMENT

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DISCLAIMER

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1 Introduction

1.1 PURPOSE

This report is one of a series of reports documenting the methods and findings of a multi-year, multi-disciplinary project coordinated by the Pacific Earthquake Engineering Research Center (PEER) and funded by the California Earthquake Authority (CEA). The overall project is titled "*Quantifying the Performance of Retrofit of Cripple Walls and Sill Anchorage in Single-Family Wood-Frame Buildings*," henceforth referred to as the "PEER–CEA Project."

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Within the PEER–CEA Project, detailed work was conducted by seven Working Groups, each addressing a particular area of study and expertise, and collaborating with the other Working Groups. The seven Working Groups are as follows:

Working Group 1: Resources Review

Working Group 2: Index Buildings

Working Group 3: Ground-Motion Selection and Loading Protocol

Working Group 4: Testing

Working Group 5: Analytical Modeling

Working Group 6: Interaction with Claims Adjustors and Catastrophe Modelers

Working Group 7: Reporting

This report is a product of the Working Group denoted in bolded text above.

This report documents the scope and results of a damage workshop effort conducted by members of WG6. The goal of the damage workshop was to provide estimates of the cost of repairing earthquake damaged single-family wood-frame homes and to compare the differences in costs between houses with and without retrofits to cripple walls and sill anchorage. Ultimately, the purpose of the workshop was to obtain new cost information to improve the information already available, to selectively estimate damage state repair packages of interest, and to obtain input on the assumptions and choices made by practicing claims adjustors when assessing damage. This information was used by other Project Team members and working groups to refine damage functions relating the cost of earthquake damage with ground shaking based on the methodology in *FEMA P-58*-1, *Seismic Performance Assessment of Buildings, Volume 1 –The Methodology* [FEMA 2012].

1.2 SCOPE

For scope of the damage workshop effort included the following tasks.

- A preliminary document, entitled *Earthquake Damage Workshop: Damage Description Package*, was developed by WG6 members. It is reproduced in Appendix A. The *Damage Description Package* provided a set of case study examples of damaged buildings, accompanied by estimated repair costs and a detailed list of estimating assumptions. It also included a list of survey questions to be answered by estimators; see Appendix B.
- At the request of the CEA, experienced claims adjustors from insurance companies volunteered to provide estimates of the case study buildings. Those that participated are listed in Appendix F.
- An initial *Damage Description Package* was provided to all adjustors for their review.
- A conference call was held to introduce the project's overall goals and to answer any questions from adjustors prior to completing their initial round of estimates.
- Each adjustor prepared estimates on a subset of the total set of case studies. The Verisk Xactware Xactimate X1 platform was employed, which is commonly used in the insurance industry. Note: PEER, the CEA, the Project Team, and the authors of this report provide no endorsement of this platform.
- The adjustor estimates were received and reviewed for areas of improvement and for issues to be discussed as a group; see Appendix C for answers to initial survey questions.
- An online workshop was held to discuss issues identified in the first round of estimates and answers by adjustors to the survey questions. Standards of practice used by claims adjustors were discussed. Consensus was reached on introducing certain refinements in the estimating assumptions in the *Damage Description Package*. For ease of use to the readers, revisions were made in a track change format. The final *Damage Description Package* is reproduced in Appendix A, with the track changes preserved. Survey questions were updated.

- Adjustors revised their estimates based on the changes agreed upon in the online workshop and submitted their final estimates and answers to survey questions for review; see Appendix D for the final survey questions, with answers in Appendix E.
- Review of the estimates indicated that not all instructions in the *Damage Description Package* were followed. For improved consistency, the final estimates were filtered and organized for data comparison.

Adjustors provided the full Xactimate estimate results, which include a line-by-line level of detail on how the estimate was completed. The collective body of the estimates runs to several thousand pages. By prior agreement, estimating information has been kept confidential, and only results are shown. Similarly, the survey respondent answers have been kept anonymous.

1.3 AUDIENCE

The results from the workshop effort were used by the PEER–CEA Project Team to refine the project loss estimates. Results and conclusions will be of value to: (a) the CEA; (b) catastrophe modelers for insurers and insurance companies; (c) practicing claims adjusters; (d) design team professionals involved in damage assessment and repair; (e) estimators and design professionals using the *FEMA P-58* methodology; and (f) researchers involved in loss estimation.

1.4 TYPES OF ESTIMATES

There are at least four distinct types of cost estimates relevant to the damage workshop effort and the PEER–CEA Project in general.

1. Cost estimates used by design teams;
2. Claims adjustor estimates;
3. *FEMA P-58* loss estimates; and
4. Insurance catastrophe modeler damage functions.

A significant discovery from the damage workshop is that linking these four types of estimates and their associated groups is not straightforward. The perspectives, procedures, and products are different. Terminology is not consistent, and assumptions vary. At times, it is as if they were speaking a different language.

A more detailed description of the differences highlighted in these four kinds of estimates is provided below:

1. ***Design team cost estimates*:** These are cost estimates for projects in design and are a prediction of what the owner will eventually pay. Drawings and specifications are produced in various stages, beginning with the concept level, and then moving on to schematic design, design development, construction documents (or "working drawings"), and bid documents. Assumptions must be made at each stage of the process about what is not yet shown; factors such as escalation to the mid-point of construction need to be included, as do contingencies. Direct costs or "hard costs" paid to the general contractor are often termed "above the line." The estimates include a variety of indirect

"below the line" or "soft costs" to cover other items, such as contingencies for changes or unknown conditions, utilities, design fees, plan check and permitting costs, and abatement costs. There are usually exclusions based on owner direction or standard estimating practice, but they can represent real costs that need to be accounted for in order to have a full picture of what the owner will ultimately pay, including items such as temporary moving fees, financing costs, and legal fees.

2. ***Claims adjustor estimates*:** For these estimates, the building exists, damage has already occurred, and it can be reviewed in great detail. There is damage that is visually observable, and sometimes there can be additional structural damage under finishes that requires further investigation or assumptions that need to be made. Adjustor estimates usually include the full or "ground up" cost that would be required. Typically, the actual payout to the owner is determined separately by the underwriter and is based on policy conditions, including deductibles, caps, and exclusions. Distinctions are made between salvage (the item can be reused as is), repair (the damaged item is repaired to its pre-earthquake state using similar nonstructural finishes, materials, and approaches), and replacement (the damaged element is replaced or rebuilt with new materials). A distinction is also typically made between replacement cost (the cost to replace the damaged items with a new version) and actual cash value (where depreciation reduces the value of the item to reflect its age and market value). Typically, adjustors do not include a factor for inflation as is done in design team cost estimates. Instead, the adjustor's estimate is updated as additional information is collected or owners incur costs, and multiple updates are common on heavily damaged buildings. Sometimes, engineers and other design professionals assist in determining the scope of repairs and thus the overall cost.

   Insurance companies have internal guidance on the approaches and assumptions to be used by their adjustors, in addition to following the terms of the insurance policy. EDA-02, *General Guidelines for the Assessment and Repair of Earthquake Damage in Residential Woodframe Buildings* [CUREE 2010] has provided helpful guidance on assessing earthquake damage and determining the extent of repair needed. In addition to funding development of the CUREE Guidelines, the CEA has recently funded an Applied Technology Council project to update the General Guidelines and add Engineering Guidelines. The CEA recommends that the resulting reports, *CEA-EDA-01* [CEA 2020a] and *CEA-EDA-02* [CEA 2020b], be used by participating insurers, and their consultants for the assessment and repair of earthquake damage.

   Adjustors typically develop quite detailed estimates, and software now exists to automate and streamline the process. For this PEER–CEA Project, the Xactimate platform was used. The cost categories and features of the Xactimate platform can influence the techniques and assumptions used by the adjustor and how the estimate is presented.

3. ***FEMA P-58* [2012] *loss estimates*:** Loss estimation techniques have been developed to predict damage to buildings given different levels of earthquake shaking. Such studies can be for an individual building or on a regional scale, where results from all the buildings in the region are aggregated. Standardized archetypes are used to represent the building. Fragility curves relate shaking intensity to damage states for the

archetypes. Fragility curves can be for damage to the whole building or for damage specific to individual components within the building. Repair and replacement costs are related to damage states. Ground motion data and shaking intensity at the building site are then combined, with the fragility curves and cost data used to estimate the extent of the damage and the relevant repair costs.

Common programs and methods for loss estimation include HAZUS [FEMA 2003], an open-source software program developed by the Federal Emergency Management Agency (FEMA) or SP3 (a commercial program that implements the *FEMA P-58* methodology). *FEMA P-58* was used for this PEER–CEA Project by other working groups (with some modifications). Both programs have strengths and weaknesses: (1) *FEMA P-58* has component-based fragility curves and cost data, unlike HAZUS, which has general fragility curves for the building as a whole; (2) *FEMA P-58*'s primary focus is on post-1950 engineered buildings and not the single-family wood-frame houses that are the subject of the PEER–CEA Project; (3) the component and damage categories available in FEMA P-58 are much more limited than the detail that is available in Xactimate; and (4) *FEMA P-58* is able to conduct many analysis runs that provide a deeper understanding of parameter sensitivity and dispersion.

4. ***Insurance catastrophe modeler damage functions*:** Catastrophe modelers use functions that relate ground shaking measures (such as intensity or spectral acceleration) to damage. These functions are based on past claims and modeler judgment. The past is used to predict the future. Damage functions are proprietary and specific to each catastrophe modeling company. The term "damage" is used by insurers to represent the overall cost of repair, whereas "loss" is a term insurers use to represent how much the insurer loses through the payout, which implicitly includes the impact of deductibles and other policy limits. A distinction is often made between fragility functions (which relate shaking with a physical description of building or component damage) and damage functions (which relate shaking and the dollar value of damage). The ultimate goal of the PEER–CEA Project is to provide catastrophe modelers with improved damage functions for older existing and retrofit houses with cripple walls and stem walls. Typically, even though insurers and modelers may have a large quantity of claims that represent real payouts to owners, the details of the damage are not typically known by the modeler. Damage functions can vary by building attributes, but they typically relate to the building as a whole. Thus, it is difficult to compare costs at the component level with other types of estimates, such as those noted above, where component-level information is available.

2 Damage Workshop

2.1 WORKSHOP DESCRIPTION

As part of the PEER–CEA Project, a diverse group of experienced claims adjustors participated in an earthquake damage workshop effort to provide estimates of the cost of repairing earthquake damaged single-family wood-frame homes in order to compare the differences in costs between houses with and without retrofits to cripple walls and sill anchorage. Goals of the workshop effort included obtaining new cost information to improve the information already available, estimating a set of damage state repair packages of interest, and obtaining input on the assumptions and choices practicing adjustors make when assessing damage.

Working Group 6 conducted a short webinar to explain the process to the volunteer adjustors and answer any questions they had before making their initial estimates. The initial estimates were synthesized into a summary document identifying issues for discussion. These were discussed during an online half-day workshop. Key issues were resolved at the workshop, with any necessary clarifications on estimate assumptions and approach. Adjustors then updated their estimates based on feedback from the workshop. The results are summarized in this report and have been used by the PEER–CEA Project Team to refine the project loss estimates.

This chapter covers the following:

- Terminology used in the damage workshop effort.
- Descriptions of the three case study buildings, in both their unretrofitted and retrofitted conditions.
- Damage states that applied to the case study buildings.
- The various scenarios that combine the building type, retrofit condition, and damage state.
- Initial estimating assumptions given to the adjustors.
- Cost categories used to group the estimate information for ease of understanding.
- Issues and decisions made at the online workshop using the survey workshop questions.
- The procedure used to post-process the estimates received from adjustors for consistency.

2.2 TERMINOLOGY

For the damage workshop effort, the following terms and definitions are used. These definitions were included in the *Damage Description Package*. Some additional terms that were used by participants in the workshop have also been added.

- ***Pre-earthquake state*:** The condition of the building before the earthquake. In the workshop effort, it was assumed that the building did not have any pre-existing earthquake damage from previous earthquakes, nor did it have any significant damage for any other reasons (such as ground settlement or water intrusion). Typical wear and tear for a reasonably well-maintained building of the case study's vintage was assumed.
- ***Unretrofitted*:** The building in its original state without any seismic retrofitting to the cripple wall or sill anchorage.
- ***Retrofitted*:** The original building plus the addition of a cripple wall and sill anchorage retrofit.
- ***Repair*:** "Repair" means returning the home to its pre-earthquake state using similar nonstructural finishes, materials, and approach. This may include patching or replacement in kind of either nonstructural or structural elements, but structural elements are not strengthened beyond their original pre-earthquake state.
- ***Upgrade*:** "Upgrade" means going beyond repair to improve the building so that its structural performance is expected to be better than it would be in the pre-earthquake state. Adding plywood and associated connections to the framing to a wall, roof, or floor that did not have plywood would be an example of an upgrade. Nonstructural finishes will not be upgraded to a higher level of quality than existed prior to the earthquake.
- ***Replacement of the entire structure*:** "Replacement" in this context means to rebuild the home such that it is as similar to the building before the earthquake as possible, together with any required building code upgrades. This term is not intended to apply to individual elements and nonstructural finishes, which may be replaced locally as part or repairs or upgrades.
- ***Replacement cost of the entire structure*:** The cost to rebuild the home as defined above. This includes the demolition and removal cost of the existing damaged building.
- ***Residual displacement*:** For the cripple wall, this is the displacement that remains at the end of the earthquake at the top of the first floor vs. the top of the foundation. It is visible as a lean in the cripple wall. For the superstructure in a one-story building, this is the displacement between the top of the walls at the eave level and the top of the first floor. In a two-story building, it is the displacement between the first and second floor, or between the second floor and the eaves. Residual displacement is a useful metric for correlations with damage and is indicated for each scenario. The residual displacement lean occurs both in the direction parallel to the wall (termed "in-plane") and the

direction perpendicular to the face of the wall (termed "out-of-plane"). A figure for residual displacement is available in Appendix A.

- ***Actual cash value*:** The market value of an item, incorporating depreciation and age.
- ***Replacement cost value*:** The cost to replace the damaged items with a new version.
- ***Ground up cost*:** The cost to repair a damaged structure, irrespective of insurance deductibles or coverage limits.
- ***As-incurred costs*:** The actual costs the owner or insurer incurs as repair or related work is undertaken. It is distinguished from estimates for costs not yet incurred.
- ***Escalation*:** The increase in costs between the date assumed for pricing (typically when the estimate is made) and the future date when the work will actually occur. A common approach in the design profession is to escalate between the time of the estimate to the mid-point of construction.
- ***Coverage A*:** Insurance term for coverage to damage to the main residence.
- ***Coverage B*:** Insurance term for coverage for damage to secondary structures besides the main residence.
- ***Coverage C*:** Insurance term for coverage for personal property damage.
- ***Coverage D*:** Insurance term for coverage for additional living expenses for temporary housing when the residence cannot be occupied due to damage or repair work.

2.3 CASE STUDIES

There are three case study hypothetical buildings that cover representative California home types. For each building, there is an unretrofitted and a retrofitted version, and for each of these versions, there are four different levels of earthquake damage. A general description of each case study is provided below. For a more detailed description of each case study, refer to the *Earthquake Damage Workshop: Damage Description Package* in Appendix A.

2.3.1 Case Study Building 1

Case Study Building 1 (CS1) is a single-story, wood-framed house. The building is representative of 1940–1955 construction in California; see Figure 2.1 for a plan view of CS1.

Figure 2.2 illustrates the typical framing and finish components for CS1. The exterior finishes consist of stucco over horizontal sheathing. At the interior, walls are covered with gypsum wallboard. Around the perimeter of the house, a 2-ft-tall cripple wall is connected to the foundation with a wet-set sill, which is a method of sill plate construction where 30-penny spikes are partially driven at 24 in. on center into one side of the sill; this side is pushed into the top of the foundation when the concrete is wet. Wet sills are no longer used in California residential construction.

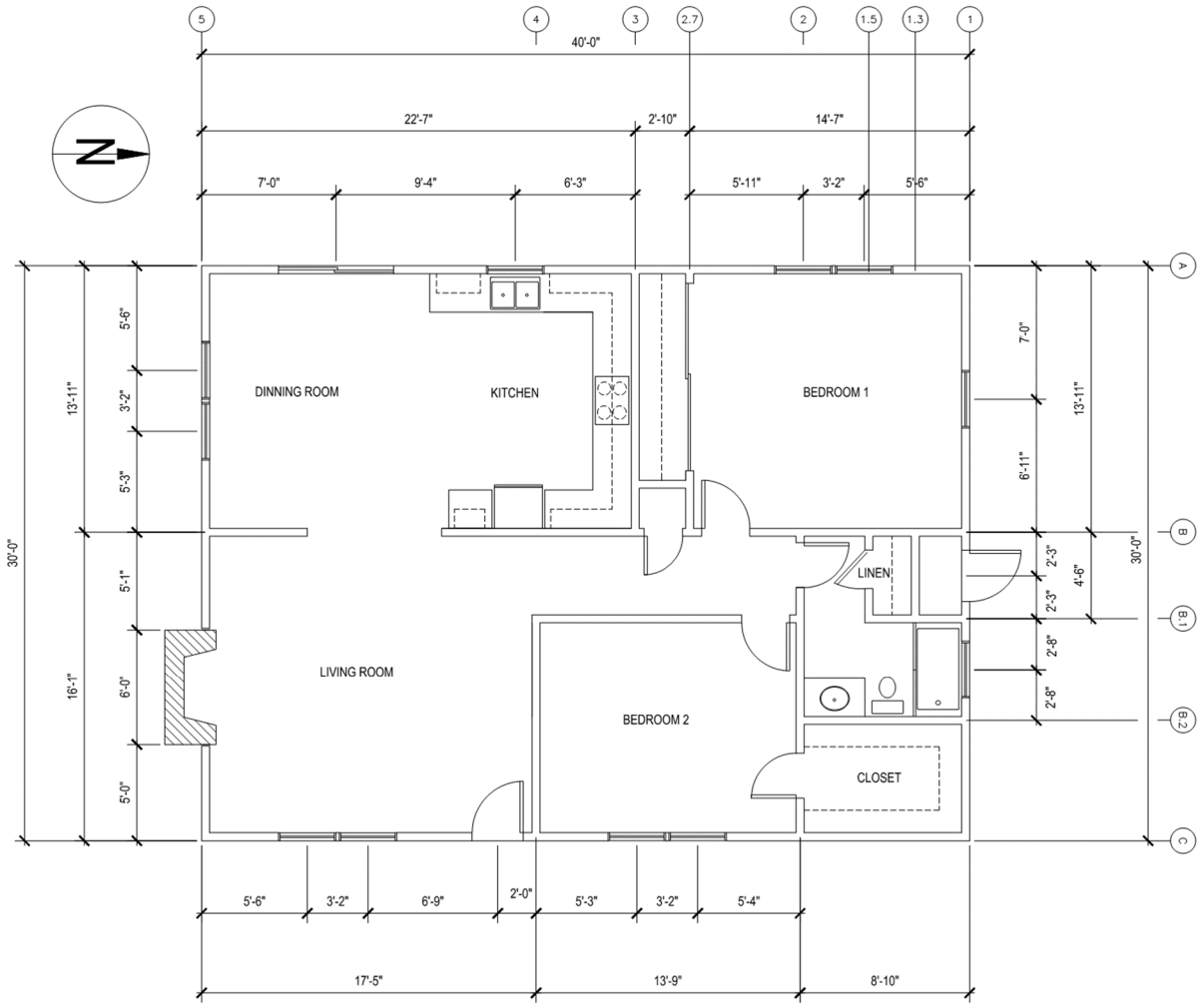


Figure 2.1 Plan view of Case Study Building 1.

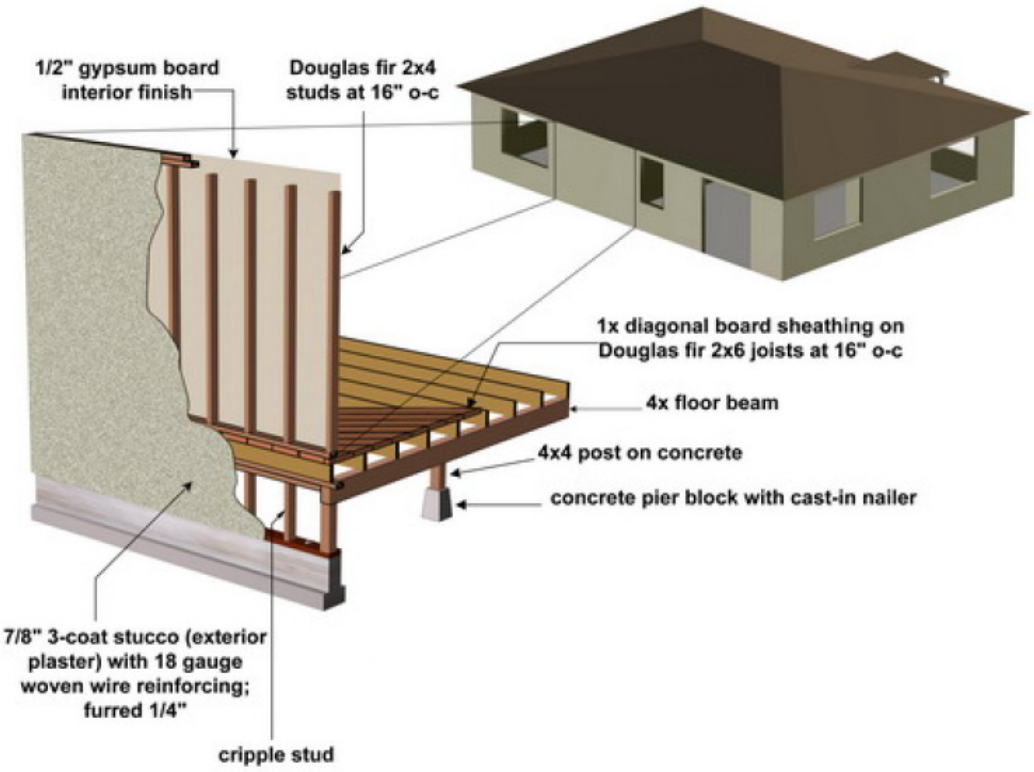


Figure 2.2 Typical framing and finish components for the target home (horizontal wood sheathing not shown behind stucco). Image from CUREE EDA-02 [2010].

For the cripple wall, there is an unretrofitted and retrofitted condition.

- ***Existing unretrofitted condition*:** The cripple wall has 2 × 4 studs at 16 in. on center bearing on a 2 × 6 sill plate supported by a strip footing. The sill plate used wet set construction. There are no anchor bolts. The outboard face of the sill is aligned with the outboard face of the concrete foundation. The stucco continues down past the top of the sill approximately 8 in.
- ***Retrofitted condition*:** For the retrofitted permutations, the cripple wall has 15/32 in. plywood or oriented strand board (OSB) on the interior face of the studs that is nailed to the existing sill, studs, and top plate below the floor joists with 8d nails at 4 in. on center. The cripple wall top plate is connected to the floor rim joists (15 shear clips each cripple wall, 60 total, A35, L50, or similar). The plywood extends for 14 ft on each perimeter face. Anchor bolts are added to the sill (10 bolts each wall, 40 total).

2.3.2 Case Study Building 2

Case Study Building 2 (CS2) is the same single-story home as CS1 except the exterior finishes consist of 1 × 6 horizontal tongue and groove redwood siding nailed to exterior studs. At the interior, walls are covered with lath and plaster instead of gypsum wallboard. Around the perimeter

of the house a 2-ft tall cripple wall is connected to the foundation with anchor bolts at 6 ft on center; see Figure 2.3 for the typical framing and finish components for CS2.

- For the cripple wall, there is an unretrofitted and retrofitted condition.
- ***Existing unretrofitted condition*:** The cripple wall has 2 × 4 studs at 16 in. on center bearing on a 2 × 6 sill plate supported by a strip footing. The sill plate is anchored to the foundation with 1/2-in.-diameter anchor bolts at 6 ft on center cast into the footing. The outboard face of the sill is aligned with the outboard face of the concrete foundation.
- ***Retrofitted condition*:** The retrofit is the same as in CS1.

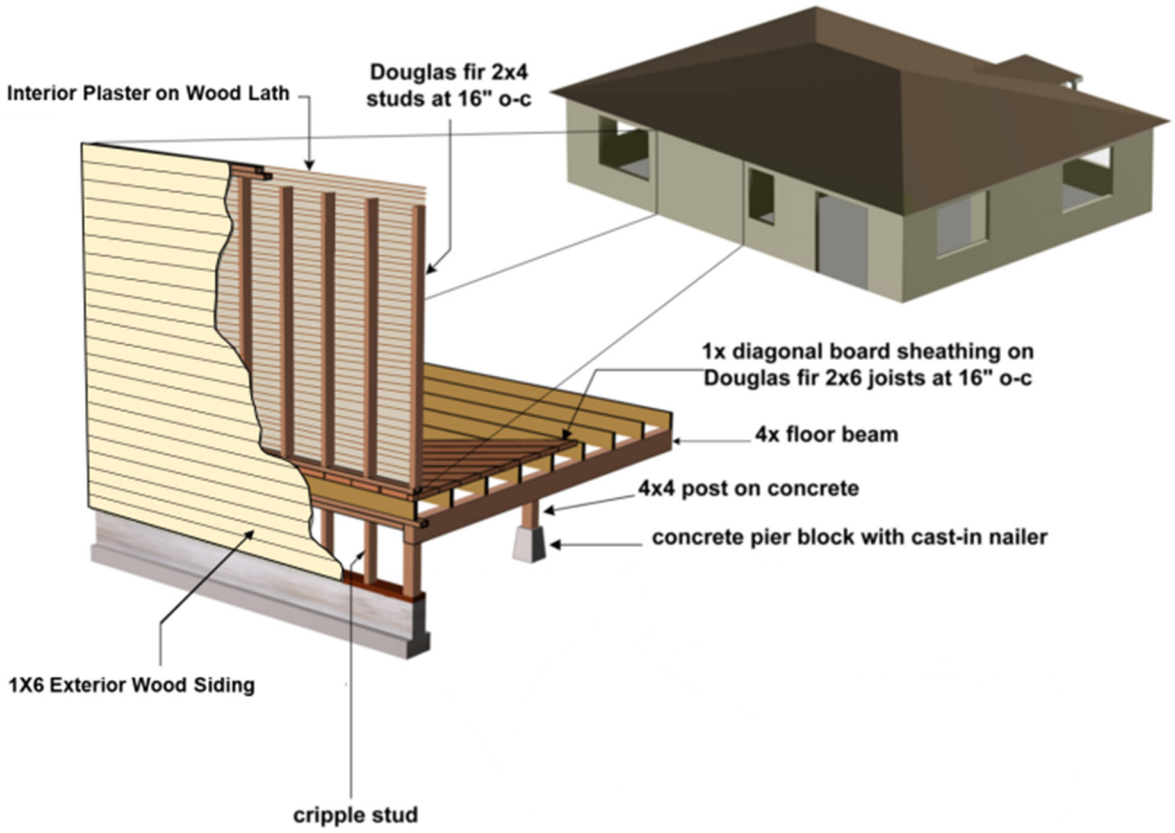


Figure 2.3 **Typical framing and finish components for Case Study Building 2 showing: (a) a 3D rendering of wall finish and framing materials (image adapted from CUREE [2010]); and (b) top of first-story wall.**

2.3.3 Case Study Building 3

Case Study Building 3 (CS3) is a two-story, wood-framed house with a garage at grade attached to the front façade of the main house. The building is representative of 1956–1970 construction in California; see Figure 2.4 for a plan view of CS3.

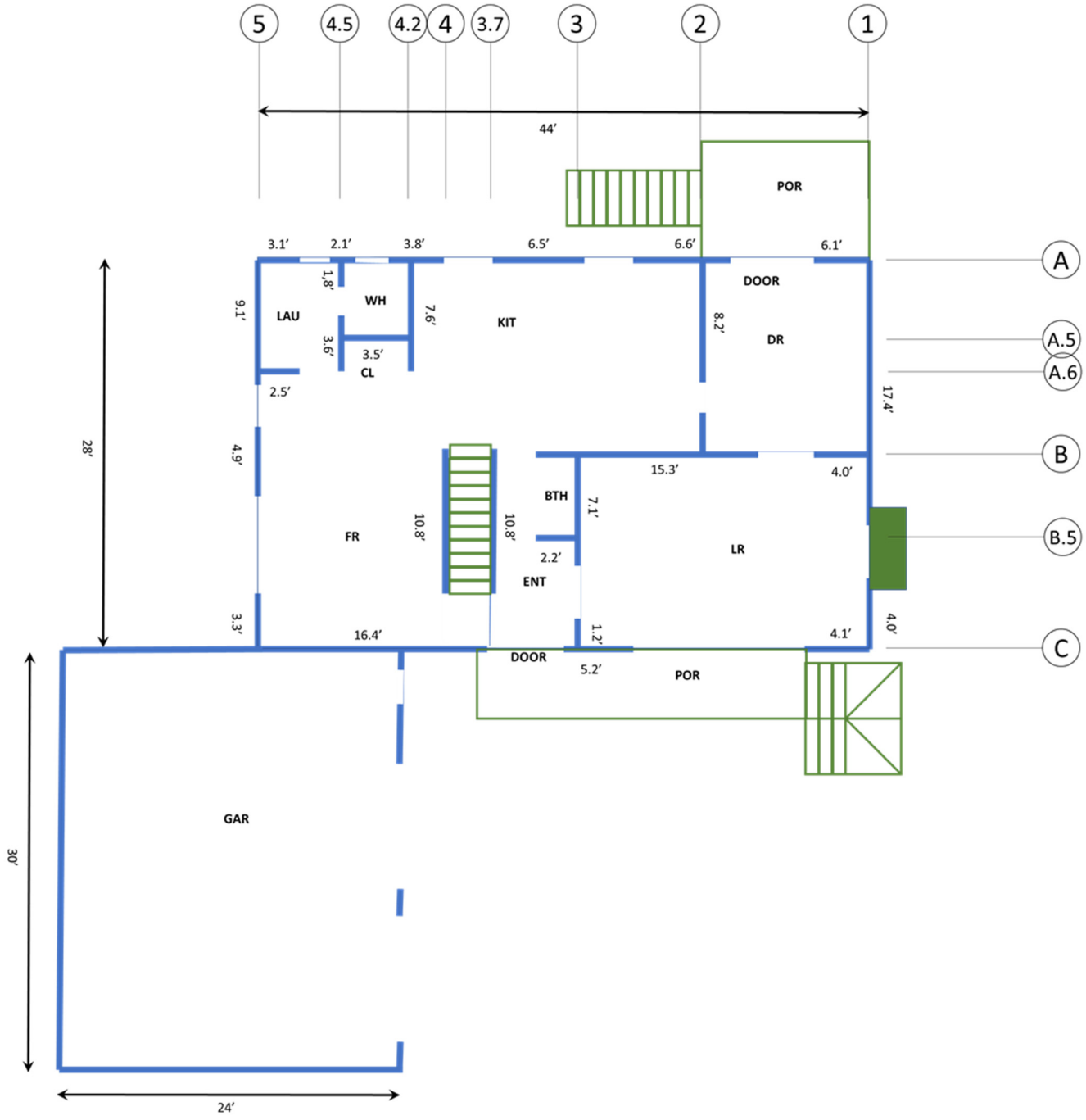


Figure 2.4 Plan view of Case Study Building 3.

Figure 2.5 illustrates the typical framing and finish components for CS3. There is T1-11 plywood siding at the exterior. At the interior, walls are covered with gypsum wallboard. Around the perimeter of the house, a 6-ft-tall cripple wall is connected to the foundation with anchor bolts at 6 ft on center.

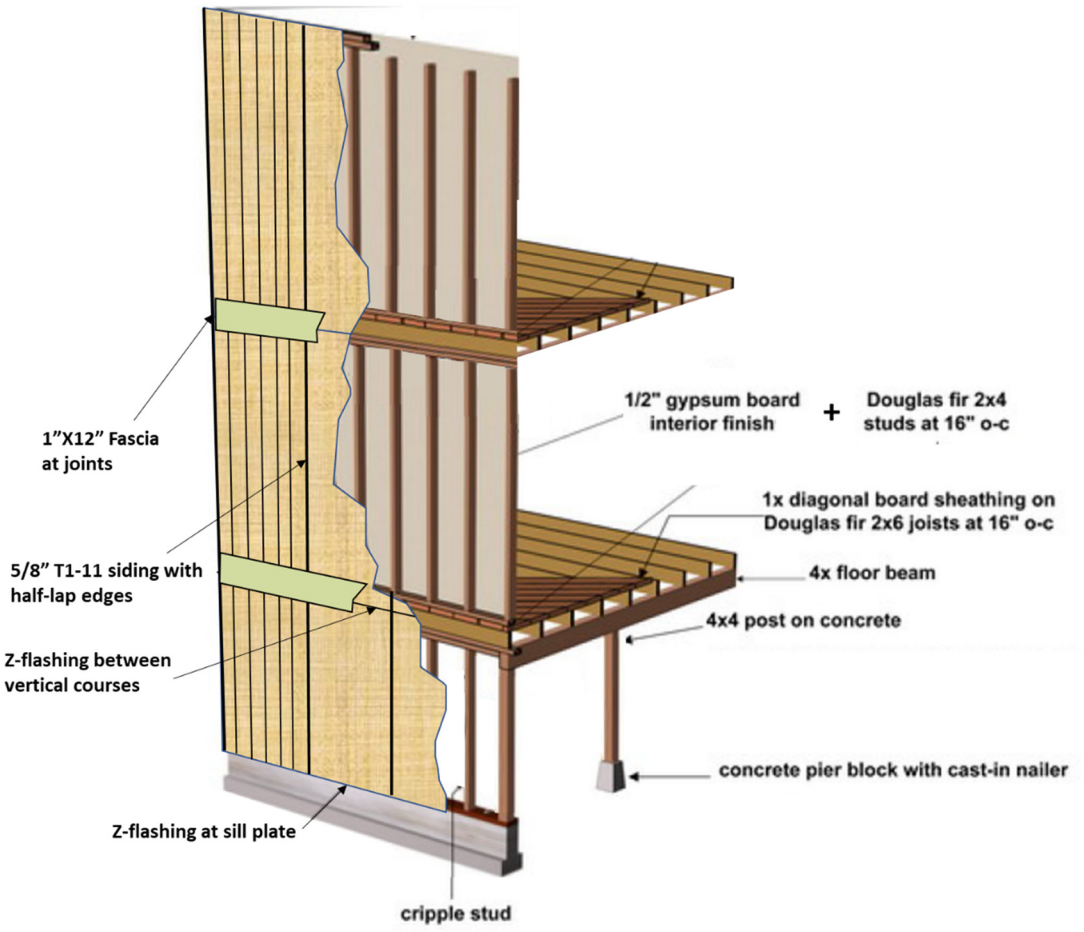


Figure 2.5 **Typical framing and finish components for the Case Study Building 3. Image adapted from CUREE [2010].**

For the cripple wall, there is an unretrofitted and a retrofitted condition:

- ***Existing unretrofitted condition*:** The cripple wall is 6 ft tall instead of the 2-ft-tall cripple walls in CS1 and CS2. The cripple wall has 2 × 4 studs at 16 in. on center bearing on a 2 × 6 sill plate supported by a strip footing. The sill plate is anchored to the foundation with 1/2-in. diameter anchor bolts at 6 ft on center cast into the footing. The outboard face of the sill is aligned with the outboard face of the concrete foundation.
- ***Retrofitted condition*:** For the retrofitted condition, in lieu of interior plywood strengthening like CS1 or CS2, the T1-11 siding nailing is improved from 8d at 8 in. on center to 8d at 4 in. on center. The cripple wall top plate is connected to the floor rim joists (23 shear clips each cripple wall, 92 total, A35, L50, or similar). Anchor bolts are added to the sill (15 bolts each wall, 60 total).

2.4 DAMAGE STATES

There are four damage states of interest that are examined. General descriptions are provided here. Details as they apply to each case study building are provided within the *Earthquake Damage Workshop: Damage Description Package* provided.

- Damage State 1: Cosmetic repair, with limited repair effort.
- Damage State 2: Significant finish damage; no appreciable structural damage; larger repair effort.
- Damage State 3:
  - Cripple Wall: Significant residual drift; loss of capacity and load transfer capability.
  - Superstructure: Nonstructural damage such that full replacement of interior and exterior nonstructural finishes is triggered; some structural damage to sill plates and framing.
- Damage State 4:
  - Cripple Wall: Full collapse of cripple wall; replacement of the cripple wall.
  - Superstructure: Replacement of entire structure.

2.5 SCENARIOS

There were three building types (CS1, CS2, and CS3) times two variations of retrofitting (unretrofitted and retrofitted) times four damage levels (Damage States 1, 2, 3, and 4) = 24 scenarios. Each scenario has damage at the cripple wall and the superstructure. Given the similarities between the various scenarios, the first case study scenario is described in detail, and subsequent variations only identify the differences. Because of similarities, only 17 scenarios needed unique Xactimate estimates.

Adjustors were divided into two groups. The first group was assigned estimates for CS1 and CS2; if they had time, they were to move on to CS3. None of the estimators moved on to CS3. The second group was assigned estimates for CS3, and, if they had time, they were to move on to CS1 and CS2. None of them did more than CS3 scenarios. Figure 2.6 illustrates the final number of estimates adjustors provided for each scenario.

The naming convention for the case study permutations is as follows: CSX-Y-DSZ-CW, where:

- CS: Case Study.
- X: “1,” “2,” or “3” for Building 1, Building 2 or Building 3.
- Y: “UN” for the original building in its unretrofitted state or “R” for the building with a cripple wall and sill anchorage retrofit.
- Z: “1,” “2,” “3,” or “4” for Damage State DS1, Damage State DS2, Damage State DS3, or Damage State DS4.

- CW: This is added when the permutation only involves the cripple wall. When it is not used, the estimate is for both the cripple wall and the superstructure; see Appendix A for more details.
- Example: CS1-UN-DS3: Case Study Building 1 in its unretrofitted original state when it has reached Damage State DS3, and the estimate covers damage to both the cripple wall and the superstructure.
- The intended goal was to have five estimates for each scenario, each from a different adjustor, resulting in 85 estimates to be produced; however, not all estimates were completed, and the final number of estimates received was 74.

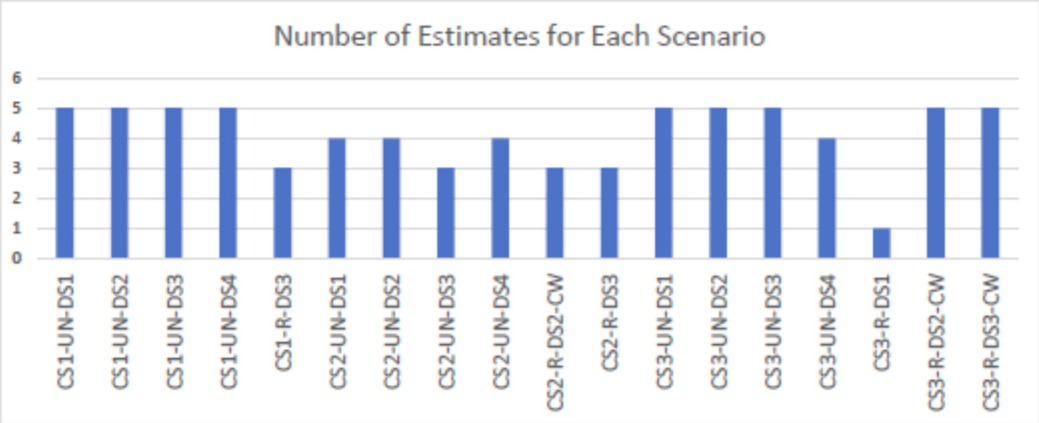


Figure 2.6 Number of estimates provided for each scenario.

2.6 INITIAL COST ESTIMATING ASSUMPTIONS

The initial *Damage Description Package* sent to adjustors provided detailed estimating assumptions to help provide consistency in the estimates and translate a theoretical exercise into an appropriate prediction of what would occur in an actual event with an actual claims adjustor estimate. Details are available in the *Damage Description Package* in Appendix A. Key assumptions are given below in italics as they were in the *Damage Description Package*, together with associated commentary.

1. *Repair vs. Replacement of the Entire Structure Trigger: The adjustor is to follow the CUREE EDA-02 guidelines in general. It will be at the adjustor's discretion to determine whether damage is extensive enough that the structure or major portions of it need to be replaced, rather than repaired, based on the adjustor's experience and industry practice. This includes the items below, which should be noted by the adjustor in their estimate.*
    a. *Complete replacement: For the building damage states described for each case study, the adjustor is to determine if damage is extensive enough to trigger complete replacement of the structure.*
    b. *Leaning cripple wall: For damage states described in each case study with leaning cripple walls from residual displacement at the end of the earthquake, the adjustor is to determine whether the cripple wall can be jacked back to plumb, whether*

rebuilding of the wall is needed, or whether the damage is extensive enough to that the entire house would be considered a loss and need to be rebuilt.

c. *Building paper replacement: For damage states described for each case study, the adjustor is to decide whether the damage is extensive enough to require full replacement of the building paper providing weather protection and the exterior siding. The damage descriptions note what can or cannot be seen in each damage state.*

Commentary: The EDA-02 guidelines [CUREE 2010] document provides substantial detail on assessing damage and determining the type and extent of repairs. The guidelines were funded by the CEA, and CEA recommends their use. This set of instructions was made to emphasize use of the guidelines. This set of instructions regarding when to repair, jack, or rebuild proved to be problematic; adjustors were uncomfortable with making this choice. As discussed in Section 2.8.3, revisions were discussed at the online workshop, and changes were made in the instructions; see Appendix A.

2. ***Extent of Repairs:*** *Per the CUREE EDA-02 guidelines, the goal is to repaint or repair to maintain consistent appearance. The adjustor decides the collateral extent to achieve this goal. For example, if there is a crack in a wall, the adjustor determines if it is locally patched or if the whole wall or room is redone based on their experience and industry practice.* ***The case study descriptions provide detailed descriptions of assumed repairs to assist the adjustor. The adjustor is not required to follow these repair descriptions if, in their experience, a different approach is warranted. In this case, the adjustor should note the differences in their approach and resulting estimate.***

Commentary: Although the EDA-02 guidelines provide substantial direction on the extent of nonstructural finish repairs that are appropriate, adjustors took different approaches, e.g., down to subtle issues like the number of primer and finish coats of paint or how far to take new paint past the damaged area. The concept of limiting the extent of repainting to areas within "line of sight" was generally followed.

3. ***Quality of Repairs:*** *Assume these are "average" buildings with "typical" nonstructural finishes, not homes with fancy finishes such as crown moldings, bull-nosed wall corners, etc.*

Commentary: High-end finishes certainly exist and can have a substantial impact on repair costs, but for consistency, adjustors were told to assume more typical average finishes were present in the case study buildings. Thus, the resulting costs represent more typical average or median conditions.

4. ***Foundation:*** *Assume for this exercise that there is no damage needing repairs at the concrete perimeter footings themselves. All damage occurs in the sill anchorage, cripple walls, and above. For scenarios where the building is rebuilt, assume there are no issues*

with a high groundwater table or unstable soils. Dewatering is not required. Foundation bearing pressures are assumed to be adequate to permit typical strip and spread footings. Deep foundations are not required.

> **Commentary:** The focus of the project is on differences in cripple wall behavior, with and without retrofitting. Retrofit techniques studied in the PEER–CEA Project focused on the cripple wall and not on the supporting concrete foundation. For the workshop effort, damage was defined to be limited to the cripple wall and not the supporting concrete foundation in order clarify the differences in various case studies. In an actual earthquake, some buildings will experience concrete foundation damage. Some buildings on poor soil may not be on strip and spread footings but use deep foundations. Thus, some buildings will have higher costs because of these issues than project estimates.

5. ***Crawl Space Access:*** *The crawl space is accessible for workers, but assume a typical extent of utilities such as pipes and ducts in the crawl space is hung from the underside of the first floor framing.*

> **Commentary:** This instruction was a reminder that these elements exist in the crawl space and thus may have damage due to earthquake shaking and racking of the cripple walls.

6. ***Landscaping:*** *Assume a typical level of shrubs and bushes around the perimeter of the house that need to be protected or removed to perform repairs.*

> **Commentary:** Repairing exterior wall damage and damage to the cripple wall will require access and staging from the exterior. Shrubs and bushes will often be in the way. This instruction was a reminder to account for this in the estimate.

7. ***Sidewalks and Driveways:*** *Assume there is no significant damage to sidewalks and driveways that needs repair.*

> **Commentary:** Although sidewalks and driveways can and will crack in moderate to heavy shaking, the focus of the PEER–CEA Project was on the cripple wall. For simplicity and consistency, adjustors were told to assume there was no significant damage to sidewalks and driveways and thus no associated cost. Thus, project estimates may underestimate actual costs related to this issue.

8. ***Utility Impacts:*** *Piping and wiring that were impacted by repair work and need to be removed and replaced are to be included the cost of the repair. Assume typical conditions for the era of construction.*

> **Commentary:** This instruction was a reminder to include collateral costs from removing and replacing piping and wiring that might be

in damaged elements like walls. Older wiring might use knob and tube construction, and it would be replaced with modern techniques.

9. ***Glazing:*** *Assume all existing window frames are wood frame, glazing is single pane, and single pane replacement is permitted. In addition, assume that none of the cracked glazing damage is in areas next to doors and exit ways that would trigger safety glass repairs.*

    Commentary: Older homes in the mild climate of the San Francisco Bay Area where the case study buildings were assumed to be located typically use single-pane windows. Many homes may have been updated to use more energy-efficient windows, but for simplicity and consistency, adjustors were told to assume single-pane construction and that repairs would be done in-kind, rather than involve upgrading the windows. In addition, for simplicity, triggers for safety glass were ignored, and it was to be assumed that none of the damage was next to doors and exit ways.

10. ***Building Code:*** *Assume the 2016 California Building Code (CBC), 2016 California Existing Building Code (CEBC), and 2016 California Residential Code are in effect, with no special local jurisdiction modifications, and that for repair-only work no code upgrades are required (including no electrical upgrades). (See Item 11 when replacement of the entire structure is required). It is assumed per 2016 CEBC Sections 404.2.2 and 404.3.1.1 that these one-family dwellings are exempt from code-required upgrades even if the level of damage is deemed "substantial structural damage" as defined in 2016 CEBC Chapter 2.*

    Commentary: This key instruction was to clarify that the damage would not trigger a code-mandated upgrade to the current code in lieu of only repair to the pre-existing condition. In an actual earthquake, some building officials may take a more conservative approach, particularly with repair of heavily damaged buildings, and actual costs may be higher than project estimates.

11. ***Replacement Cost of Entire Structure:*** *The adjustor is to provide their best estimate for rebuilding the building in kind. Provide a specific value in $/sf, not a range. Assume the building will be replaced to match the pre-existing condition, plus any required code upgrades. Include the cost for demolition and removal of the existing building. See below for additional cost assumptions. We understand that determining the replacement cost for the entire structure is typically the responsibility of the underwriting group within an insurance company, but we are interested in the adjustor's perceptions and estimates. If it is typical to separate living space and an attached garage, provide a $/sf estimate for each. If it is more typical to estimate garage replacement as a function of the number of cars rather than square feet, please estimate accordingly.*

    Commentary: For situations when the entire building would be replaced, this instruction pointed out that the new building was to be of a similar level of quality as the original. Replacement triggers or requires that the new structure be built to the current code, so this

was noted. For the replacement cost, adjustors typically used the default value in Xactimate for the location and date of construction, and the assumed finish conditions.

12. ***Demand Surge:*** *Do not include any factors for demand surge that may be caused by increased labor and material pricing after a major earthquake.*

    Commentary: Demand surge is term used for the increased labor and material pricing that is often observed to occur after a major incident, like an earthquake, when there are limited contractors available compared to the amount of repair work that needs to be done. The surge in demand leads to increase in bid prices. This instruction to not include demand surge was made because insurance catastrophe modelers typically apply proprietary demand surge factors separately from their damage functions. Keeping demand surge effects out of the project estimate values would provide for easier cross comparison.

13. ***Geotechnical Hazards:*** *Assume for this exercise that the only geotechnical hazard is from ground shaking, and this is the sole cause of damage. There is no damage from liquefaction, lateral spreading, or fault rupture at the site.*

    Commentary: This instruction was made for simplicity since the focus of the project is on the effect of ground shaking on cripple wall and superstructure behavior. There may be increased damage from liquefaction, lateral spreading, and fault rupture that is not reflected in the project cost estimates.

14. ***Additional Cost Estimation Details:*** *The following describes included and excluded cost categories and other assumptions.*

    a. *Do not reduce the cost by a deductible or cap the losses by a presumed coverage limit. The total "ground up" cost is desired.*

       Commentary: This key instruction represents a significant difference in how a typical claim would be addressed, where insurance deductibles and caps would apply to the amount paid out. However, the project goal was to estimate the total cost of damage and not obscure that by deductibles and caps. This was reviewed with catastrophe modelers prior to the workshop effort.

    b. *Location: Assume the damaged home is in San Carlos, California, with a 94070 ZIP Code.*

       Commentary: This location was somewhat arbitrary. It is the home ZIP Code of one of the Project's authors. It was chosen because it is a smaller city in the larger Bay Area and would not be impacted by denser urban conditions that might apply in larger cities like San

Francisco, Oakland, or Los Angeles. The ZIP Code was used in the Xactimate platform to adjust baseline costs for the city's location.

c. *Estimating Date: Assume construction repair costs and replacement costs are both relative to January 1, 2019. Note any typical factor to the adjustment for cost escalation over the course of construction, such as the midpoint of construction.*

Commentary: A date was needed for cost estimation. This date was used in the Xactimate platform, so that baseline costs use January 1, 2019. The recommendation to include escalation to the mid-point of construction proved problematic, as this is not typically done in the insurance industry. This was discussed in the online workshop and revisions were made.

d. *Direct Costs*

i. *The following direct costs are included: General contractor costs to the owner, including subcontractor costs, general conditions, overhead and profit, bonds, and insurance. Use your company's standard protocols and Xactimate's overhead and profit features for items such as the general contractor's overhead and profit, general conditions, bonds, and insurance. If your company does not include specific items like dumpsters or portable toilets in the overhead category of Xactimate, then include them as specific line items in the repair estimate when they are needed to do the work.*

Commentary: This instruction was to help clarify that "direct costs" are those that the owner will pay to the general contractor. They need to include items that are termed "general conditions," such as dumpsters and portable toilets needed at the job site.

ii. *Landscaping demolition and replacement costs: Use your company's standard protocols for including or excluding the cost of landscaping removal for construction access (e.g., shrubs around foundations), and replacement of damaged or removed landscaping in the Coverage A claim amount.*

Commentary: As noted above, there will be shrubs and bushes in front of exterior walls that require protection or removal. Standard company protocols were to be followed on how to account for the cost of addressing these items. Replacement of damaged or removed landscaping is not typically included in the claim amounts.

iii. *Depreciation costs: For the purpose of this exercise, estimates will be based on replacement cost value, rather than actual cash value, so depreciation will not be applied.*

Commentary: For Coverage A for the main residence, the CEA, like many insurers, uses a policy based on replacement cost value (RCV). Some insurers use actual cash value (ACV) policies, where depreciation needs to be applied. Even though depreciation would be applied to Coverage A costs in an ACV policy, it was decided to specify RCV estimates only, as most policies are RCV; this simplifies the estimating effort, reduces the variability, avoids the issue of needing to know what percentage of homeowners chose to accept the initial ACV value and did not do the repair to obtain the remaining payout to RCV, and keeps the focus on the retrofitted foundation vs. unretrofitted foundation.

e. *Indirect Costs: In addition to the direct cost of repairs, comment on the following indirect costs. Provide a separate, line item value used for each of these items, as a percentage of the direct construction costs in the Excel survey.*

   i. *Construction contingency: Contingency to address items not directly identified in the repair itemization that may be required when further assessment is known.*

   ii. *Utilities for construction: Include the cost of power and water if needed for construction.*

   iii. *Design fees: Design fees such as for structural engineering, architectural design, and geotechnical engineering. If an upgrade triggers design fees such as for engineering, please include this.*

   iv. *Plan check and permitting fees and shear wall special inspection fees: Fees paid to the building department for plan review and permitting and to a special inspection firm for city-required shear wall hold-down inspections.*

   v. *Lead paint and asbestos abatement: If a standard assumption for lead paint abatement and abatement of asbestos in drywall joint compound and crawl space insulation would be made, based on the age of the house, include a cost for this task.*

   vi. *Occupied structure: Include costs associated with working inside an occupied space.*

   vii. *Coverage C costs: Coverage C costs allocated for personal property damage. Assume an average level of personal property and associated damage.*

   viii. *Coverage D costs: Coverage D costs allocated for additional living expenses if the family needs to be temporarily housed during repair, upgrade, or replacement of the entire structure. Assume the same family for each case study building. This is the Northridge family of four: Kobe, his wife Loma, their two high school age children (son Fernando and daughter Cascadia), and their young golden retriever, Xactipup. Assume the*

temporary residence is no farther from the parents' workplaces and the children's school than their permanent home.

Commentary: This instruction generally proved to be problematic. Items were discussed in detail in the online workshop, and substantial revisions were made for the revised *Damage Description Package*; see Section 2.8.3 and Appendix A.

f. Excluded Costs: The following costs are assumed to be excluded for this exercise.

i. Special inspection and testing: Assume no special inspection or testing costs are triggered other than those noted above.

Commentary: Some more complicated buildings and repairs may need additional special inspection besides review of shear wall hold-downs, as well as testing, such as is required for steel installation and welding or concrete placement and strength assessment. Because this is fairly unusual for single-family home repairs, the adjustors were told to exclude it. Thus, actual costs for some buildings may be higher than project estimates.

ii. Legal fees: No legal advice is assumed to be needed, and no legal proceedings occur.

Commentary: For some complicated repairs, there may be legal issues involved, such as when the damage impacts a neighboring building, or the home is historic. For simplicity, adjustors were told to exclude this unusual cost. Thus, actual costs for some buildings may be higher than project estimates.

iii. Historic preservation costs: Homes are not assumed to be historic.

Commentary: Historic homes typically have higher repair costs because of the need to address archaic materials and to match finishes and level of quality. For simplicity, adjustors were told to assume the damaged homes were not considered historic. Thus, actual costs for some buildings may be higher than project estimates.

iv. Other hazardous materials: Assume there are no other hazardous materials, such as mold, soil contamination, or radon, and that there are no other materials with asbestos (such as vinyl tile) other than the crawl space ductwork noted above.

Commentary: This instruction was for simplicity and consistency. Based on discussion at the workshop, revisions

were made to have a more expansive set of assumptions on asbestos; see Section 2.8.3 and Appendix A.

v. *ADA: Americans with Disability Act upgrades are assumed not to be triggered.*

Commentary: Private homes not used for public accommodation (such as a doctor's office or a day care center) are exempt from ADA requirements (see https://adata.org/faq/does-ada-cover-private-apartments-and-private-homes).

vi. *Overtime: Assume typical contractor working hours, without overtime.*

Commentary: Although a homeowner may choose to pay a premium for overtime work to expedite repairs, this instruction was made for simplicity and consistency. It is related as well to demand surge as discussed above.

vii. *Neighborhood access and utility functionality: Assume there are no special access condition costs at the home and that roads to the home are functional and utilities to supply power and water to the worksite are functional.*

Commentary: For simplicity and consistency, adjustors were told to assume that there would not be unusual access conditions to the site (such as working around damaged bridges or roads). Similarly, they were instructed to assume there was no lack of power and water; these utility services, even if they had been originally damaged, were assumed to have been restored by the time repair work at the case study homes began.

viii. *Construction management: The owner will not hire a construction manager or representative, and no costs are assigned to the owner's time.*

Commentary: Although construction managers are commonly used for larger construction jobs to help owners manage the project, this is less typical for single-family homes. For simplicity and consistency, adjustors were told to assume no manager was used and further not to assign a cost to the owner's time to deal with the repair process (even if this might reflect a substantial lost opportunity cost).

ix. *Financing costs: The cost of money is not included.*

Commentary: Although some owners might need to take out a loan to fund the repair work not covered by insurance, adjustors were told not to include interest costs on such a loan.

x. *Coverage B costs: Coverage B costs allocated for structures other than the main house are not included. For the Case Study Building 3, assume the garage is attached to the main house and part of Coverage A.*

Commentary: Coverage A is the standard insurance industry term for coverage to the main residence; Coverage B is the term used for secondary structures besides the main house, such as for a detached garage or in-law unit that might be on the property. For simplicity and consistency, adjustors were told to assume that damage and repair costs only applied to the main house, i.e., Coverage A.

2.7 COST CATEGORIES

The damage described in each of the damage states corresponds to one of the following categories:

- Cripple Wall and Foundation
- Exterior Damage (above the cripple wall level)
- Interior Damage (above the cripple wall level)
- Windows and Doors
- Ceilings
- Floors
- Roof
- Miscellaneous (eventually used for tile damage in the kitchen and bathroom)
- Chimney
- Stairs and Porch
- MEP
- Indirect Cost (eventually used to cover construction contingency, utilities for construction, design fees, plan check and permitting fees and shear wall special inspection fees, lead paint and asbestos abatement, occupied structure costs, Coverage C costs, Coverage D costs)

The *Damage Description Package* instructed adjustors on which category to assign repairs and their associated costs. The total replacement cost value, or RCV, was also calculated for each estimate. Xactimate calculates the ACV, or actual cash value, which takes into account depreciation. For this exercise, the adjustors were told to ignore depreciation, assigning it a value of zero in Xactimate. Therefore, the output of ACV is actually the RCV. All tables in Section 3 report the RCV.

2.8 WORKSHOP PROCESS

At the request of the CEA, experienced claims adjustors from insurance companies volunteered to provide estimates of case study examples of damaged buildings. Associated files for each case

study were developed by the authors from Rutherford + Chekene (R+C) using the Verisk Xactware Xactimate X1 platform and provided to the claims adjustors to complete their estimates. These adjustor estimates served as the baseline for comparison against the *FEMA P-58* approach to damage and loss analysis, and the insurance catastrophe modeler's functions.

2.8.1 Timeline

Initial packages for adjustors containing information and instructions regarding the damage workshop, Xactimate template files for their assigned case studies, and a survey regarding their key assumptions were distributed on January 25, 2019. On February 1, 2019, PEER conducted a short webinar for the volunteer adjustors to explain the process and to help answer questions prior to starting their estimates. The adjustors sent their initial estimates by February 8, 2019, to R+C and CEA for review. The adjustors also answered the survey of questions regarding key assumptions made by the adjustor following the initial estimates. The survey helped identify topics to be discussed by the group at the online workshop. Initial estimates and survey responses were then analyzed, identifying issues for discussion at the online workshop. These key issues regarding consistency of estimate items were addressed and resolved in the workshop on February 20, 2019. Those in attendance included design team professionals, the volunteer adjustors, members of the Project Team using the *FEMA P-58* methodology, and insurance catastrophe modelers, with each discipline offering a different perspective and standard of practice for creating estimates. Each group highlighted key differences in approach as well as what indirect costs are included when creating estimates.

By March 1, 2019, workshop conclusions, including clarifications on estimate assumptions and approach, were incorporated in an updated *Damage Description Package* with revised instructions and descriptions based on workshop feedback. Adjustors then updated their estimates and returned final Xactimate files to R+C and CEA by March 15, 2019, or soon after.

2.8.2 Initial Package for Adjustors

The initial package received by adjustors on January 25, 2019, contained the *Earthquake Damage Workshop: Damage Description Package* with a detailed account of the various case studies and damage states, a survey asking what improvements to the *Damage Description Package* would be helpful for claims adjustors to complete their estimates, and Xactimate files for the scenarios assigned to each of the adjustors. The Xactimate files were created as a baseline for all adjustors to start with, ensuring the same general approach for each estimate.

Table 2.1 provides the list of survey questions that was provided in the initial package to adjustors. Adjustors submitted their answers to the survey and the updated Xactimate files by February 8, 2019, or soon after.

Table 2.1 Survey questions provided in initial package.

Number	Question
1a	For Damage State 4, what is the replacement cost in $/sf and source of the value?
1b	What portion of the replacement cost was for demolition and removal of the existing home ($/sf)?
1c	What portion of the replacement cost was for the garage in Case Study 3 ($/sf)?
2a	For Damage State 3, did you replace the entire structure the rather than repair/upgrade the damage?
2b	If you answered yes, why did you replace the entire structure?
3a	For Damage State 1, 2, or 3, did you upgrade rather than repair the damage?
3b	If you answered yes, which damage state(s) were upgraded and which elements?
3c	Why did you upgrade or not upgrade?
4a	For Damage State 1, 2, or 3, did you locally replace rather than repair the damage?
4b	If you answered yes, which damage state(s) had local replacement and which elements?
4c	Why did you locally replace instead of repair?
5a	For Damage State 3, did you jack and replumb the cripple wall or replace it entirely?
5b	At what level of residual displacement do you think it is no longer economically practical to jack the cripple wall to plumb and rebuilding is needed?
5c	Up to what level of residual displacement do you leave the cripple wall in its tilted condition?
5d	For Case Study Building 1, did you replace the horizontal sheathing under the stucco with plywood?
5e	What rules or approach did you use for triggered collateral extent to obtain a consistent appearance in general?
6	If there is local damage to an interior wall finishes, at what point (if any) do you repair/repaint the entire wall or room?
7	What rules or approach did you use in deciding when to replace the building paper?
8	What percentage if any did you assume for escalation?
9	What amount if any did you assume for the following items as a percentage of the direct construction costs?
9a	Construction contingency
9b	Utilities (power and water) for construction
9c	Design fees
9d	Plan check and permitting fees and shear wall special inspection fees
9e	Lead paint and asbestos abatement
9f	Occupied structure
9g	Coverage C costs allocated for personal property damage
9h	Coverage D costs allocated for additional living expenses
10	What additional information would help you refine your estimate?
11	Are there assumptions with which you disagree?
12	Any other comments or suggestions?

2.8.3 Online Workshop Discussions and Decisions Made

The online workshop held on February 20, 2019, provided a forum for all parties involved to discuss key issues regarding approaches to estimating and consistency of estimate assumptions and terminology. For example, claims adjustors do not use escalation and generally are not familiar with the term. However, cost estimators on a design team must include a line item for escalation because the building has not yet been built or the retrofit has not yet occurred. Adjustors rely on engineers for advice on the scope of required repair or replacement in heavily damaged buildings. Adjustors indicated that they take extensive photographs of damage and make very detailed notes on a room-by-room basis, documenting the extent of cracking and determining the extent of nonstructural repairs that will be needed. The programs they use, such as Xactimate, are specifically designed for this purpose.

The following is a list of questions that adjustors were initially asked in the survey, which led to issues discussed in the online workshop. The goal was to come to a consensus on how to address these issues so adjustors could then update their estimates to be more consistent.

1. Survey Question 4a, 4b, 4c, 4d, 7: For Damage State 1, 2, or 3, did you locally replace rather than repair the damage? What rules or approach did you use in deciding when to replace the building paper?
    - Issue: Adjustors typically completely replace certain building materials such as tile or building paper. Reasons for this include inability to match the original finish, or subcontractors' unwillingness to warranty only partial repairs.
    - Decision: Instructions were added to the final *Damage Description Package* that give direction for when to completely replace a material and when it is up to the discretion of the adjustor. For damage states described for each case study, the following line items were defined to require full replacement if damage occurs:
        - If the siding or stucco is removed, the building paper providing weather protection must be completely replaced where it is exposed.
        - If damage occurs to any tile, assume the tile cannot be matched and a full replacement of the tile in the room with damage is required.
2. Survey Question 5a, 5b, 5c, 5d: For Damage State 3, did you jack and replumb the cripple wall or replace it entirely?
    - Issue: Adjustors rely heavily on structural engineers for this recommendation and typically do not make decisions regarding the structural integrity of the cripple wall.
    - Decision: There was no consensus among the claims adjustors on when to jack and replumb the wall or when to replace it. Adjustors noted that they typically rely on advice from engineers to help resolve claims in such cases. However, there is no clear consensus among structural engineers on this issue as well. For consistency, instructions were added to the final *Damage Description Package* to clarify whether to assume the wall can be jacked back to plumb or whether rebuilding of the wall is needed. For Damage State 1, the wall was not leaning.

For some cases in Damage State 2, the walls were leaning and could be jacked back to plumb. Finally, for Damage State 3, adjustors were to assume shoring of the house and rebuilding the cripple wall were required.

3. Survey Question 8: What percentage did you assume for escalation?
    - Issue: Adjustors do not typically take escalation into account. Instead, they often make multiple estimates and refine them when "as incurred" costs are known.
    - Decision: Adjustors were instructed to continue to use the January 2019 price list in Xactimate and ignore escalation as there is no practice to include it by claims adjustors. A note was added in the instructions that adjustors are instead to exclude escalation. Increases between the initial adjustor estimate and final adjustor estimate are covered below.
4. Survey Question 9a: What percentage of direct construction cost did you assume for construction contingency?
    - Issue: Adjustors typically do not use the term "construction contingency." However, they often make multiple estimates and refine them when "as-incurred" costs are known.
    - Decision: To handle this, adjustors were instructed in the final *Damage Description Package* to add a line item up front in Xactimate to add 5% to represent this increase from the initial to the final estimate.
5. Survey Question 9b: What percentage of direct construction cost did you assume for utilities (power and water) for construction?
    - Issue: Adjustors associate the cost of utilities with the duration of construction, not necessarily as a percentage of the total construction cost.
    - Decision: Instructions for when to account for power and water, and what is the assumed duration of construction were added to the final *Damage Description Package*. Xactimate has line items for these costs.
6. Survey Question 9c: What percentage of direct construction cost did you assume for design fees?
    - Issue: Design fees are typically considered to be "as-incurred" costs by adjustors. Responses from adjustors varied. Some suggested for DS1 and DS2 it could be 1.5–3% and for DS3, up to 5–10%.
    - Decision: Adjustors were instructed in the final *Damage Description Package* to add an assumption of 2% of the total cost for design fees into Xactimate as an upfront line item for DS1 and DS2. An assumption of 7% of the total cost for design fees was added to estimates for DS3. Instructions also clarified that design fees include the costs for an engineer to assess what type of repair is needed as well as to design the repair. They do not include visits to determine if the damage is actually covered by insurance. This is an "expense" that is in the insurance company's overhead.

7. Survey Question 9d: What percentage of direct construction cost did you assume for plan check, permit, and special inspection?
    - Issue: Plan check, permit, and special inspection fees are typically considered "as-incurred" costs by adjustors.
    - Decision: Adjustors were instructed in the final *Damage Description Package* to include 3% premium on direct cost in Xactimate to represent these fees.
8. Survey Question 9e: What percentage of direct construction cost did you assume for lead paint and asbestos abatement?
    - Issue: Lead paint and asbestos abatement are typically considered "as-incurred" costs by claims adjustors.
    - Decision: Responses were that typically 60–70% or 70–80% of houses require some form of abatement in California. This was rounded to 2/3. The cost of abatement of a room is around $1,500. Abatement of the whole house is around $15,000. Testing for lead and asbestos is required for all homes as they are older than the threshold dates most insurers were using. This was required for all scenarios. Updated instructions proposed three abatement scenarios for each case study building:
        - DS1 most likely would not be damaged enough to require abatement, and this would have a zero increase.
        - DS2 would require abatement of localized areas and be assigned a weighted average of 2/3 x $1,500 = $1,000 to be added to direct cost.
        - DS3 would require abatement of the whole house given the large amount of damage and be assigned a weighted average of 2/3 x $15,000 = $10,000 to be added to the direct cost.
9. Survey Question 9f: What percentage of direct construction cost did you assume for an occupied structure?
    - Issue: Additional costs to detail with an occupied structure are typically "as-incurred" costs.
    - Decision: R+C added instructions to assume length of repair and if it could be occupied or not. The three scenarios are:
        - DS1 is ready for occupation with a construction schedule of two weeks.
        - DS2 is ready for occupation with a construction schedule of two months.
        - DS3 is not ready for occupation with construction schedule of one year.

    These scenario assumptions affect the cost of power and water the contractor needs to assume and the costs associated for working in an occupied structure.

10. Survey Question 9g: What percentage of direct construction cost did you assume for Coverage C costs allocated for personal property damage?

- Issue: If Coverage C and D costs were included, the catastrophe modelers would also need to account for them for consistency.
- Decision: Catastrophe modelers have functions for Coverage A costs only, to make comparisons. Direction was added in the final *Damage Description Package* to exclude Coverage C and D costs.

11. Survey Question 9h: What percentage of direct construction cost did you assume for Coverage D costs allocated for additional living expenses?
    - Issue: If Coverage C and D costs were included, the catastrophe modelers would also need to account for them for consistency.
    - Decision: Catastrophe modelers have functions for Coverage Type A only, to make comparisons. Direction was added in the final *Damage Description Package* to exclude Coverage C and D costs.

In addition to the issues listed above, the adjustors were not always consistent about which damage items related to which category. In an effort to correct this, tables for each case study were added the final *Damage Description Package* to help guide adjustors into placing the repairs in the correct category. These tables are reproduced as Table 2.2 and Table 2.3 for CS1 and CS2; see Appendix A for CS3.

Table 2.2 identifies the cost categories with damage for the CS1 scenarios. As an example, for the CS1-UN-DS1 (CS1 in its unretrofitted condition with Damage State 1), the *Damage Description Package* indicates there is exterior damage (and thus merits a green box with a dollar sign), but there is no damage to windows and doors (and thus that cost category is left blank). However, when the damage increases to Damage State 3 (CS1-UN-DS3), there is damage to windows and doors (and thus that cost category now has a green box with a dollar sign).

For CS2 and CS3, if the damage in the category were the same as another previously described in a different case study, this was noted for the convenience of the adjustor; see categories highlighted in yellow in Table 2.3 for CS2. Note: the cost to address that damage in some cases might be different. For example, for the CS2-UN-DS3 case, while the description of damage and the ultimate repair approach for the interior damage category is the same as for the CS1-R-DS3 case, the CS1 house has gypsum wallboard wall finishes, and the CS2 building has lath and plaster finishes. The removal of lath and plaster leads to higher costs. This is covered in more detail in Section 3.6.

Adjustors revised their estimates based on the conclusions from the online workshop and resubmitted. As an example, Figure 2.7 and Figure 2.8 show the CS1-UN mean RCV before and after the online workshop.

Table 2.2 **Categories that require a monetary line item based on damage description for Case Study Building 1.**

Case Study 1												
	Total ACV	Cripple Wall and Foundation	Exterior Damage	Interior Damage	Windows and Doors	Ceilings	Floors	Roof	Miscellaneous	Chimney	Stairs and Porch	MEP
CS1-UN-DS1	$	$	$	$					$			
CS1-UN-DS2	$	$	$	$		$			$	$		
CS1-UN-DS3	$	$	$	$	$	$		$	$	$	$	$
CS1-UN-DS4	$	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
CS1-R-DS3	$	$	$	$	$	$		$	$	$	$	$

Table 2.3 **Categories that require a monetary line item based on damage description for Case Study Building 2.**

Case Study 2												
	Total ACV	Cripple Wall and Foundation	Exterior Damage	Interior Damage	Windows and Doors	Ceilings	Floors	Roof	Miscellaneous	Chimney	Stairs and Porch	MEP
CS2-UN-DS1	$			$					Same as CS1-UN-DS1			
CS2-UN-DS2	$		$	$	$	Same as CS1-UN-DS2			$	Same as CS1-UN-DS2		
CS2-UN-DS3	$	$	$	Same as **CS1-R-DS3**	$	Same as CS1-UN-DS3		Same as CS1-UN-DS3	Same as **CS1-R-DS3**	Same as CS1-UN-DS3	Same as CS1-UN-DS3	Same as CS1-UN-DS3
CS2-UN-DS4	$	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
CS2-R-DS2-CW	$	$	Same as CS2-UN-DS2	Same as CS2-UN-DS2	Same as CS2-UN-DS2	Same as CS2-UN-DS2			Same as CS2-UN-DS2	Same as CS2-UN-DS2		
CS2-R-DS3	$	$	$	$	Same as CS2-UN-DS3	Same as CS2-UN-DS3		Same as CS2-UN-DS3	Same as CS2-UN-DS3	Same as CS2-UN-DS3	Same as CS2-UN-DS3	Same as CS2-UN-DS3

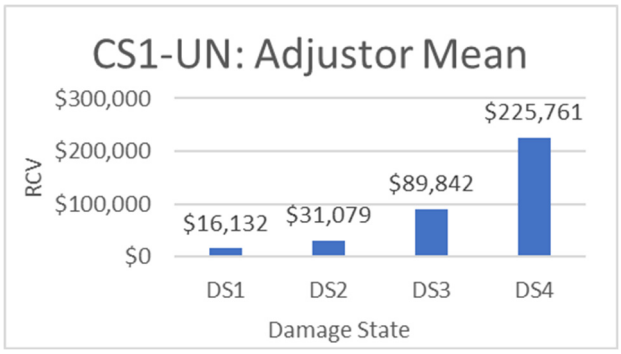


Figure 2.7 Mean RCV before workshop.

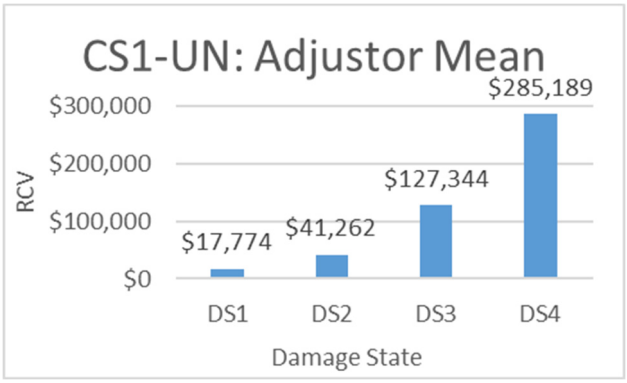


Figure 2.8 Mean RCV after workshop.

The mean total RCV costs for each damage state all consistently increased from before the workshop to after the workshop. For DS1, the increase was 10%; for DS2, 33%; for DS3, 42%; and for DS4, 68%. Additionally, the total number of estimates received increased from 61 before the workshop to 74 after the workshop.

Not all adjustors submitted updated results. For those that did not submit updated results, an "indirect cost" value was added to the total based on the following rules established during the online damage workshop:

- For DS1 and DS2, indirect cost includes 10% (5% construction contingency + 2% design fees + 3% plan check and permitting fees) of total cost + abatement.
- For DS3, indirect cost includes 15% (5% construction contingency + 7% design fees + 3% plan check and permitting fees) of total cost + abatement.

With all estimates taken into account, including the ones where an indirect cost was added based on the rules above, the change in RCV can be seen in Table 2.4. When examining only the RCV values of the adjustors that produced an estimate both before and after the online workshop the mean RCV increased for all estimates; see Table 2.5. Therefore, adjustors all increased their estimates based on feedback from the online workshop. The data presented in Section 3 includes the added indirect cost based on the rules established in the online workshop.

Table 2.4 Percentage change in mean RCV after online workshop with all estimates included.

Damage state	CS1-UN	CS2-UN	CS3-UN
DS1	10%	-14%	47%
DS2	33%	-3%	13%
DS3	42%	8%	15%
DS4	26%	9%	N/A

Table 2.5 Percentage change in mean RCV after online workshop with only estimates from adjustors who provided estimates both before and after the workshop.

Case study	CS1-UN	CS2-UN	CS3-UN
DS1	16%	3%	79%
DS2	62%	1%	14%
DS3	100%	38%	13%
DS4	17%	14%	N/A

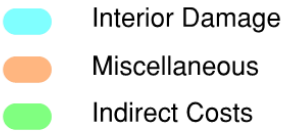
2.8.4 Post-Processing

Unfortunately, the repairs for each line item were not always placed in the correct category by the adjustors. Xactimate program limitations also contributed to a lack of consistency regarding where the adjustors accounted for each of the line items discussed in the *Damage Description Package*. Some post-processing data was performed for a more consistent comparison of specific damage categories. In order to provide a framework for comparing these estimates with those of the design team, the *FEMA P-58* analysis, and the catastrophe modelers, an "indirect cost" category was used. Line items included in the indirect cost category include the following.

1. Construction contingency
2. Utilities for construction
3. Design fees
4. Plan check and permitting fees and shear wall special inspection fees
5. Lead paint and asbestos abatement
6. Costs associated with working inside an occupied space
7. Contents move-out, moving contents in and out of workspace
8. California Lumber Assessment fees – Since January 1, 2013, a new law requires a 1% assessment on purchases of lumber products and engineered wood products for use in California, based on the selling price of the products.

In addition, the two other main categories where adjustors mis-categorized line items were the interior damage category and the miscellaneous category. Each estimate that was submitted was reviewed, and the repair items were sorted into the appropriate category; see Figure 2.9 for an example of miscellaneous cost item that was improperly assigned to the cripple wall and foundation cost category.

In this example, the $812.69 was removed from the cripple wall and foundation category and placed in the miscellaneous category. This example also highlights the ACV vs. RCV output. Note: the depreciation is zero; therefore, the RCV and ACV values are identical. All graphs, charts, and tables in Section 3 show the data that has been post-processed.



DESCRIPTION	QTY	UNIT PRICE	TAX	O&P	RCV	DEPREC.	ACV
CRIPPLE WALL AND FOUNDATION							
28. R&R Ceramic/porcelain tile	25.00 SF	19.41	9.30	98.92	593.47	(0.00)	593.47
29. R&R 1/4" Cement board	25.00 SF	7.19	2.93	36.54	219.22	(0.00)	219.22
Cripple Wall and Foundation Totals:			**12.23**	**135.46**	**812.69**		**812.69**
Totals: Kitchen			**12.23**	**135.46**	**812.69**	**0.00**	**812.69**

Figure 2.9 Example of a post-processed estimate.

3 Findings

3.1 CATEGORIES

As described in Chapter 2, adjustors organized the repair costs into one of the following cost categories:

- Cripple Wall and Foundation
- Exterior Damage
- Interior Damage
- Windows and Doors
- Ceilings
- Floors
- Roof
- Miscellaneous
- Chimney
- Stairs and Porch
- MEP
- Indirect Cost

The value that was of the most interest was the total RCV; see Figure 3.1 for an example output of the submitted estimates organized by cost category. As noted above in Section 2.7, Xactimate calculates the ACV, or actual cost value, which takes depreciation into account. For this exercise, the adjustors were told to ignore depreciation, assigning it a value of zero in Xactimate. Therefore, the output of ACV is actually the RCV. All tables in Chapter 3 report the RCV. The results from each estimate were logged into tables based on case study building; see Table 3.1 for CS1, Table 3.2 for CS2, and Table 3.3 for CS3.

Coverage	Item Total	%	ACV Total	%
Cripple Wall and Foundation	3,762.33	10.46%	3,762.33	10.46%
Exterior Damage	6,804.08	18.92%	6,804.08	18.92%
Interior Damage	2,940.21	8.18%	2,940.21	8.18%
Windows and Doors	0.00	0.00%	0.00	0.00%
Ceilings	0.00	0.00%	0.00	0.00%
Floors	0.00	0.00%	0.00	0.00%
Roof	0.00	0.00%	0.00	0.00%
Miscellaneous	894.00	2.49%	894.00	2.49%
Chimney	21,563.76	59.96%	21,563.76	59.96%
Stairs and Porch	0.00	0.00%	0.00	0.00%
MEP	0.00	0.00%	0.00	0.00%
Total	35,964.38	100.00%	35,964.38	100.00%

Figure 3.1 Example of estimate output by cost category.

Table 3.1 Adjustor estimate data for Case Study Building 1.

Adjustor #	Code	Total RCV	Cripple Wall and Foundation	Exterior Damage	Interior Damage	Windows and Doors	Ceilings	Floors	Roof	Miscellaneous	Chimney	Stairs and Porch	MEP	Indirect Cost	RCV Mean	RCV Standard Deviation	Total RCV ($/SF)	RCV Mean ($/SF)
1	CS1RDS3	$138,579	$10,296	$12,521	$23,382	$4,088	$6,517	$4,411	$971	$13,374	$23,868	$2,512	$2,325	$34,314	$136,346	$5,012	$115	$114
3	CS1RDS3	$130,606	$5,535	$11,525	$40,007	$5,316	$0	$0	$1,634	$7,689	$22,151	$2,583	$4,190	$29,976			$109	
5	CS1RDS3	$139,853	$35,327	$20,253	$51,658	$4,435	$0	$0	$2,577	$6,863	$11,346	$2,867	$4,529	$0			$117	
1	CS1UNDS1	$13,824	$1,221	$3,183	$1,830	$0	$0	$0	$0	$5,805	$0	$0	$0	$1,784	$17,774	$6,469	$12	$15
2	CS1UNDS1	$9,835	$3,307	$1,606	$3,215	$0	$0	$0	$0	$0	$0	$0	$0	$1,707			$8	
3	CS1UNDS1	$16,477	$1,117	$3,234	$3,715	$0	$0	$0	$0	$6,025	$0	$0	$0	$2,386			$14	
4	CS1UNDS1	$24,630	$618	$3,511	$2,785	$0	$0	$0	$0	$14,256	$0	$0	$0	$3,460			$21	
5	CS1UNDS1	$24,105	$2,463	$7,387	$13,127	$0	$0	$0	$0	$1,128	$0	$0	$0	$0			$20	
1	CS1UNDS2	$29,402	$1,464	$3,895	$2,064	$0	$624	$0	$0	$7,367	$9,192	$0	$0	$4,796	$41,262	$12,834	$25	$34
2	CS1UNDS2	$40,471	$2,609	$6,804	$2,851	$0	$430	$0	$0	$813	$21,564	$0	$0	$5,401			$34	
3	CS1UNDS2	$30,541	$3,101	$5,310	$5,264	$0	$833	$0	$0	$5,956	$1,424	$0	$0	$8,654			$25	
4	CS1UNDS2	$60,994	$14,439	$5,529	$4,104	$0	$0	$0	$0	$14,201	$11,647	$0	$0	$11,073			$51	
5	CS1UNDS2	$44,901	$3,044	$8,931	$20,249	$0	$0	$0	$0	$1,331	$11,346	$0	$0	$0			$37	
1	CS1UNDS3	$110,089	$7,414	$10,117	$16,954	$3,385	$6,725	$0	$971	$5,847	$23,868	$2,512	$2,325	$29,970	$127,344	$30,330	$92	$106
2	CS1UNDS3	$106,808	$38,442	$16,257	$19,814	$0	$0	$0	$1,224	$8,441	$0	$0	$0	$22,630			$89	
3	CS1UNDS3	$110,230	$5,745	$11,564	$19,360	$5,316	$2,770	$0	$1,633	$7,689	$22,151	$2,583	$4,190	$27,229			$92	
4	CS1UNDS3	$178,879	$68,396	$14,057	$22,855	$4,982	$0	$0	$1,391	$14,413	$10,652	$0	$0	$42,133			$149	
5	CS1UNDS3	$130,715	$26,189	$20,253	$51,658	$4,435	$0	$0	$2,577	$6,863	$11,346	$2,867	$4,529	$0			$109	
1	CS1UNDS4	$292,800													$285,189	$96,500	$244	$238
2	CS1UNDS4	$235,936															$197	
3	CS1UNDS4	$220,651															$184	
4	CS1UNDS4	$450,000															$375	
5	CS1UNDS4	$226,558															$189	

Table 3.2 Adjustor estimate data for Case Study Building 2.

Adjustor #	Code	Total RCV	Cripple Wall and Foundation	Exterior Damage	Interior Damage	Windows and Doors	Ceilings	Floors	Roof	Miscellaneous	Chimney	Stairs and Porch	MEP	Indirect Cost	RCV Mean	RCV Standard Deviation	Total RCV ($/SF)	RCV Mean ($/SF)
1	CS2RDS2CW	$17,702	$900	$479	$2,968	$1,341	$0	$0	$0	$8,617	$0	$0	$0	$3,397	$20,888	$5,048	$15	$17
2	CS2RDS2CW	$26,708	$1,446	$1,136	$8,265	$1,168	$0	$0	$0	$6,025	$1,424	$0	$0	$7,244			$22	
4	CS2RDS2CW	$18,254	$900	$451	$2,302	$1,352	$0	$0	$0	$4,506	$5,242	$0	$0	$3,502			$15	
1	CS2RDS3	$118,190	$9,862	$12,269	$35,223	$5,311	$5,888	$4,411	$0	$13,448	$0	$0	$832	$30,947	$128,629	$23,362	$98	$107
3	CS2RDS3	$155,390	$40,289	$19,361	$59,390	$6,581	$0	$0	$2,577	$6,863	$11,346	$2,867	$6,116	$0			$129	
4	CS2RDS3	$112,306	$11,553	$16,217	$32,080	$4,622	$4,989	$0	$1,800	$11,809	$5,242	$0	$1,491	$22,504			$94	
1	CS2UNDS1	$10,327	$0	$0	$2,216	$0	$0	$0	$0	$6,873	$0	$0	$0	$1,238	$14,394	$7,607	$9	$12
2	CS2UNDS1	$16,409	$0	$0	$8,004	$0	$0	$0	$0	$6,025	$0	$0	$0	$2,379			$14	
3	CS2UNDS1	$24,105	$2,463	$7,387	$13,127	$0	$0	$0	$0	$1,128	$0	$0	$0	$0			$20	
4	CS2UNDS1	$6,734	$0	$0	$2,220	$0	$0	$0	$0	$3,385	$0	$0	$0	$1,129			$6	
1	CS2UNDS2	$16,802	$0	$479	$2,968	$1,341	$0	$0	$0	$8,617	$0	$0	$0	$3,397	$20,145	$3,938	$14	$17
2	CS2UNDS2	$25,262	$0	$1,136	$8,265	$1,168	$0	$0	$0	$6,025	$1,424	$0	$0	$7,244			$21	
3	CS2UNDS2	$21,208	$260	$901	$17,433	$1,283	$0	$0	$0	$1,331	$0	$0	$0	$0			$18	
4	CS2UNDS2	$17,309	$0	$451	$2,656	$1,166	$0	$0	$0	$4,506	$5,242	$0	$0	$3,290			$14	
1	CS2UNDS3	$109,184	$2,878	$9,967	$30,029	$5,404	$5,878	$4,411	$0	$17,723	$0	$0	$3,030	$29,865	$118,474	$18,961	$91	$99
3	CS2UNDS3	$140,288	$23,429	$21,119	$59,390	$6,581	$0	$0	$2,577	$6,863	$11,346	$2,867	$6,116	$0			$117	
4	CS2UNDS3	$105,949	$8,341	$11,975	$32,425	$4,622	$4,989	$0	$1,800	$12,895	$5,242	$0	$0	$23,661			$88	
1	CS2UNDS4	$282,000	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$239,432	$29,340	$235	$200
2	CS2UNDS4	$229,675	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0			$191	
3	CS2UNDS4	$214,751	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0			$179	
4	CS2UNDS4	$231,303	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0			$193	

Table 3.3 Adjustor estimate data for Case Study Building 3.

Adjustor #	Code	Total RCV	Cripple Wall and Foundation	Exterior Damage	Interior Damage	Windows and Doors	Ceilings	Floors	Roof	Miscellaneous	Chimney	Stairs and Porch	MEP	Indirect Cost	RCV Mean	RCV Standard Deviation	Total RCV ($/SF)	RCV Mean ($/SF)
1	CS3RDS1	$13,132	$0	$0	$4,494	$0	$0	$0	$0	$7,121	$0	$0	$0	$1,517			$5	
1	CS3RDS2CW	$75,466	$20,318	$17,003	$5,605	$0	$380	$0	$1,611	$9,394	$13,319	$0	$0	$7,835	$90,664	$19,474	$31	$37
2	CS3RDS2CW	$74,076	$4,225	$16,116	$5,984	$0	$0	$0	$0	$10,772	$29,330	$0	$0	$7,649			$30	
3	CS3RDS2CW	$110,538	$415	$16,188	$25,719	$5,307	$6,567	$0	$1,742	$9,992	$29,656	$1,270	$9,032	$4,651			$45	
4	CS3RDS2CW	$113,125	$23,925	$29,099	$7,025	$0	$996	$0	$0	$9,002	$29,444	$0	$0	$13,633			$46	
5	CS3RDS2CW	$80,114	$3,796	$13,953	$7,961	$0	$27	$0	$0	$10,641	$30,515	$0	$0	$13,222			$33	
1	CS3RDS3CW	$252,835	$75,018	$52,638	$27,910	$2,046	$6,505	$0	$1,504	$9,394	$28,863	$320	$2,977	$45,660	$210,604	$53,573	$103	$85
2	CS3RDS3CW	$161,400	$12,719	$30,012	$35,614	$5,185	$3,087	$0	$4,025	$10,936	$28,802	$0	$0	$31,020			$66	
3	CS3RDS3CW	$155,562	$21,001	$19,390	$25,986	$5,307	$6,567	$0	$1,686	$21,371	$29,656	$1,270	$9,032	$14,297			$63	
4	CS3RDS3CW	$275,693	$89,454	$27,485	$50,989	$4,392	$5,884	$0	$2,103	$9,002	$29,444	$1,254	$16,295	$39,391			$112	
5	CS3RDS3CW	$207,528	$22,631	$26,762	$50,412	$5,032	$3,781	$0	$2,303	$11,119	$29,493	$1,342	$0	$54,654			$84	
1	CS3UNDS1	$13,132	$0	$0	$4,505	$0	$0	$0	$0	$7,110	$0	$0	$0	$1,517	$17,552	$4,596	$5	$7
2	CS3UNDS1	$16,687	$0	$0	$4,398	$0	$0	$0	$0	$10,772	$0	$0	$0	$1,517			$7	
3	CS3UNDS1	$23,272	$0	$0	$2,698	$0	$0	$0	$0	$19,487	$0	$0	$0	$1,087			$9	
4	CS3UNDS1	$13,373	$0	$0	$4,353	$0	$0	$0	$0	$7,121	$0	$0	$0	$1,898			$5	
5	CS3UNDS1	$21,298	$0	$0	$5,903	$0	$0	$0	$0	$11,258	$0	$0	$0	$4,137			$9	
1	CS3UNDS2	$75,074	$19,956	$17,003	$5,605	$0	$380	$0	$1,611	$9,348	$13,319	$0	$0	$7,851	$83,576	$16,612	$30	$34
2	CS3UNDS2	$74,076	$4,225	$16,116	$5,984	$0	$0	$0	$0	$10,772	$29,330	$0	$0	$7,649			$30	
3	CS3UNDS2	$77,904	$4,437	$7,786	$7,001	$0	$507	$0	$1,524	$22,426	$31,850	$0	$0	$2,373			$32	
4	CS3UNDS2	$113,146	$23,947	$29,099	$7,025	$0	$996	$0	$0	$9,002	$29,444	$0	$0	$13,633			$46	
5	CS3UNDS2	$77,679	$1,963	$13,953	$7,988	$0	$0	$0	$0	$10,641	$30,515	$0	$0	$12,620			$32	
1	CS3UNDS3	$225,131	$49,956	$52,638	$29,274	$2,046	$6,505	$0	$1,749	$8,030	$28,863	$320	$2,977	$42,772	$196,430	$46,004	$91	$80
2	CS3UNDS3	$160,417	$11,874	$30,012	$35,614	$5,185	$3,087	$0	$4,025	$10,936	$28,802	$0	$0	$30,883			$65	
3	CS3UNDS3	$139,693	$4,660	$26,321	$25,990	$5,307	$6,567	$0	$1,524	$16,324	$29,656	$1,270	$9,032	$13,044			$57	
4	CS3UNDS3	$251,633	$65,393	$27,485	$50,989	$4,392	$5,884	$0	$2,103	$9,002	$29,444	$1,254	$16,295	$39,391			$102	
5	CS3UNDS3	$205,274	$20,376	$26,762	$50,412	$5,032	$3,781	$0	$2,303	$11,119	$29,493	$1,342	$0	$54,654			$83	
2	CS3UNDS4	$476,710	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$504,108	$118,599	$193	$205
3	CS3UNDS4	$677,600	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0			$275	
4	CS3UNDS4	$412,687	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0			$167	
5	CS3UNDS4	$449,434	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0			$182	

3.2 INDIVIDUAL CASE STUDY SCENARIOS

For each individual scenario, the RCV for each adjustor and the mean RCV for the scenario was calculated using the tables in Section 3.1. The tables were used to create histograms comparing the RCV means for each scenario; see Figure 3.2 for an example of one scenario. Additionally, individual cost categories such as the cripple wall and foundation were examined as a percentage of the total RCV; see Figure 3.3 for an example.

The total RCV for each individual scenario was also compared with the results from using *FEMA P-58* cost functions, which provided a mean RCV and a standard deviation, illustrating a range of possible RCV values that might occur.

The main differences between CS1 and CS2 are the exterior siding material, the interior wall materials, and the foundation anchorage. The *FEMA P-58* cost functions for wood-frame structures were originally developed for exterior stucco, interior gypsum wallboard, and exterior plywood. Thus, only CS1 and CS3 were initially assessed using the *FEMA P-58* functions prior to the workshop, with CS2 developed purposefully to gain information on interior plaster on wood lath and exterior wood-siding repair costs. See Table 3.4 for the *FEMA P-58* results from CS1 and Table 3.5 for the *FEMA P-58* results from CS3. In addition, the *FEMA P-58* functions do not have as much refinement in available cost categories compared to Xactimate. Thus, some cost categories using *FEMA P-58* functions have a zero value, even though there is damage in that category and associated cost built into the function for a particular wall or material unit.

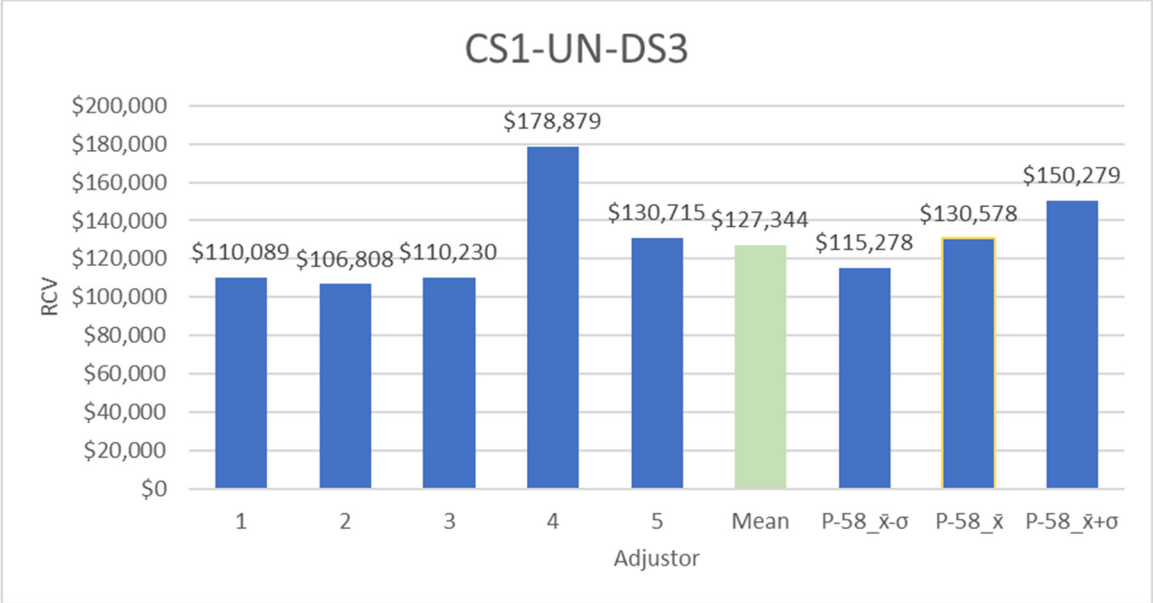


Figure 3.2 **Example of RCV comparison of one scenario (Case Study Building 1, unretrofitted, in Damage State 3).**

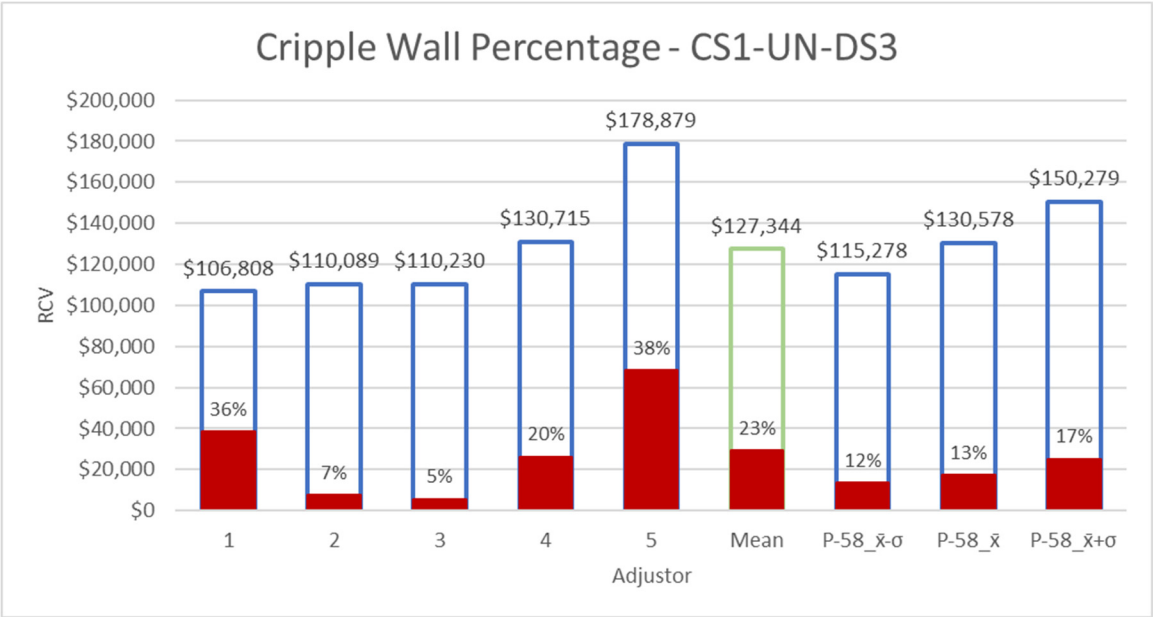


Figure 3.3 **Example of cripple wall percentage of RCV for one scenario (Case Study Building 1, unretrofitted, Damage State 3). Total costs are in the unfilled boxes. The red filled boxes and associated percentages give the cripple wall percentage of total cost.**

Table 3.4 ***FEMA P-58*** **estimate data for Case Study Building 1.**

Code	Total RCV	Cripple Wall and Foundation	Exterior Damage	Interior Damage	Windows and Doors	Ceilings	Floors	Roof	Miscellaneous	Chimney	Stairs and Porch	MEP	Indirect Cost
CS1UNDS1RC-β	$16,129	$2,949	$7,864	$4,693	$0	$0	$0	$0	$623	$0	$0	$0	$0
CS1UNDS1RC	$22,914	$3,811	$10,165	$8,137	$0	$0	$0	$0	$800	$0	$0	$0	$0
CS1UNDS1RC+β	$30,624	$4,927	$13,139	$11,582	$0	$0	$0	$0	$977	$0	$0	$0	$0
CS1UNDS2RC-β	$27,897	$4,269	$11,481	$9,200	$0	$0	$0	$0	$2,947	$0	$0	$0	$0
CS1UNDS2RC	$43,260	$5,518	$16,606	$17,896	$0	$0	$0	$0	$3,240	$0	$0	$0	$0
CS1UNDS2RC+β	$62,153	$7,982	$24,018	$26,591	$0	$0	$0	$0	$3,562	$0	$0	$0	$0
CS1UNDS3RC-β	$115,278	$13,476	$46,655	$52,201	$0	$0	$0	$0	$2,947	$0	$0	$0	$0
CS1UNDS3RC	$130,578	$17,418	$52,408	$57,511	$0	$0	$0	$0	$3,240	$0	$0	$0	$0
CS1UNDS3RC+β	$150,279	$25,194	$58,162	$63,361	$0	$0	$0	$0	$3,562	$0	$0	$0	$0
CS1UNDS4RC-β	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
CS1UNDS4RC	$240,000	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
CS1UNDS4RC+β	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0

Table 3.5 ***FEMA P-58*** **estimate data for Case Study Building 3.**

Code	Total ACV	Cripple Wall and Foundation	Exterior Damage	Interior Damage	Windows and Doors	Ceilings	Floors	Roof	Miscellaneous	Chimney	Stairs and Porch	MEP	Indirect Cost
CS3UNDS1RC-β	$6,016	$0	$0	$4,146	$0	$0	$0	$0	$1,870	$0	$0	$0	$0
CS3UNDS1RC	$9,590	$0	$0	$7,190	$0	$0	$0	$0	$2,400	$0	$0	$0	$0
CS3UNDS1RC+β	$13,163	$0	$0	$10,233	$0	$0	$0	$0	$2,930	$0	$0	$0	$0
CS3UNDS2RC-β	$38,496	$6,363	$15,163	$8,129	$0	$0	$0	$0	$8,841	$0	$0	$0	$0
CS3UNDS2RC	$55,688	$8,224	$21,931	$15,812	$0	$0	$0	$0	$9,720	$0	$0	$0	$0
CS3UNDS2RC+β	$77,799	$11,895	$31,721	$23,495	$0	$0	$0	$0	$10,686	$0	$0	$0	$0
CS3UNDS3RC-β	$183,775	$15,460	$47,438	$112,036	$0	$0	$0	$0	$8,841	$0	$0	$0	$0
CS3UNDS3RC	$206,424	$19,983	$53,287	$123,434	$0	$0	$0	$0	$9,720	$0	$0	$0	$0
CS3UNDS3RC+β	$234,717	$28,903	$59,137	$135,990	$0	$0	$0	$0	$10,686	$0	$0	$0	$0
CS3UNDS4RC-β	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
CS3UNDS4RC	$492,800	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
CS3UNDS4RC+β	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0

Tables 3.1–3.5 were used to create histograms comparing the adjustor estimate RCV values to the *FEMA P-58* range of possible RCV values that might occur; see Figure 3.4 for an example of one scenario.

Typically, all adjustor estimates were within the *FEMA P-58* range. For example, the adjustor range went from $29,402 to $60,994, and the *FEMA P-58* mean minus/plus a standard deviation range was from $27,897 to $62,153. The mean values were quite close with an adjustor mean of $41,262 and the *FEMA P-58* mean at $43,260.

The *FEMA P-58* results were also compared for particular cost categories; see Figure 3.5 for a comparison between adjustor totals and *FEMA P-58* results highlighting the cripple wall percentage of the total cost. For example, the mean total cost for adjusters was $41,262, with 12% of that value as the cripple wall and foundation cost.

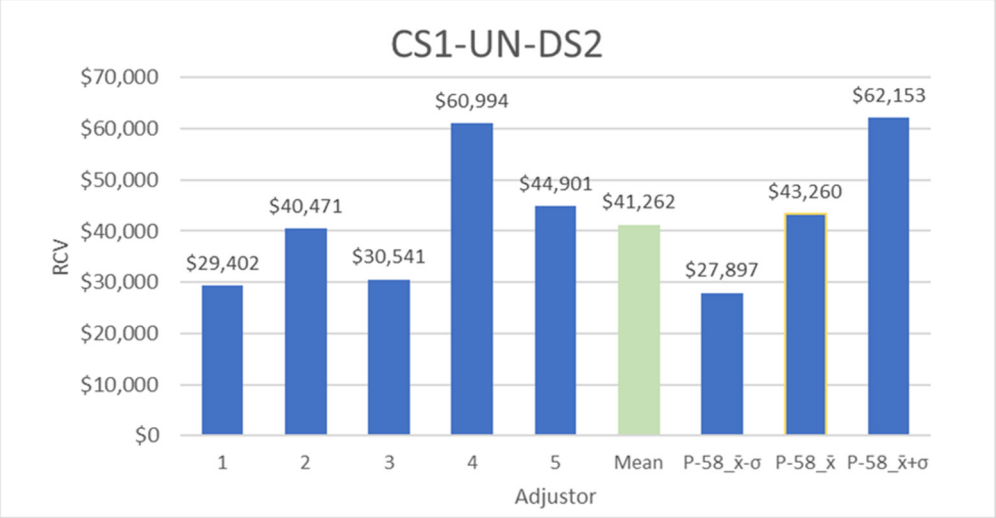


Figure 3.4 Example of adjustor estimate comparison with *FEMA P-58* for Case Study Building 1, unretrofitted, Damage State 2.

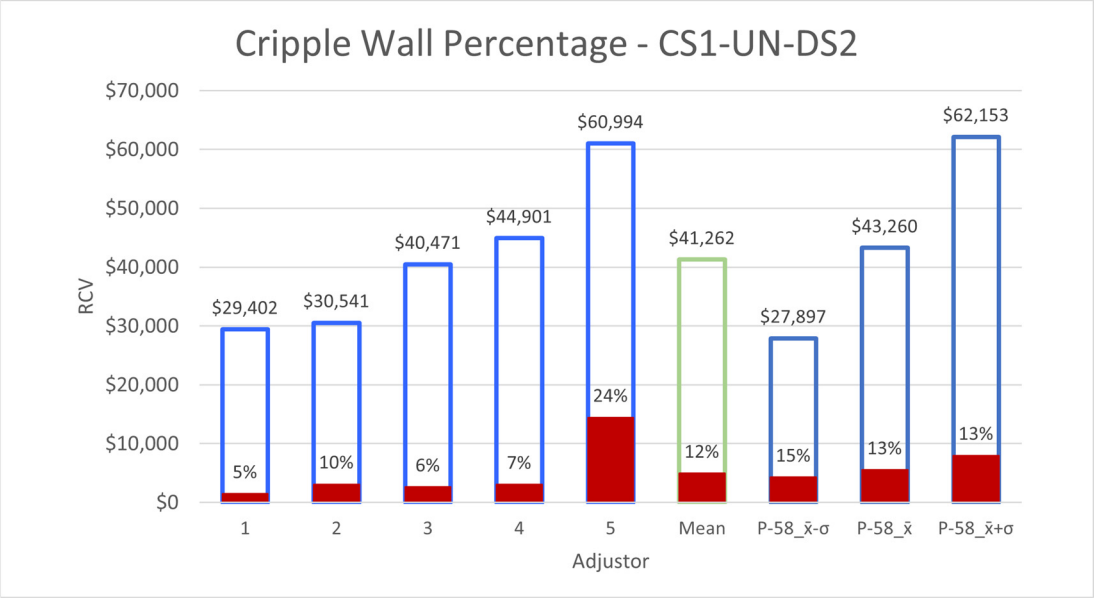


Figure 3.5 **Example of adjustor estimate comparison with *FEMA P-58* results for Case Study Building 1, unretrofitted, Damage State 2. Total costs are in the unfilled boxes. The red filled boxes and associated percentages give the cripple wall percentage of total cost.**

3.3 CASE STUDY COMPARISONS

3.3.1 RCV Means for Unretrofitted Case Study Buildings

The RCV means for the three unretrofitted versions of each case study building at each of the four damage states are calculated and compared in Table 3.6.

Table 3.6 was used to create histograms comparing the RCV means for the four damage states; see Figure 3.6, Figure 3.7, and Figure 3.8 for the adjustor RCV means of each damage state for the three case study buildings. In Figure 3.6, there were five estimates for submitted for each damage state for CS1. In Figure 3.7 for CS2, there were four estimates for submitted for Damage States 1, 2, and 4. There were three estimates submitted for Damage State 3 for CS2. In Figure 3.8, there were five estimates for submitted for each damage state for CS3.

Table 3.6 **RCV means for each damage state and the unretrofitted case study buildings.**

Case Study	CS1-UN	CS2-UN	CS3-UN
DS1	$17,774	$14,394	$17,552
DS2	$41,262	$20,145	$83,576
DS3	$127,344	$118,474	$196,430
DS4	$285,189	$239,432	$504,108

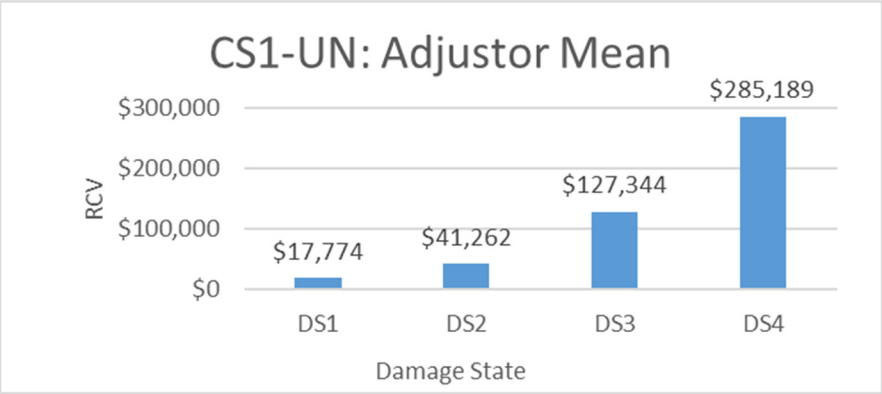


Figure 3.6 **Adjustor RCV means of each damage state for the unretrofitted Case Study Building 1.**

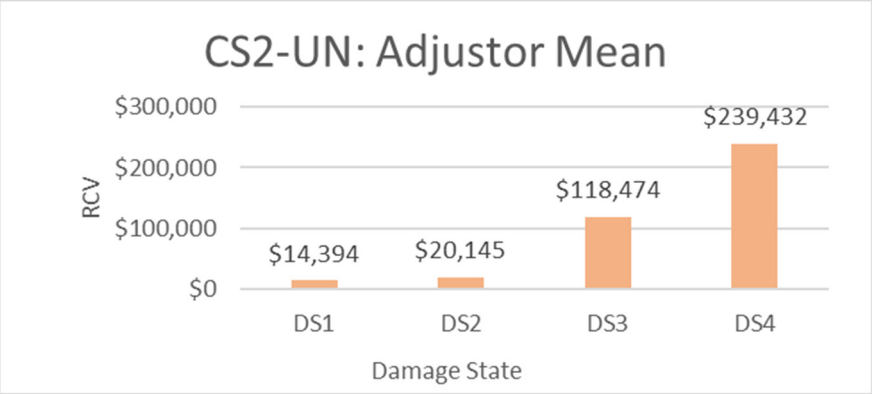


Figure 3.7 **Adjustor RCV means of each damage state for the unretrofitted Case Study Building 2.**

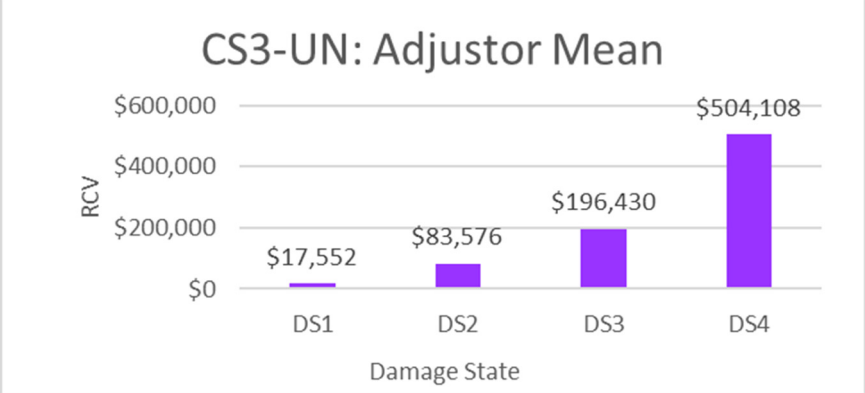


Figure 3.8 **Adjustor RCV means of each damage state for the unretrofitted Case Study Building 3.**

Case Study Building 3 was two stories with 2464 square feet, while CS1 and CS2 were one-story, 1200 square foot residences. In order to compare the three case studies, the RCV means were normalized by RCV mean per square foot; see Table 3.7 for RCV means per square foot for each damage state; see Figure 3.9 for a comparison of the RCV mean per square foot of all three case studies. Case Study Building 1 had a higher RCV per square foot at every damage state.

The standard deviation for each case study was also calculated; see Figure 3.10 for the standard deviation per square foot for each damage state. Case Study Building 1 had the highest dispersion of data at each damage state. Typically, CS3 had the second highest dispersion of data, with the exception of Damage State 1.

Table 3.7 RCV means per square foot for each damage state and the unretrofitted case study buildings.

Case Study	CS1-UN	CS2-UN	CS3-UN
DS1	$15	$12	$7
DS2	$34	$17	$34
DS3	$106	$99	$80
DS4	$238	$200	$205

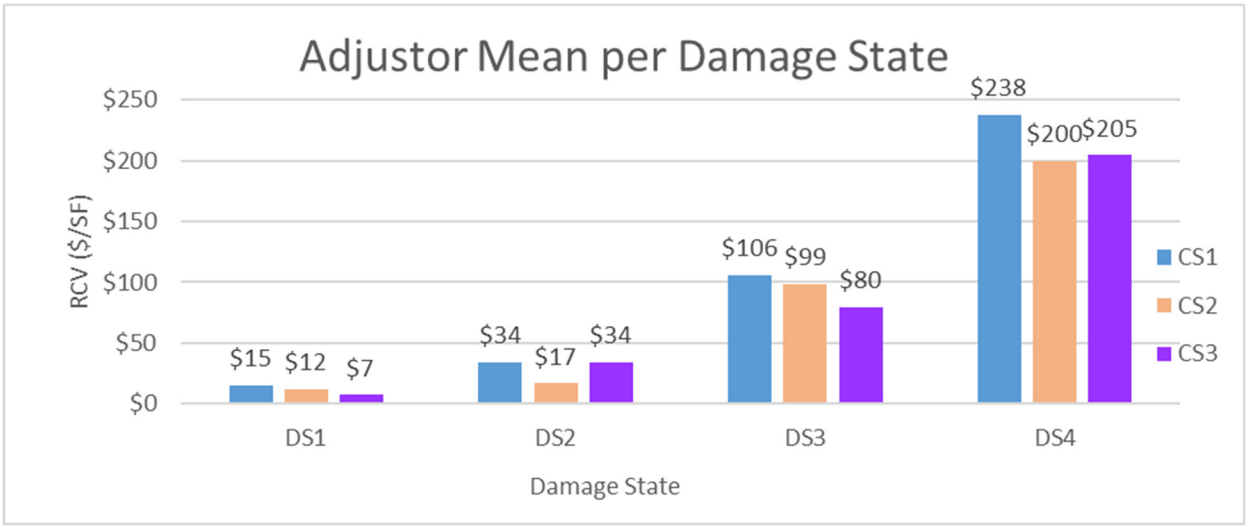


Figure 3.9 Adjustor RCV means per square foot of each damage state for all three case study buildings.

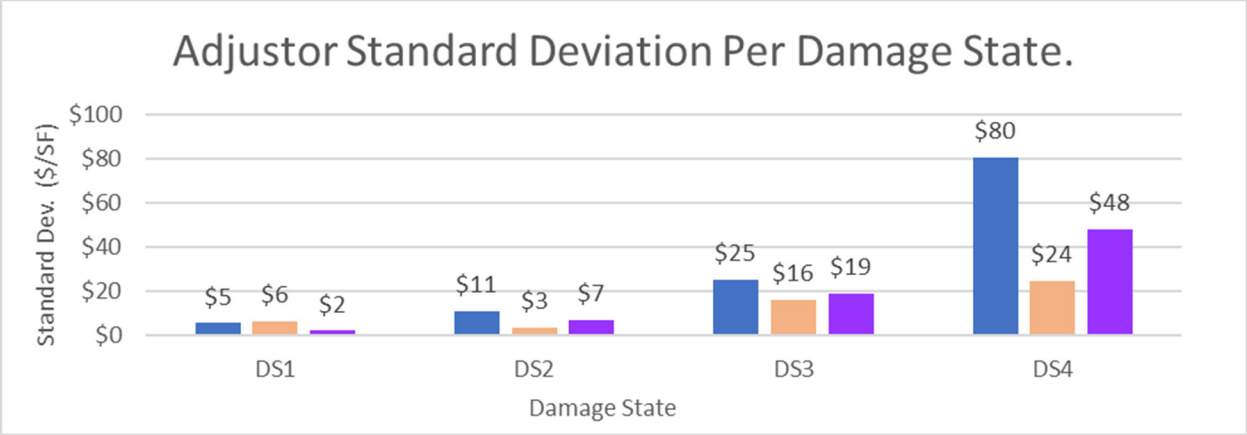


Figure 3.10 **Adjustor RCV standard deviation per square foot of each damage state for all three case study buildings.**

3.3.2 RCV Means for Cripple Wall and Indirect Cost Percentages

The cripple wall and foundation cost category and the indirect cost category were investigated as a percentage of the total RCV; see Figure 3.11 to Figure 3.16 for cripple wall and indirect cost percentages for each damage state. The unfilled blue box is the total RCV. The red and green filled boxes and associated percentages are the percentages of the total from the cripple wall and foundation costs (red) and indirect costs (green).

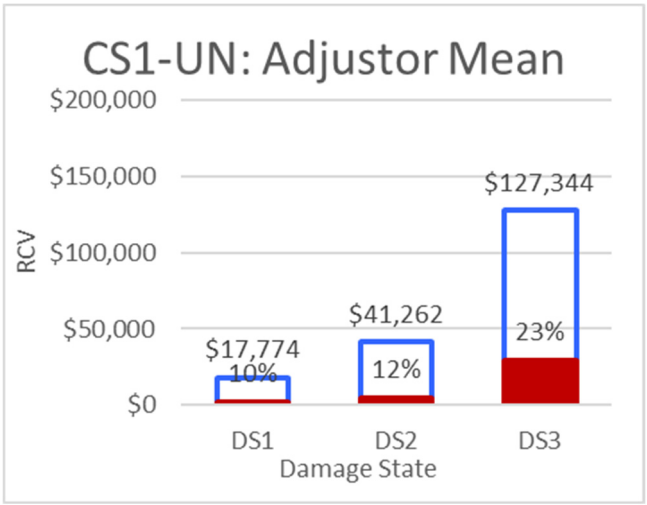


Figure 3.11 **Case Study Building 1: cripple wall percentage. Total costs are in the unfilled boxes. The red filled boxes and associated percentages give the cripple wall percentage of total cost.**

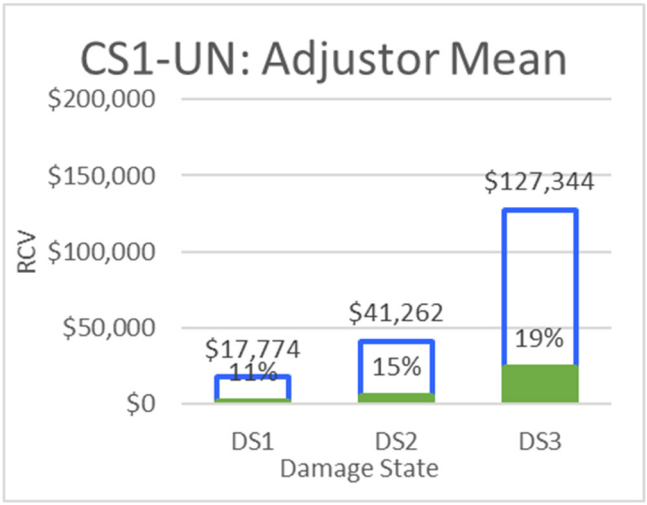


Figure 3.12 **Case Study Building 1: indirect cost percentage. Total costs are in the unfilled boxes. The green filled boxes and associated percentages give the indirect portion of total cost.**

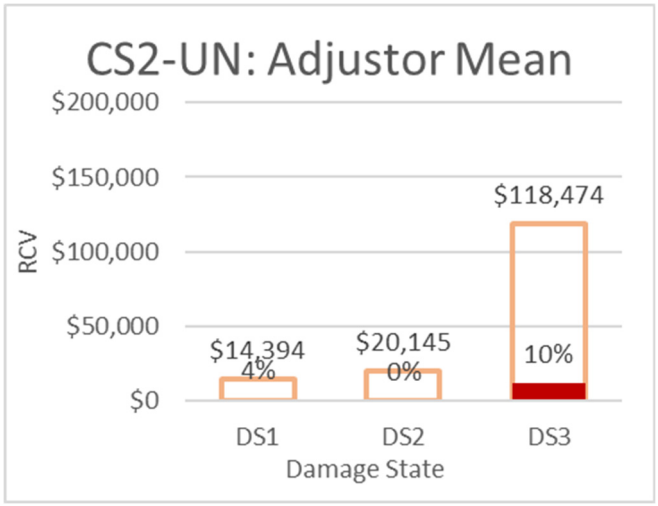


Figure 3.13 **Case Study Building 2: cripple wall percentage. Total costs are in the unfilled boxes. The red filled boxes and associated percentages give the cripple wall portion of total cost.**

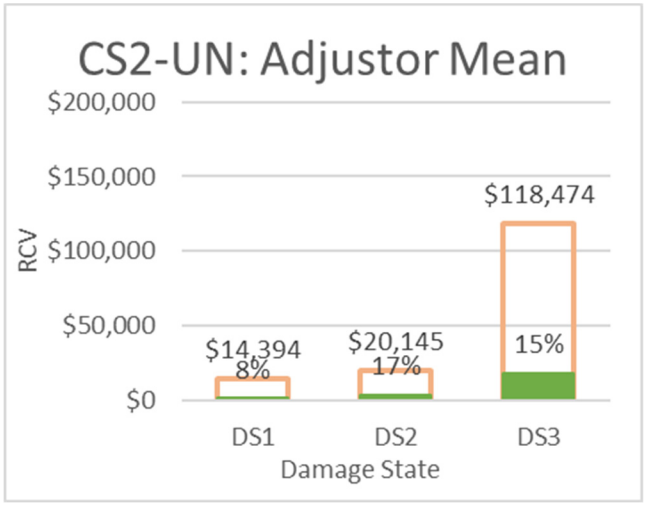


Figure 3.14 **Case Study Building 2: indirect cost percentage. Total costs are in the unfilled boxes. The green filled boxes and associated percentages give the indirect portion of total cost.**

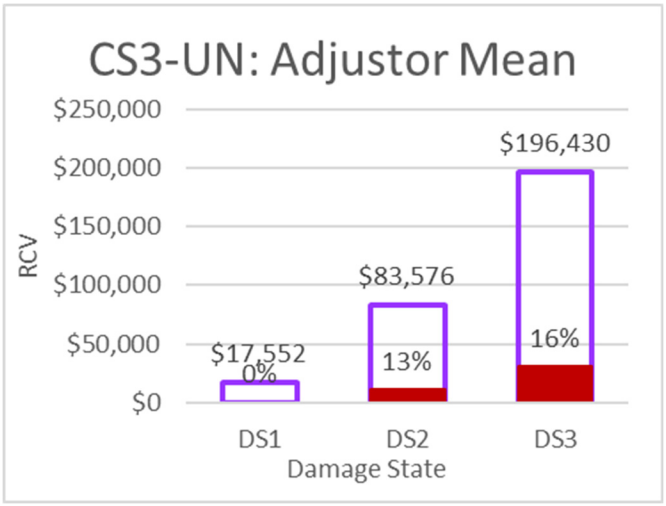


Figure 3.15 **Case Study Building 3: cripple wall percentage. Total costs are in the unfilled boxes. The red filled boxes and associated percentages give the cripple wall percentage of total cost.**

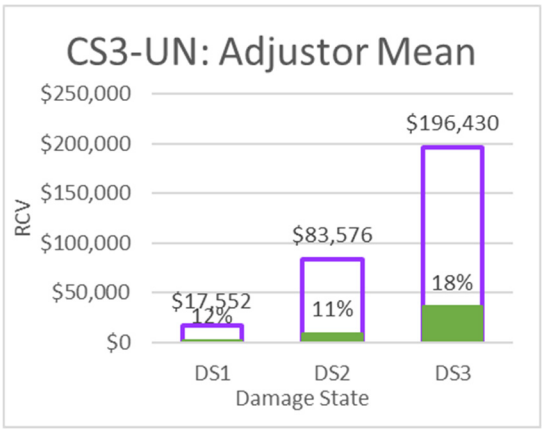


Figure 3.16 **Case Study Building 3: indirect cost percentage. Total costs are in the unfilled boxes. The green filled boxes and associated percentages give the indirect portion of total cost.**

Means for each case study for the cripple wall and foundation category alone were also calculated; see Figure 3.17. Means for each case study for indirect cost category alone were also calculated; see Figure 3.18.

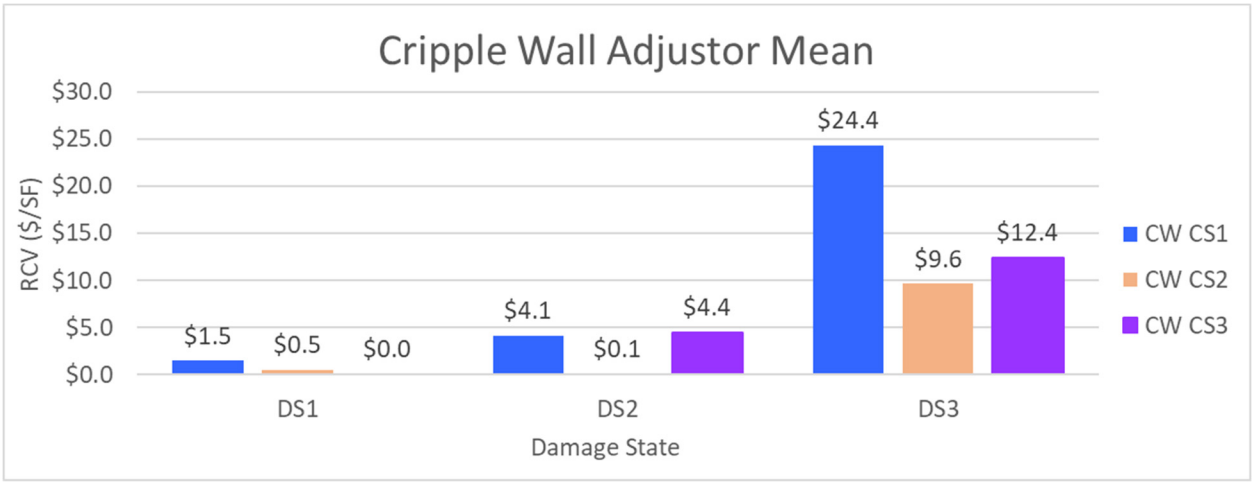


Figure 3.17 **Adjustor cripple wall mean for each damage state normalized per square foot for each unretrofitted case study building.**

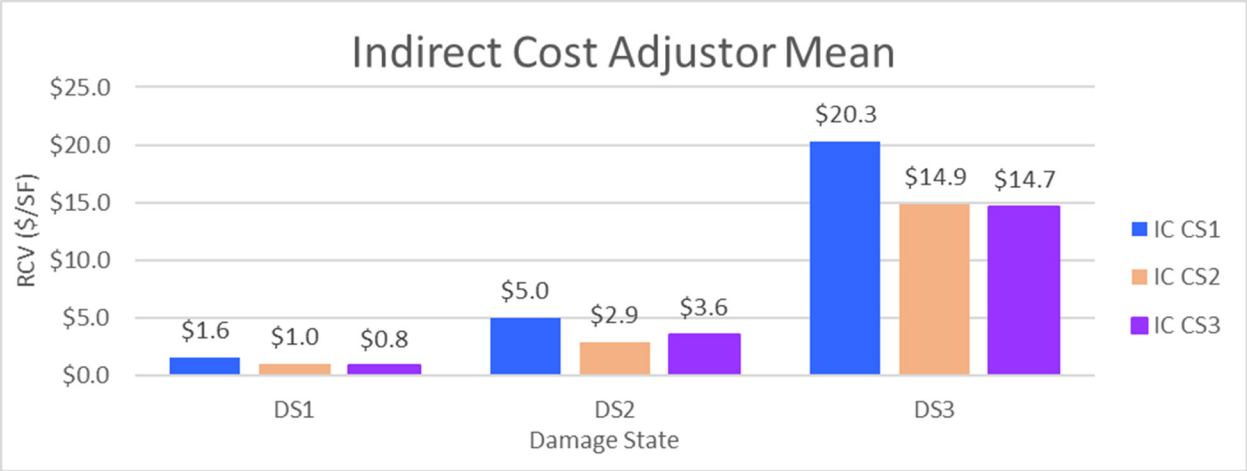


Figure 3.18 **Adjustor indirect cost mean for each damage state normalized per square foot for each unretrofitted case study building.**

3.4 UNRETROFITTED VS. RETROFITTED CONDITIONS

The total RCV was compared for the unretrofitted versus retrofitted cripple wall conditions as well; see Figure 3.19 for the total RCV for CS1 and Damage State 3 and Figure 3.20 for the RCV mean per square foot and cripple wall percentage of the total RCV.

The unretrofitted versus retrofitted cripple wall conditions were compared for Damage State 2 and Damage State 3 for CS2; see Figure 3.21 for the total RCV for Damage State 2 and Figure 3.22 for the RCV mean per square foot and cripple wall percentage of the total RCV estimate for Damage State 2; see Figure 3.23 for the total RCV for CS2 and Damage State 3 and Figure 3.24 for the RCV mean per square foot and cripple wall percentage of the total RCV.

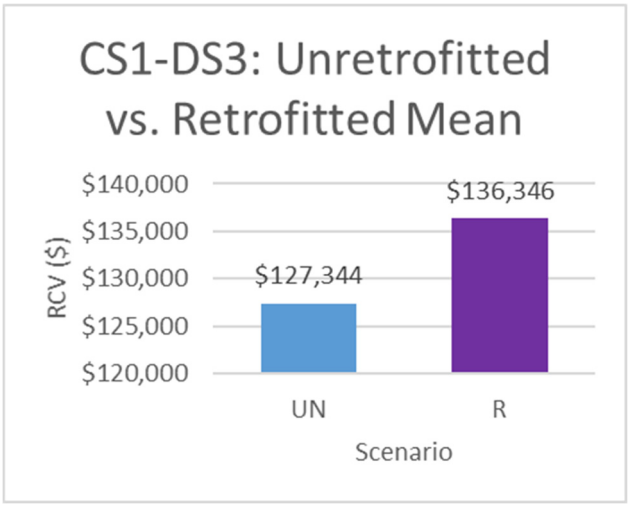


Figure 3.19 **Case Study Building 1: DS3 unretrofitted vs. retrofitted RCV.**

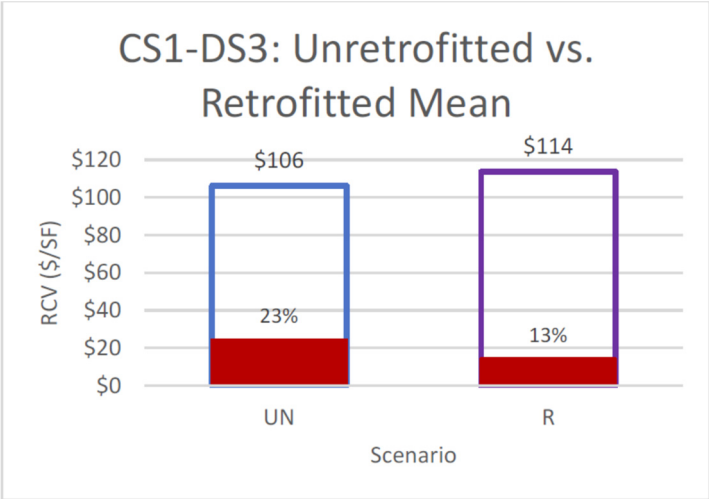


Figure 3.20 **Case Study Building 1: DS3 unretrofitted vs. retrofitted RCV/SF with cripple wall percentage. Total costs are in the unfilled boxes. The red filled boxes and associated percentages give the cripple wall percentage of total cost.**

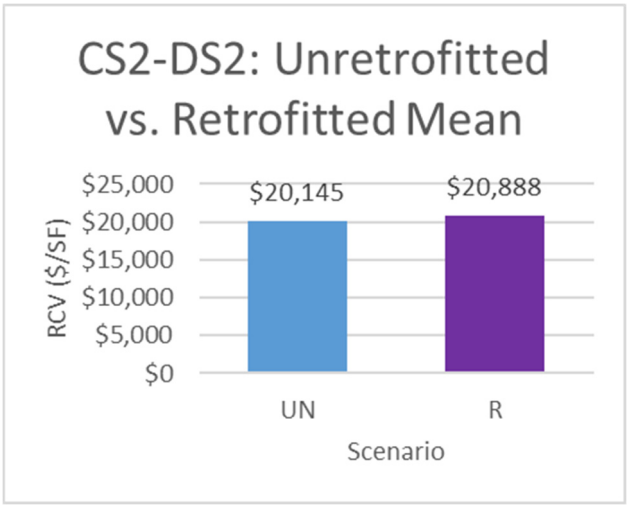


Figure 3.21 **Case Study Building 2: DS2 unretrofitted vs. retrofitted RCV.**

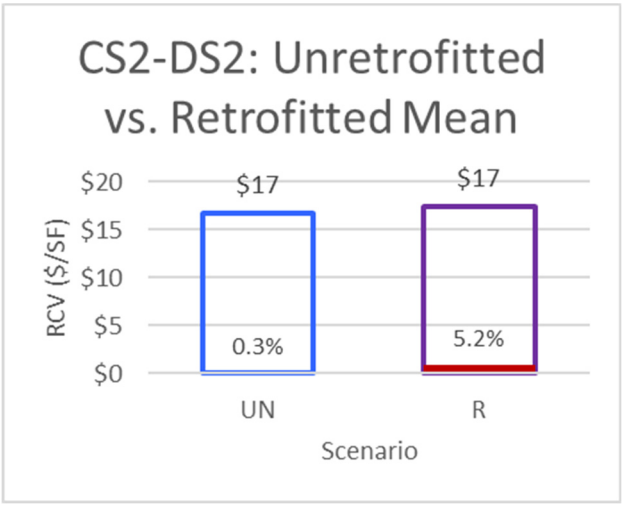


Figure 3.22 **Case Study Building 2: DS2 unretrofitted vs. retrofitted RCV/SF with cripple wall percentage. Total costs are in the unfilled boxes. The red filled boxes and associated percentages give the cripple wall percentage of total cost.**

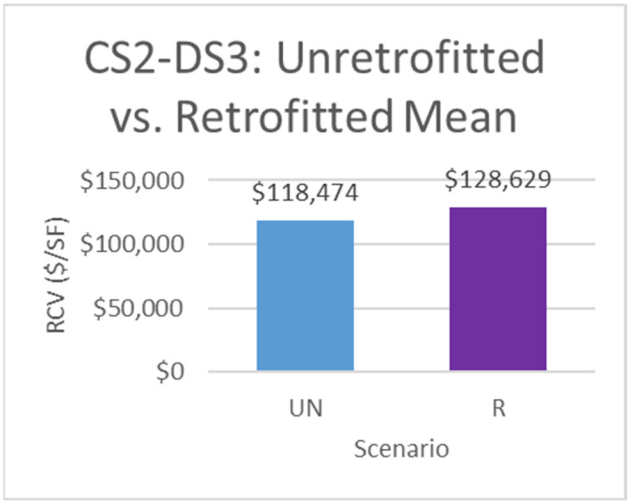


Figure 3.23 **Case Study Building 2: DS3 unretrofitted vs. retrofitted RCV.**

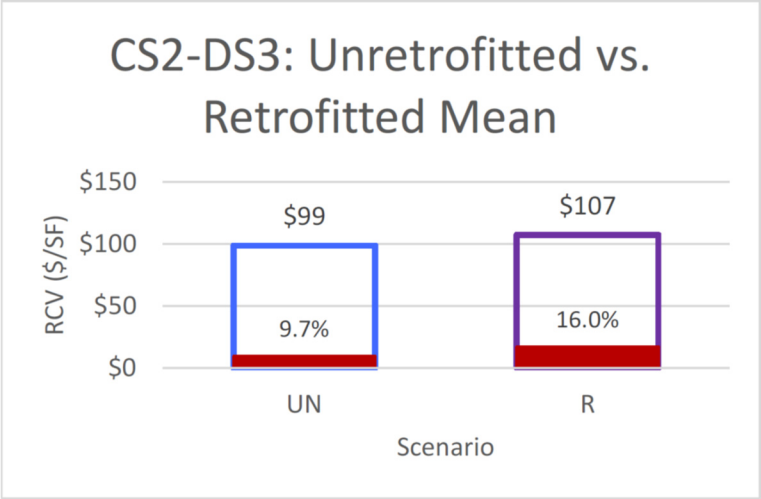


Figure 3.24 **Case Study Building 2: DS3 unretrofitted vs. retrofitted RCV/SF with cripple wall percentage. Total costs are in the unfilled boxes. The red filled boxes and associated percentages give the cripple wall percentage of total cost.**

The unretrofitted versus retrofitted cripple wall conditions were also compared for Damage State 2 and Damage State 3 for CS3; see Figure 3.25 for the total RCV for Damage State 2; see Figure 3.26 for the RCV mean per square foot and cripple wall percentage of total RCV; see Figure 3.27 for the total RCV for CS3 and Damage State 3 and Figure 3.28 for the RCV mean per square foot and cripple wall percentage of total RCV.

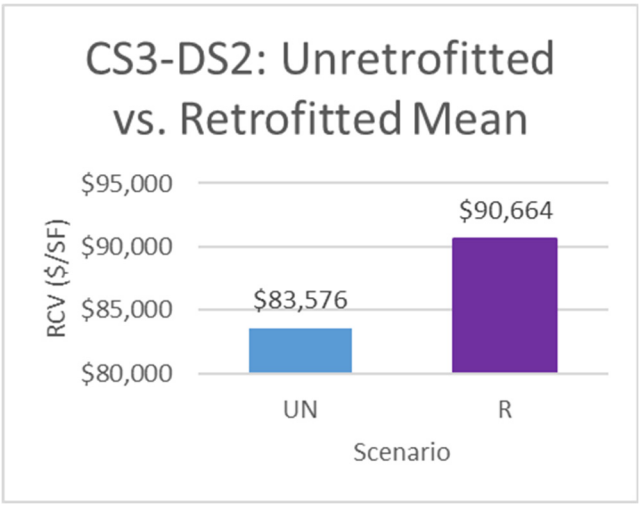


Figure 3.25 **Case Study Building 3: DS2 unretrofitted vs. retrofitted RCV.**

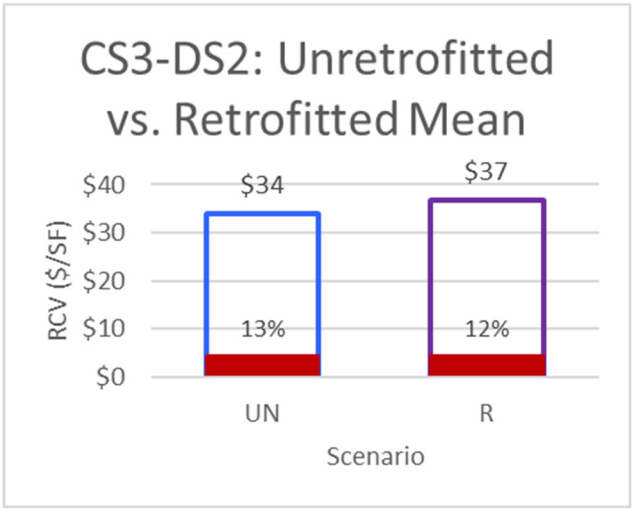


Figure 3.26 **Case Study Building 3: DS2 unretrofitted vs. retrofitted RCV/SF with cripple wall percentage. Total costs are in the unfilled boxes. The red filled boxes and associated percentages give the cripple wall percentage of total cost.**

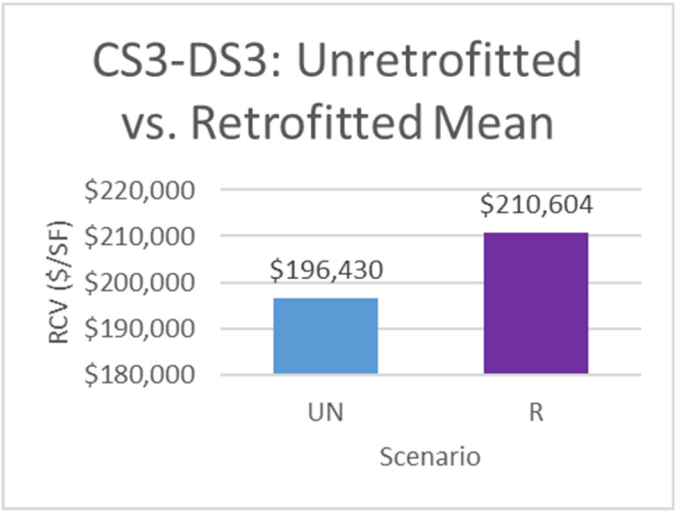


Figure 3.27 **Case Study Building 3: DS3 unretrofitted vs. retrofitted RCV.**

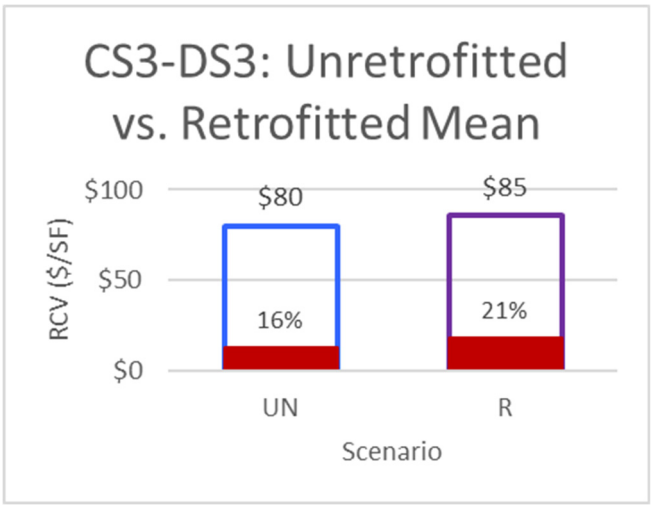


Figure 3.28 **Case Study Building 3: DS3 unretrofitted vs. retrofitted RCV/SF with cripple wall percentage. Total costs are in the unfilled boxes. The red filled boxes and associated percentages give the cripple wall percentage of total cost.**

3.5 XACTIMATE VS. *FEMA P-58* ESTIMATES

The RCV means for each damage state from the claims adjustor Xactimate estimates were compared to the *FEMA P-58* means for each damage state for the unretrofitted versions of CS1 and CS3; see Figure 3.29 for CS1 results; see Figure 3.30 for CS3 results. Note: the results are quite similar.

In order to compare CS1 and CS3 results, the means were normalized by cost per square foot; see Figure 3.31 for the mean RCV per square foot cost for CS1 and CS3 at all damage states.

Though the adjustors and the users of the *FEMA P-58* functions used different tools to complete their estimates, ultimately the adjustor estimates aligned very closely with the *FEMA P-58* results. A key factor that contributed to this alignment was that all participants had a deep understanding of the assumptions before completing their final estimates.

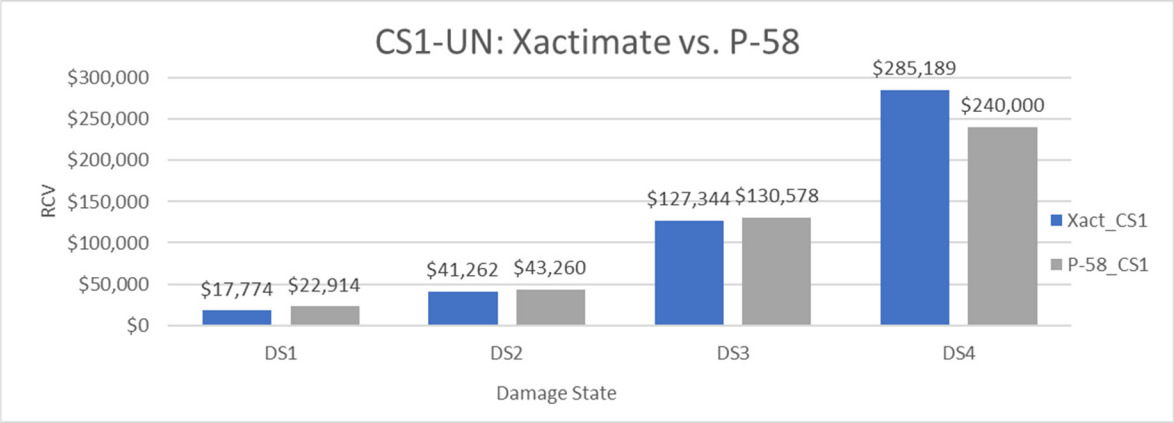


Figure 3.29 **Unretrofitted Case Study Building 1: RCV means and *FEMA P-58* means comparison.**

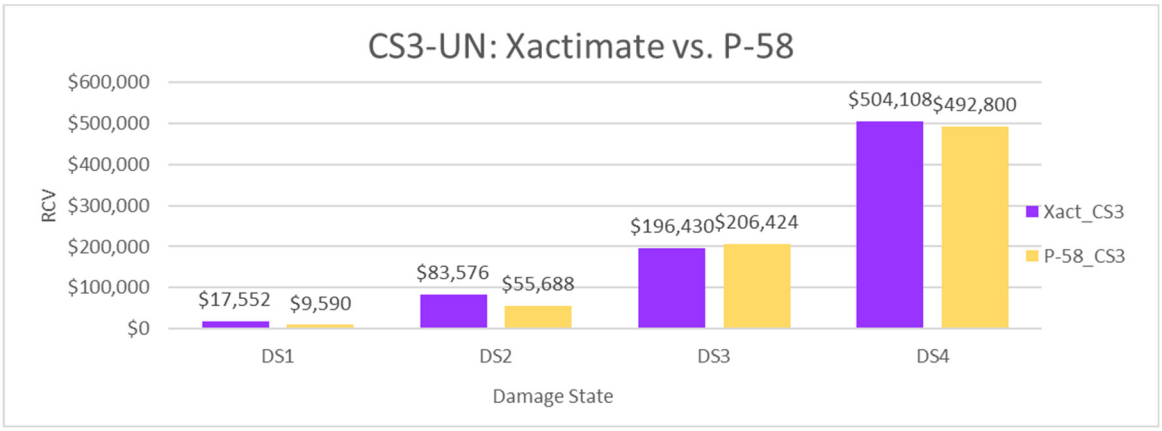


Figure 3.30 **Unretrofitted Case Study Building 3: RCV means and *FEMA P-58* means comparison.**

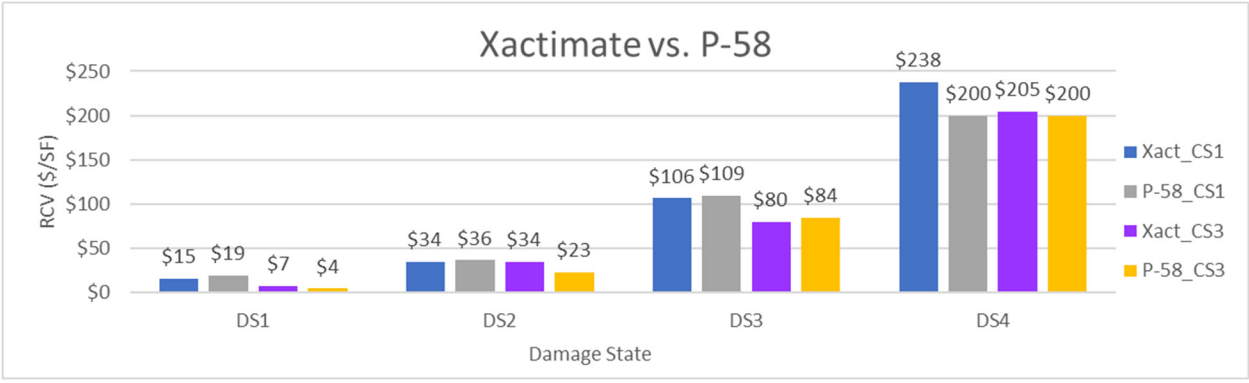


Figure 3.31 **RCV means and *FEMA P-58* means comparison for unretrofitted CS1 and CS3.**

3.6 LATH AND PLASTER ADJUSTMENT FIGURES

Case Study Building 1 and CS2 have the same floor plan but used different interior materials. Case Study Building 1 has standard 1/2-in. gypsum wallboard with normal painted finish. Alternatively, CS2 has 7/8-in. plaster on wood lath (3/8-in. lath with 1/2-in. plaster) instead of gypsum wallboard with normal paint finish. The *FEMA P-58* cost functions do not cover plaster on wood lath and thus do not address these subtle differences between repairs for gypsum wallboard vs. lath and plaster. Therefore, an adjustment factor for the lath and plaster was developed to account for the added cost of interior materials for CS2. This adjustment factor could be applied to the *FEMA P-58* interior damage category for CS1 to determine equivalent results for CS2.

The adjustment factor was developed for each damage state. For Damage States 1 and 2, the interior damage category is limited to interior wall finish repair. Therefore, the adjustment factor was found by comparing the interior damage mean from adjustors for CS1 vs. CS2 at each damage state. For example, the adjustment for Damage State 1 is as follows.

Interior damage category mean for CS1-UN-DS1 = $4,935

Interior damage category mean for CS2-UN-DS1 = $6,392

CS2/CS1 adjustment factor for interior damage, DS1 = ($6,392) / ($4,935) = 1.30

The same procedure is used for Damage State 2.

Interior damage category mean for CS1-UN-DS2 = $6,906

Interior damage category mean for CS2-UN-DS1 = $7,830

CS2/CS1 adjustment factor for interior damage, DS2 = ($7,830) / ($6,906) = 1.13

For Damage State 3, the interior damage category includes more line items than wall finish repair alone. It also includes trim repair, repair to partition framing, and replacement of studs. In order to determine the adjustment factor for CS3, an example using the living room from both buildings was performed; see Table 3.8 for living room interior wall repair comparison of CS1 and CS2 for Damage State 3.

Table 3.8 Comparison of living room interior wall repair of Case Study Building 1 and Case Study Building 2 for Damage State 3.*

Case Study 2: Remove damaged lath and plaster, replace with gypsum wallboard		Case Study 1: Remove damaged gypsum wallboard, replace with gypsum wallboard	
Line Item	**Cost**	**Line Item**	**Cost**
Sheathing - plywood @ 3/8 in.	$830.24	Sheathing - plywood @ 3/8 in.	$830.24
Tear off plaster on wood lath	$1,385.36		
1/2-in.- drywall - hung, taped, floated, ready for paint	$1,355.58	R&R 1/2-in. drywall - hung, taped, ready for texture	$1,136.90
5/8-in. drywall - hung, taped, floated, ready for paint	$1,035.13	5/8-in. drywall - hung, taped, floated, ready for paint	$1,035.13
Texture drywall - machine	$277.84	Texture drywall - machine	$277.84
Seal/prime then paint the walls (2 coats)	$498.23	Seal/prime then paint the walls (2 coats)	$498.23
Seal/prime then paint the ceiling (2 coats)	$365.96	Seal/prime then paint the ceiling (2 coats)	$365.96
Blown-in insulation – 12 in. depth - R30	$ 361.01	Blown-in insulation – 12 in. depth - R30	$361.01
Detach & reset light fixture	$88.60	Detach & reset light fixture	$88.60
Detach & reset exterior door - metal insulated- flush or panel style	$201.05	Detach & reset exterior door - metal insulated- flush or panel style	$201.05
R&R door opening (jamb & casing) – 32 in. to 36 in. - paint grade	$154.73	R&R door opening (jamb & casing) – 32 in. to 36 in. - paint grade	$154.73
R&R door hinges (set of 3)	$74.20	R&R door hinges (set of 3)	$74.20
R&R door lockset & deadbolt - exterior	$131.61	R&R door lockset & deadbolt - exterior	$131.61
Paint door/window trim and jamb - coats (per side)	$90.66	Paint door/window trim and jamb - coats (per side)	$90.66
Casing – 3-1/4 in.	$166.13	Casing – 3-1/4 in.	$166.13
Paint door/window trim & jamb - 2 coats (per side)	$90.66	Paint door/window trim & jamb - 2 coats (per side)	$90.66
R&R baseboard – 5-1/4 in. w/shoe	$478.12	R&R baseboard – 5-1.4 in. w/shoe	$478.12
Paint baseboard w/cap &/or shoe two coats	$128.29	Paint baseboard w/cap &/or shoe two coats	$128.29
Reglaze window, 17–24 sf	$545.17	Reglaze window, 17–24 sf	$545.17
Carpenter - general framer - per hour	$119.66	Carpenter - general framer - per hour	$119.66
Total	**$8,378.23**	**Total**	**$6,774.19**

* The CS2/CS1 adjustment factor for lath and plaster, DS3 = ($8,378)/($6,774) = 1.24; see Table 3.9 for a summary of the lath and plaster adjustment factors for each damage state.

Table 3.9 Lath and plaster adjustment factors for Case Study Building 2.

	CS1	CS2	CS2/CS1
	Interior Damage	**Interior Damage**	**Interior Damage**
DS1	$4,935	$6,392	**1.30**
DS2	$6,906	$7,830	**1.13**
DS3 Living room only	$6,774	$8,378	**1.24**

4 Conclusions

4.1 SPEAKING THE SAME LANGUAGE

The damage workshop effort, including the survey question responses and discussions at the online damage workshop, reinforced the observation that cost estimates used by design teams, claims adjustor estimates, loss estimates such as those from HAZUS [FEMA 2003] or *FEMA P-58* [FEMA 2012], and insurance catastrophe modeler damage function estimates are all conducted by different people with different perspectives using different processes to produce different products. When these different disciplines come together, if representatives from one discipline do not fully understand the assumptions made by the other disciplines, they will not have consistent results or a clear understanding of all facets of the process. The difference in the adjustor estimates before and after the workshop is evidence of this. Revisions in estimating instructions led to meaningful changes in the results. It was also a surprise that some basic assumptions used by some disciplines, such as the use of escalation, are not part of the practice or even terms used by other disciplines. It is important to try to speak the same language in order to better understand one another's work. The damage workshop conversations helped to shed light on this need.

4.2 DETAILED ESTIMATING ASSUMPTIONS ARE NECESSARY

Working Group 6 members included practitioners with substantial experience in reviewing cost estimates for design projects and in regional loss estimation. It was well understood before the damage workshop effort that detailed estimating assumptions would be required to define what to include and what not to include in the estimates. Significant review was made of the assumptions prior to the workshop by CEA advisors, experts in claims adjusting and the use of Xactimate, and insurance catastrophe modelers. Nonetheless, despite this effort, the process still revealed a significant number of refinements and directives needed to achieve improved clarity and consistency. Some examples included: (1) when to replace building paper after damaged stucco is demolished and repaired; (2) the extent of repairs to apply for different levels of damaged and racked cripple walls, and (3) how to handle contingencies, utility costs, and additional living expenses during repair work. Loss estimate studies should be viewed with an eye to this issue. Do they define their terms? Do they list the estimating assumptions there were made? Are the assumptions realistic?

4.3 ESTIMATE RESULTS FROM ADJUSTORS ARE SIMILAR TO RESULTS USING THE *FEMA P-58* METHODOLOGY

Even though the methods and tools used by claims adjustors and *FEMA P-58* are different, and even though there are cost categories missing in *FEMA P-58* that are used by claims adjustors, the bottom line results at both the building level and at key component levels, such as the cripple wall and foundation, were similar for both methods. This was something of a surprise, and it was carefully examined. As a result, the Project Team concluded that general revisions to the *FEMA P-58* results were not needed beyond adjustments made following careful review of existing *FEMA P-58* functions prior to workshop assessments.

4.4 SOME KEY ASSUMPTIONS MUST BE RECOGNIZED TO MAKE COMPARISONS

Using the damage workshop results for comparisons with damage functions used by insurance catastrophe modelers requires recognizing some key assumptions, including:

- Demand surge caused by increased labor and material pricing after a major earthquake was deliberately not included in the adjustor estimates because it is understood that catastrophe modelers address demand surge separately from the basic loss functions.
- There are special features that will increase costs and that are not common in individual buildings but are represented by a portion of the buildings in the community. Adjustors were directed to exclude such features in their estimates for consistency and simplicity. These include buildings with high-end finishes; concrete foundation damage; sidewalk and driveway damage; possible building code upgrades required by local building officials; damage from liquefaction, lateral spreading, and fault rupture; additional special inspection and testing; legal fees; hazardous materials besides lead paint and asbestos, like mold, soil contamination, and radon; premiums for historic buildings; ADA upgrade costs; increased costs if access and utilities at the site are compromised; construction management costs; and financing costs. If these factors were included, the median repair cost would likely rise as would the upper end of the estimated range.
- Adjustors reported that abatement of lead paint and asbestos in California can add substantial cost. This had not been appreciated by the Project Team before the workshop. Estimating assumptions were refined as a result. Further study of these costs and the attributes that influence them is needed.
- Costs for repairing brittle finishes like tile can be a substantial portion of the repair cost because it is difficult to match original tile. This typically leads many adjustors to recommend full replacement of tile in the room, even if the extent of damage is small. This had not been fully appreciated by the Project Team before the workshop.

- Insurance policy rules, including deductibles and caps and depreciation assumptions, can impact the amount paid out. Thus, comparing the cost of the total damage with insurance payouts can be difficult and inconsistent.

5 Recommendations

The findings in Chapter 3 and the conclusions in Chapter 4 lead to the following recommendations.

- The project approach using the *FEMA P-58* methodology should continue with only minor refinements needed on some specific individual components and should address items not well covered by *FEMA P-58*, such as lath and plaster repairs.
- Cost estimates for earthquake damage repair need to be done with very clear and very detailed descriptions of the assumptions that were made, and the results need to be viewed in the context and limitations of those assumptions.
- Because of the significant and increasing cost of lead paint and asbestos abatement in earthquake damage repair in California, more in-depth study of this issue is needed to better understand the cost and policy implications.
- The EDA-02 *General Guidelines for the Assessment and Repair of Earthquake Damage in Residential Construction* [CUREE 2010] provide guidance to claims adjustors on common types of earthquake damage that occur in wood-frame residential construction, how to assess the significance of the damage, and what techniques should be used to repair the damage. The guidelines are a valuable tool used by claims adjustors, but updates are needed, particularly for heavily damaged buildings requiring structural repairs. The CEA has funded a project, managed by the Applied Technology Council developed updated general guidelines and engineering guidelines: *CEA-EDA-01* [CEA 2020(a)] and *CEA-EDA-02* [CEA 2020(b)]. These documents should be promoted within the insurance and design communities to improve understanding and consistency of repair assessment and estimating.
- Greater understanding is needed of the issues that trigger moving from (1) repairing damaged cripple walls, to (2) jacking and repairing the wall, to (3) jacking and replacing the wall, to (4) full building replacement. There was no clear consensus between adjustors on what approach to take for heavily damaged conditions. They typically defer to structural engineering advisors; however, there is also no clear consensus among structural engineers. More study is needed.
- Insurance claim payouts remain a highly desirable resource for the engineering and scientific community to improve its analytical loss estimating research, but

proprietary considerations limit the availability of the information. Sharing this valuable information, particularly at the detailed component level as well as detailed inventory data, while finding ways to preserve anonymity and proprietary advantage, would be extremely beneficial to the effort of improving insurance pricing for seismic retrofitting of components such as cripple walls and sill anchorage. For example, insurers could aggregate anonymous claims payout information in the cost estimate categories used in the damage workshop effort. A second step would be to include building characteristics together with the claims payout data, but perhaps stripped of identifiable locations.

REFERENCES

CEA (2020a). *Earthquake Damage Assessment and Repair Guidelines for Residential Wood-Frame Buildings, Volume 1 – General Guidelines*, *CEA-EDA-01*, prepared by the Applied Technology Council for the California Earthquake Authority, Sacramento, CA, *https://www.earthquakeauthority.com/Insurance-Professionals/For-Adjusters/General-Guidelines/CEA-EDA-01-GeneralGuide.pdf.*

CEA (2020b). *Earthquake Damage Assessment and Repair Guidelines for Residential Wood-Frame Buildings, Volume 2 – Engineering Guidelines*, *CEA-EDA-02*, prepared by the Applied Technology Council for the California Earthquake Authority, Sacramento, CA, *https://www.earthquakeauthority.com/Insurance-Professionals/For-Adjusters/General-Guidelines/CEA-EDA-02-EngineeringGuide-1.pdf*.

CUREE (2010). *General Guidelines for the Assessment and Repair of Earthquake Damage in Residential Woodframe Buildings*, *CUREE Publication No. EDA-02*, Consortium of Universities for Research in Earthquake Engineering, Richmond, CA.

FEMA (2003). *HAZUS MH MR4 Technical Manual, Multi-hazard Loss Estimation Methodology, Earthquake Model*, developed by the Federal Emergency Management Agency under a contract with the National Institute of Building Sciences, Washington, DC.

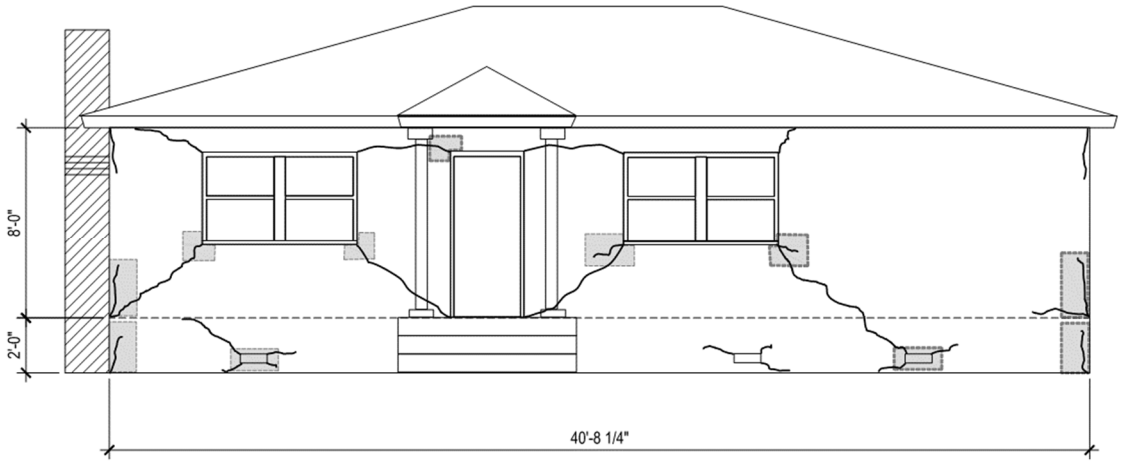
FEMA (2012). *Seismic Performance Assessment of Buildings, Volume 1 – The Methodology*, *FEMA P-58-1:* prepared by the Applied Technology Council for the Federal Emergency Management Agency, Washington, D.C.

APPENDIX A FINAL EARTHQUAKE DAMAGE WORKSHOP: DAMAGE DESCRIPTION PACKAGE

Note: The initial *Damage Description Package* was issued on January 25, 2019, to assist claims adjustors in preparing initial estimates. Based on discussion at the February 20, 2019, damage workshop, revisions were made. The updated and final version of the *Damage Description Package* was issued on March 1, 2019. Revisions were shown in track change format for ease of use by the adjustors. They are preserved here so changes can be seen. Minor modifications in the March 1, 2019 *Damage Description Package* have been made for clarity in insertion here, such as changing the names of the appendices to "attachments" and updating the page numbering.

Earthquake Damage Workshop: Damage Description Package

March 1~~January 25,~~ 2019



Read First Summary for Claims Adjustors

1. Thank you for volunteering to participate in the Damage Workshop effort. Your help is greatly appreciated and will make a meaningful difference in the success and value of the project.
2. This damage description package provides descriptions of the case study buildings for which we would like you to provide estimates.
3. The package is large, but it is organized, and it can be scanned and utilized efficiently. Give it a chance and don't feel too overwhelmed. Please budget your time, so you can give equal attention to each case. It is up to you how to break the work up. Consider planning to do a few hours at a time.
4. Xactimate files have been prepared with key information such as the building geometry for each of the case study buildings so that you don't have to do this.
5. We are seeking your expertise in looking at the description of damage, deciding the scope of repair work needed, and then entering that scope into Xactimate.
6. Detailed instructions are provided, and an example report is included in an appendix.
7. A short webinar is scheduled for February 1, 2019 to help answer any initial questions.

Table of Contents

Overview, Instructions, Terminology, Damage State Descriptions, Case Study Naming Conventions, and Cost Estimating Assumptions

Overview

As part of the California Earthquake Authority (CEA) project with the Pacific Earthquake Engineering Research Center (PEER), an earthquake damage workshop will be held on February 20, 2019. The goal of the workshop is to provide estimates of the cost of repairing earthquake damage to single-family wood-frame homes in order to compare the differences in costs between houses with and without retrofits to cripple walls and sill anchorage.

At the request of CEA, experienced claims adjustors from insurance companies have volunteered to provide estimates of case study examples of damaged buildings. This package of information describes the case study buildings and documents the damage. It also provides instructions for the process associated with the workshop. Associated files for each case study have been developed using the Verisk Xactware Xactimate X1 platform. The X1 platform will be used by adjustors to document their estimates. Initial estimates will be done prior to the workshop. Note that at the end of this package, there is a short survey of questions regarding key assumptions made by the estimator following the initial estimates. The survey will help identify topics that should be discussed by the group at the workshop.

PEER will conduct a short webinar to explain the process to the volunteer adjustors before they start to help answer questions. The initial estimates will be synthesized into a summary document identifying issues for discussion. These will be discussed during an online half day workshop. Issues will be resolved at the workshop with any necessary clarifications on estimate assumptions and approach. Adjustors may then update their estimates. The results will be summarized and used by the PEER-CEA Project Team to refine the project loss estimates.

Instructions to Adjustors

1. Review the following documents.
    a. *Case study damage descriptions in this package:* There are three case study hypothetical buildings that cover representative California home types. For each building, there is a retrofitted and an unretrofitted version, and for each of these versions, there are four different levels of earthquake damage. Thus, there are 3 building types x 2 variations of retrofitting x 4 damage levels = 24 scenarios. Each scenario has damage at the cripple wall and at the superstructure. There are similarities between the various scenarios so that the first case study scenario is described in detail, and subsequent variations only identify the differences. **Because of similarities, only 14 scenarios need unique Xactimate estimates.** See the notes in the section of each case study devoted to the retrofit condition for which scenarios need unique estimates. A summary is also provided in Attachment 1 for a list of scenarios. **Adjustors will be divided into two groups. The first group will provide estimates for Case Study Building 1 and 2, and if they have time move on to Case Study Building 3. The second group will provide**

estimates for Case Study Building 3, and if they have time move on to Case Study Buildings 1 and 2.

b. *Xactimate files for the case studies:* Please confirm that they can be opened and are compatible with your version of Xactimate. If not, contact Bret Lizundia, Rutherford + Chekene, damage workshop coordinator for PEER, at blizundia@ruthchek.com.

c. *Excel file of survey questions:* A copy of the questions is in Attachment 2. Please complete the questions after finishing your Xactimate estimates.

2. On February 1, 2019, there will be a short webinar to explain the process and answer any initial questions. Call-in information is:

   Topic: CEA-PEER Damage Workshop – Short Kickoff Call on Process and General Questions
   Time: Feb 1, 2019 10:00 AM Pacific Time (US and Canada)

   Join Zoom Meeting
   https://berkeley.zoom.us/j/950984817

   One tap mobile
   +16699006833,,950984817# US (San Jose)
   +16465588656,,950984817# US (New York)

   Dial by your location
   +1 669 900 6833 US (San Jose)
   +1 646 558 8656 US (New York)
   +1 877 853 5247 US Toll-free
   +1 877 369 0926 US Toll-free
   Meeting ID: 950 984 817
   Find your local number: https://zoom.us/u/ajjuPCxDm

3. By February 8, 2019:
   a. Update the Xactimate files for each case study scenario to estimate the cost of addressing the described damage. An example Xactimate report is in Attachment 3.
   b. Complete the survey.
   c. Return the Xactimate files, pdf output of Xactimate reports, and survey to both:
      i. Bret Lizundia, Rutherford +Chekene, damage workshop coordinator for PEER, at blizundia@ruthchek.com and
      ii. Mitch Ziemer, CEA Insurance and Claims Director, at MZiemer@calquake.com

4. By February 15, 2019, a summary report will be issued to participants with items for workshop discussion.

5. On February 20, 2019, from 8:30am-12:30am, there will be an online workshop to discuss the initial estimates and comments. Call-in information is:

Topic: CEA-PEER Damage Workshop
Time: Feb 20, 2019 8:30 AM Pacific Time (US and Canada)

Join Zoom Meeting
https://berkeley.zoom.us/j/869580771

One tap mobile
+16699006833,,869580771# US (San Jose)
+16465588656,,869580771# US (New York)

Dial by your location
+1 669 900 6833 US (San Jose)
+1 646 558 8656 US (New York)
+1 877 853 5247 US Toll-free
+1 877 369 0926 US Toll-free
Meeting ID: 869 580 771
Find your local number: https://zoom.us/u/adrAybKQiI

6. By March 1, 2019, a summary report on workshop conclusions will be issued, plus an updated damage description package with revised instructions and descriptions based on workshop feedback. This will include updated Xactimate files and survey questions.

7. By March 15, 2019:
   a. Update the Xactimate files for each case study/permutation to estimate the cost of addressing the described damage.
   b. Complete the survey.
   c. Return the Xactimate files, pdf output of Xactimate reports, and Excel survey to both:
      i. Bret Lizundia, Rutherford +Chekene, damage workshop coordinator for PEER at blizundia@ruthchek.com and
      ii. Mitch Ziemer, CEA Insurance and Claims Director at MZiemer@calquake.com

8. By March 29, 2019, a final report will be issued summarizing the estimates and associated findings.

Please address questions to both Bret Lizundia and Mitch Ziemer at the above email addresses. It will take everyone's best effort to stay on track with us on this rigorous timeline. Thank you for your cooperation.

Repair and Upgrade Guidelines

In general, repairing and upgrading damage to the case study buildings should follow the following document, together with the adjustor's experience and industry standard practice.

General Guidelines for the Assessment and Repair of Earthquake Damage in Residential Woodframe Buildings, CUREE Publication No. EDA-02, Consortium of Universities for Research in Earthquake Engineering, Richmond, CA, February 2010.

Chimney repair or replacement should follow:

FEMA, 2015b, "Repair of Earthquake-Damaged Masonry Fireplace Chimneys," FEMA DR-4193-RA1,https://www.fema.gov/media-library-data/1439241984631-3b4c44f900c8893449327f0e764ef849/FEMAP-1024RA1.pdf

Terminology

For this exercise, the following terms and definitions are used.

- Pre-earthquake state: The condition of the building before the earthquake. It is assumed for this exercise that the building does not have any pre-existing earthquake damage from a previous earthquake, nor does it have any significant damage for any other reasons such as ground settlement or water intrusion. Typical wear and tear for a reasonably well-maintained building of the case study's vintage is to be assumed.
- Unretrofitted: The building in its original state without any seismic retrofitting to the cripple wall or sill anchorage.
- Retrofitted: The original building plus the addition of a cripple wall and sill anchorage retrofit.
- Repair: "Repair" means returning the home to its pre-earthquake state using similar nonstructural finishes, materials, and approach. This may include patching or replacement in kind of either nonstructural or structural elements, but structural elements are not strengthened beyond their original pre-earthquake state.
- Upgrade: "Upgrade" means going beyond repair to improve the building so that its structural performance is expected to be better than it would be in the pre-earthquake state. Adding plywood and associated connections to the framing to a wall, roof, or floor that did not have plywood would be an example of an upgrade. Nonstructural finishes will not be upgraded to a higher level of quality than existed prior to the earthquake.
- Replacement of the Entire Structure: "Replacement" in this context means to rebuild the home such that it is as similar to the building before the earthquake as possible, together with any required building code upgrades. This term is not intended to apply to individual elements and nonstructural finishes which may be replaced locally as part or repairs or upgrades.
- Replacement Cost of the Entire Structure: The cost to rebuild the home as defined above. This includes the demolition and removal cost of the existing damaged building.
- Residual displacement: For the cripple wall, this is the displacement that remains at the end of the earthquake at the top of the first floor vs. the top of the foundation. It is visible as a lean in the cripple wall. For the superstructure, in a one-story building, this is the displacement between the top of the walls at the eave level and the top of the first floor. In a two-story building, it is the displacement between the first and second floor or between the second floor and the eaves. Residual displacement is a useful metric for correlations with damage and is indicated for each scenario. The residual displacement lean occurs

both in the direction parallel to the wall (termed "in-plane") and the direction perpendicular to the face of the wall (termed "out-of-plane"). See Figure A-1..

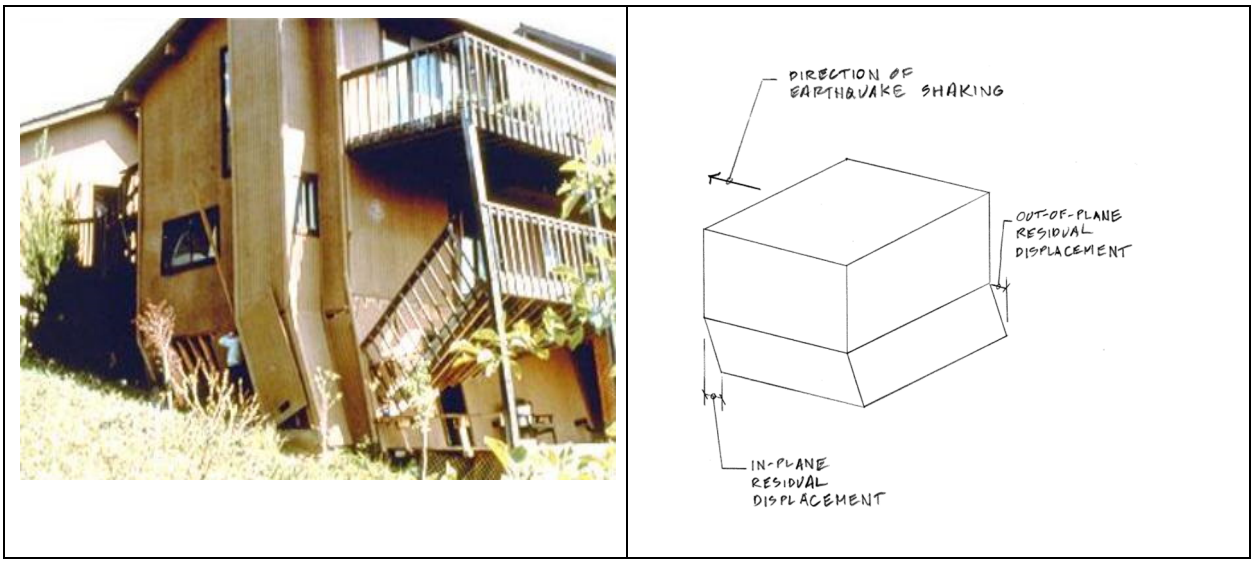


Figure A-1 Examples of residual displacement. Photo from Cal OES [2013].

General Damage State Descriptions

There are four damage states of interest that will be examined. General descriptions are provided here. Details as they apply to each case study building are provided ahead.

- Damage State 1: Cosmetic repair, with limited repair effort.
- Damage State 2: Significant finish damage; no appreciable structural damage; larger repair effort.
- Damage State 3:
  - Cripple Wall: Significant residual drift; loss of capacity and load transfer capability.
  - Superstructure: Full replacement of interior and exterior nonstructural finishes; some structural damage to sill plates and framing.
- Damage State 4:
  - Cripple Wall: Full collapse of cripple wall; replacement of the cripple wall.
  - Superstructure: Replacement of entire structure.

Case Study Naming Convention

The naming convention for the permutations is as follows: CSX-Y-DSZ-CW where:

- CS: Case Study.
- X: "1," "2," or "3" for Building 1, Building 2 or Building 3.
- Y: "UN" for the original building in its unretrofitted state or "R" for the building with a cripple wall and sill anchorage retrofit.

- Z: "1," "2," "3," or "4" for Damage State DS1, Damage State DS2, Damage State DS3, or Damage State DS4.
- CW: This is added when the permutation only involves the cripple wall. When it is not used, the estimate is for both the cripple wall and the superstructure. See Attachment 1 for more details.
- Example: CS1-UN-DS3: Case Study Building 1 in its unretrofitted original state when it has reached Damage State DS3, and the estimate covers damage to both the cripple wall and the superstructure.

Cost Estimating Assumptions

1. Repair vs. Replacement of the Entire Structure Trigger: The adjustor is to follow the CUREE EDA-02 guidelines in general. It will be at the adjustor's discretion to determine whether damage is extensive enough that the structure or major portions of it need to be replaced, rather than repaired, based on the adjustor's experience and industry practice. This includes the items below, which should be noted by the adjustor in their estimate.
    a. Complete structure replacement: For the building damage states described for each case study, the adjustor is to determine if damage is extensive enough to trigger complete replacement of the structure.
    b. Leaning cripple wall: For damage states described in each case study with leaning cripple walls from residual displacement at the end of the earthquake, instructions clarify whether to assume the wall can be jacked back to plumb or ~~the adjustor is to determine whether the cripple wall can be jacked back to plumb,~~ whether rebuilding of the wall is needed. For Damage State 1, the wall is not leaning. For some cases in Damage State 2, the walls are leaning and can be jacked back to plumb. Finally for Damage State 3, assume shoring of the house and rebuilding the cripple wall. ~~, or whether the damage is extensive enough to that the entire house would be considered a loss and need to be rebuilt.~~
    c. ~~Building paper~~Complete material replacement: For items not listed in this section, it is up to the discretion of the adjustor whether to completely replace or repair instead. However, for certain items, if any damage is sustained, a complete replacement will be automatically triggered. Reasons for this include inability to match the original finish, or the ~~liability~~ subcontractor unwillingness to warranty only partial repairs. For damage states described for each case study, ~~the adjustor is to decide whether the damage is extensive enough to~~the following line items will require full replacement if an damage occurs:
        i. If the siding or stucco is removed, ~~of~~ the building paper providing weather protection ~~and the exterior siding.~~must be completely replaced where it is exposed.
        ~~i.~~ii. If damage occurs to any tile, assume the tile cannot be matched and a full replacement of the tile in the room with damage is required. ~~The damage descriptions note what can or cannot be seen in each damage state.~~

2. Extent of Repairs: Per the CUREE EDA-02 guidelines, the goal is to repaint or repair to maintain consistent appearance. The adjustor decides the collateral extent to achieve this

goal. For example, if there is a crack in a wall, the adjustor determines if it is locally patched or if the whole wall or room is redone based on their experience and industry practice. **The case study descriptions provide detailed descriptions of assumed repairs to assist the adjustor. The adjustor is not required to follow these repair descriptions if, in their experience, a different approach is warranted. In this case, the adjustor should note the differences in their approach and resulting estimate.**

3. Quality of Repairs: Assume these are "average" buildings with "typical" nonstructural finishes, not homes with fancy finishes such as crown moldings, bull-nosed wall corners, etc.

4. Foundation: Assume for this exercise that there is no damage needing repairs at the concrete perimeter footings themselves. All damage occurs in the sill anchorage, cripple walls, and above. For scenarios where the building is rebuilt, assume there are no issues with a high groundwater table or unstable soils. Dewatering is not required. Foundation bearing pressures are assumed to be adequate to permit typical strip and spread footings. Deep foundations are not required.

5. Crawl Space Access: The crawl space is accessible for workers, but assume a typical extent of utilities such as pipes and ducts in the crawl space is hung from the underside the first floor framing.

6. Landscaping: Assume a typical level of shrubs and bushes around the perimeter of the house that need to be protected or removed to perform repairs.

7. Sidewalks and Driveways: Assume there is no significant damage to sidewalks and driveways that needs repair.

8. Utility Impacts: Piping and wiring that were impacted by repair work and need to be removed and replaced are to be included the cost of the repair. Assume typical conditions for the era of construction.

9. Glazing: Assume all existing window frames are wood frame, glazing is single pane, and single pane replacement is permitted. In addition, assume that none of the cracked glazing damage is in areas next to doors and exit ways that would trigger safety glass repairs.

10. Building Code: Assume the 2016 California Building Code (CBC), 2016 California Existing Building Code (CEBC), and 2016 California Residential Code are in effect, with no special local jurisdiction modifications, and that for repair only work no code upgrades are required (including no electrical upgrades). (See Item 11 when replacement of the entire structure is required). It is assumed per 2016 CEBC Sections 404.2.2 and 404.3.1.1 that these one-family dwellings are exempt from code-required upgrades even if the level of damage is deemed "substantial structural damage" as defined in 2016 CEBC Chapter 2.

11. Replacement Cost of Entire Structure: The adjustor is to provide their best estimate for rebuilding the building in kind. Provide a specific value in $/sf, not a range. Assume the

building will be replaced to match the pre-existing condition, plus any required code upgrades. Include the cost for demolition and removal of the existing building. See below for additional cost assumptions. We understand that determining the replacement cost for the entire structure is typically the responsibility of the underwriting group within an insurance company, but we are interested in the adjustor's perceptions and estimates. If it is typical to separate living space and an attached garage, provide a $/sf estimate for each. If it is more typical to estimate garage replacement as a function of the number of cars rather than square feet, please estimate accordingly.

12. Demand Surge: Do not include any factors for demand surge that may be caused by increased labor and material pricing after a major earthquake.

13. Geotechnical Hazards: Assume for this exercise that the only geotechnical hazard is from ground shaking, and this is the sole cause of damage. There is no damage from liquefaction, lateral spreading, or fault rupture at the site.

14. Additional Cost Estimation Details: The following describes included and excluded cost categories and other assumptions.
    a. Do not reduce the cost by a deductible or cap the losses by a presumed coverage limit. The total "ground up" cost is desired.
    b. Location: Assume the damaged home is in San Carlos, California with a 94070 ZIP Code.
    c. Estimating Date: Assume construction repair costs and replacement costs are both relative to January 1, 2019. Often cost estimates include adjustments for cost escalation that occurs between when a project starts to when it is complete. For example, typical cost estimates include escalation considered to the midpoint of construction. ~~Note any typical factor to~~ For the purposes of this exercise exclude any~~the~~ adjustment for cost escalation over the course of construction.~~, such as the midpoint of construction.~~
    d. Direct Costs
        i. The following direct costs are included: General contractor costs to the owner, including subcontractor costs, general conditions, overhead and profit, bonds, and insurance. Use your company's standard protocols and Xactimate's overhead and profit features for items such as the general contractor's overhead and profit, general conditions, bonds, and insurance. If your company does not include specific items like dumpsters or portable toilets in the overhead category of Xactimate, then include them as specific line items in the repair estimate when they are needed to do the work.
        ii. Landscaping demolition and replacement costs: Use your company's standard protocols for including or excluding the cost of landscaping removal for construction access (e.g. shrubs around foundations), and replacement of damaged or removed landscaping in the Coverage A claim amount.
        iii. Depreciation costs: For the purpose of this exercise, estimates will be based on replacement cost value, rather than actual cash value, so depreciation will not be applied.

e. Indirect Costs: In addition to the direct cost of repairs, comment on the following indirect costs. Unless the value is given below, p~~P~~rovide a separate, line item value used for each of these items, as a percentage of the direct construction costs in the Excel survey.

i. Construction contingency: Contingency to address items not directly identified in the repair itemization that may be required when further assessment is known. For the purposes of this exercise, assume a construction contingency of five percent additional cost for each case study.

ii. Utilities for construction: Include the cost of power and water as a line item in Xactimate ~~if needed for construction~~based on duration of construction. Construction durations for each damage state are as follows:~~.~~

1. Damage State 1: Residence is occupiable with an estimated construction time of two weeks.
2. Damage State 2: Residence is occupiable with an estimated construction time of two months.
3. ~~1.~~Damage State 3: Residence is unoccupiable with an estimated construction time of one year.

~~ii.~~iii. Design fees: Design fees such as for structural engineering, architectural design, and geotechnical engineering. ~~If an upgrade triggers design fees such as for engineering, please include this.~~ Please note, engineering advice to determine if damage is covered by insurance is not to be included in the estimate, but engineering time to determine what repairs are required and engineering time to design the repairs is covered in the estimate. For Damage State 1 and Damage State 2, assume design fees for engineering are two percent of the total cost. For Damage State 3, assume design fees for engineering are seven percent of the total cost.

~~iii.~~iv. Plan check and permitting fees and shear wall special inspection fees: Fees paid to the building department for plan review and permitting and to a special inspection firm for city-required shear wall hold-down inspections. For the purposes of this exercise, assume three percent of total cost is allocated to plan check and permitting fees and shear wall special inspection fees.

v. Lead paint and asbestos abatement: Assume testing for lead and asbestos is required for all case studies as they are older than the threshold dates most insurers use. For this exercise, it is assumed that around two thirds of houses in California require abatement. Assume abatement of a room is $1,500 and abatement of the whole house is $15,000. This will be required for all scenarios. There are three abatement scenarios for each case study building.~~If a standard assumption for lead paint abatement and abatement of asbestos in drywall joint compound and crawl space insulation would be made, based on the age of the house, include a cost for this task.~~

1. Damage State 1 does not have enough damage to require abatement and will not increase the cost.
2. Damage State 2 requires abatement of localized areas and a weighted average of (2/3) x ($1,500) = $1,000 is to be added to the total cost.

1.3. Damage State 3 requires abatement of the whole house given the large amount of damage sustained. A weighted average of (2/3) x ($15,000) = $10,000 is to be added to the total cost.

iv. Occupied structure: Include costs associated with working inside an occupied space. For construction durations, see Section ii.

v. Coverage C costs: Coverage C costs allocated for personal property damage. Assume an average level of personal property and associated damage.

vi. Coverage D costs: Coverage D costs allocated for additional living expenses if the family needs to be temporarily housed during repair, upgrade, or replacement of the entire structure. Assume the same family for each case study building. This is the Northridge family of four: Kobe, his wife Loma, their two high school age children (son Fernando and daughter Cascadia), and their young golden retriever, Xactipup. Assume the temporary residence is no farther from the parents' workplaces and the children's school than their permanent home.

f. Excluded Costs: The following costs are assumed to be excluded for this exercise.

i. Special inspection and testing: Assume no special inspection or testing costs are triggered other than those noted above.

ii. Legal fees: No legal advice is assumed to be needed, and no legal proceedings occur.

iii. Historic preservation costs: Homes are not assumed to be historic.

iv. Other hazardous materials: Assume there are no other hazardous materials, such as mold, soil contamination, or radon, and that there are no other materials with asbestos (such as vinyl tile) other than the crawl space ductwork noted above.

v. ADA: Americans with Disability Act upgrades are assumed not to be triggered.

vi. Overtime: Assume typical contractor working hours, without overtime.

vii. Neighborhood access and utility functionality: Assume there are no special access condition costs at the home and that roads to the home are functional and utilities to supply power and water to the worksite are functional.

viii. Construction management: The owner will not hire a construction manager or representative, and no costs are assigned to the owner's time.

ix. Financing costs: The cost of money is not included.

x. Coverage B costs: Coverage B costs allocated for structures other than the main house are not included. For the Case Study Building 3, assume the garage is attached to the main house and part of Coverage A.

xi. Coverage C costs: For this exercise, exclude Coverage C costs allocated for personal property damage.

x.xii. Coverage D costs: For this exercise, exclude Coverage D costs allocated for additional living expenses of the family to be temporarily housed during repair, upgrade, or replacement of the entire structure. Exclude all costs that fall under Coverage D from the estimates.

Xactimate Report Format and General Directions

Xactimate files will be provided to the adjustors for each estimate scenario. To save the adjustors time, building geometry has been input into the file. To help provide a more consistent approach amongst adjustors, several pieces of information have been entered into the files and should not be modified, such as the case study name (to be consistent with the naming convention described above), and the building location and sales tax assumptions (to assist with pricing). Attachment 3 shows an example of a typical Xactimate report for a case study scenario and key input screens, and they are annotated to provide general direction on some of the assumptions to follow, including which items should not be modified and which can be adjusted at the adjustors' discretion.

Case Study Building 1: One-Story, 1200 sf, 1940-1955, 2' Cripple Wall, Stucco Over Horizontal Sheathing

Building Description

Case Study Building 1 has the following characteristics.

Geometry: The building is a one-story house with out-to-out plan dimensions of 40' by 30', for a gross square footage of 1,200 SF. The plan is rectangular with no re-entrant corners. The story height is 8'. There is a hip roof with a 4:12 pitch with an 18" eave overhang around the entire perimeter. Steps lead up 2' from grade to the front porch and first floor. Steps lead down from Bedroom 1 to the back patio as well. Building square footage also does not include the exterior stairs, porch, or deck.

Construction Period: The building is representative of 1940-1955 construction in California. It was built in 1948. In 2004, the roofing was replaced, and the exterior was repainted.

Structural System: Asphalt laminated shingle roofing is supported by straight 1x6 sheathing which in turn is supported by wood 2x6 rafters which span to interior and exterior 2x4 stud walls. Similarly, 2x4 ceiling joists are supported by interior and exterior walls. Diagonal 1x8 floor sheathing is supported by wood joists which bear on a perimeter wood cripple wall and interior post and beam framing. The front and rear stairs have brick paving over concrete on top of the concrete stair landings. The rear back patio is concrete.

Exterior Materials: Exterior material is 7/8" cement stucco applied in three coats (scratch, brown, and finish) on metal wire lath over 1" by 6" (nominal) horizontal wood sheathing nailed to 2x4 studs at 16" o.c. This occurs both above the first floor and on the cripple wall between the first floor and foundation.

Cripple Wall Details

- Existing Unretrofitted Condition: The cripple wall has 2x4 studs at 16" o.c. bearing on a 2x6 sill plate supported by a strip footing. The sill plate used wet set construction where 30-penny spikes were partially driven at 24" o.c. into one side of the sill and this side was pushed into the top of the foundation when the concrete was wet. There are no anchor bolts. The outboard face of the sill is aligned with the outboard face of the concrete foundation. The stucco continues down past the top of the sill approximately 8".
- Retrofitted Condition: For the retrofitted permutations, the cripple wall has 15/32" plywood or OSB on the interior face of the studs that is nailed to the existing sill, studs, and top plate below the floor joists with 8d nails at 4" o.c. The cripple wall top plate is connected to the floor rim joists (15 shear clips each cripple wall, 60 total, A35, L50 or similar). The plywood extends for 14 feet on each perimeter face. Anchor bolts are added to the sill (10 bolts each wall, 40 total).

Interior Materials: Interior material is standard ½" gypsum wallboard with normal painted finish, except for the ceiling which is 5/8" gypsum wallward. Baseboard is less than 5-1/4" wide with quarter round molding. Interior door and window trim is 3-1/4" wide. Standard = materials and styles can be assumed (there is no crown molding, for example). Dining room has chair rail with no cabinetry or countertops. Floors in kitchen and bathroom are standard grade ceramic tile. All other flooring is common oak flooring. The kitchen has typical laminate countertops and 6"

backsplash. Kitchen wall ceramic tile is placed between countertops and upper cabinetry units. All cabinetry is assumed to be of typical quality. The bathroom has sliding shower door with tiled surround including window sill. The bathroom also has a tiled half wall around the perimeter.

Mechanical, Electrical, and Plumbing: Standard electrical and plumbing services are assumed for the one-story house. The kitchen stove, water heater, and forced-air furnace use natural gas. There is no seismic shutoff valve for the natural gas line at the meter. The water heater is braced and located in the hall closet. There is no air conditioner. The stove and water heater are 10 years old; the furnace is 20 years old.

Location: The home is located in San Carlos, CA at ZIP Code 94070.

Site and Soil Conditions: The site is generally flat. The soil at the site is alluvial fill, and it is categorized as Site Class D per the 2016 CBC.

Figures: Examples of representative buildings covered by this case study are shown in Figure A-2. See Figure A-3 for a floor plan and Figure A-4 for exterior wall elevations. See Figure A-5 for images of the structure and finish materials. Figure A-6 shows a detail of the cripple wall retrofit.

Figure A-2 Examples of buildings similar to Case Study Building 1.

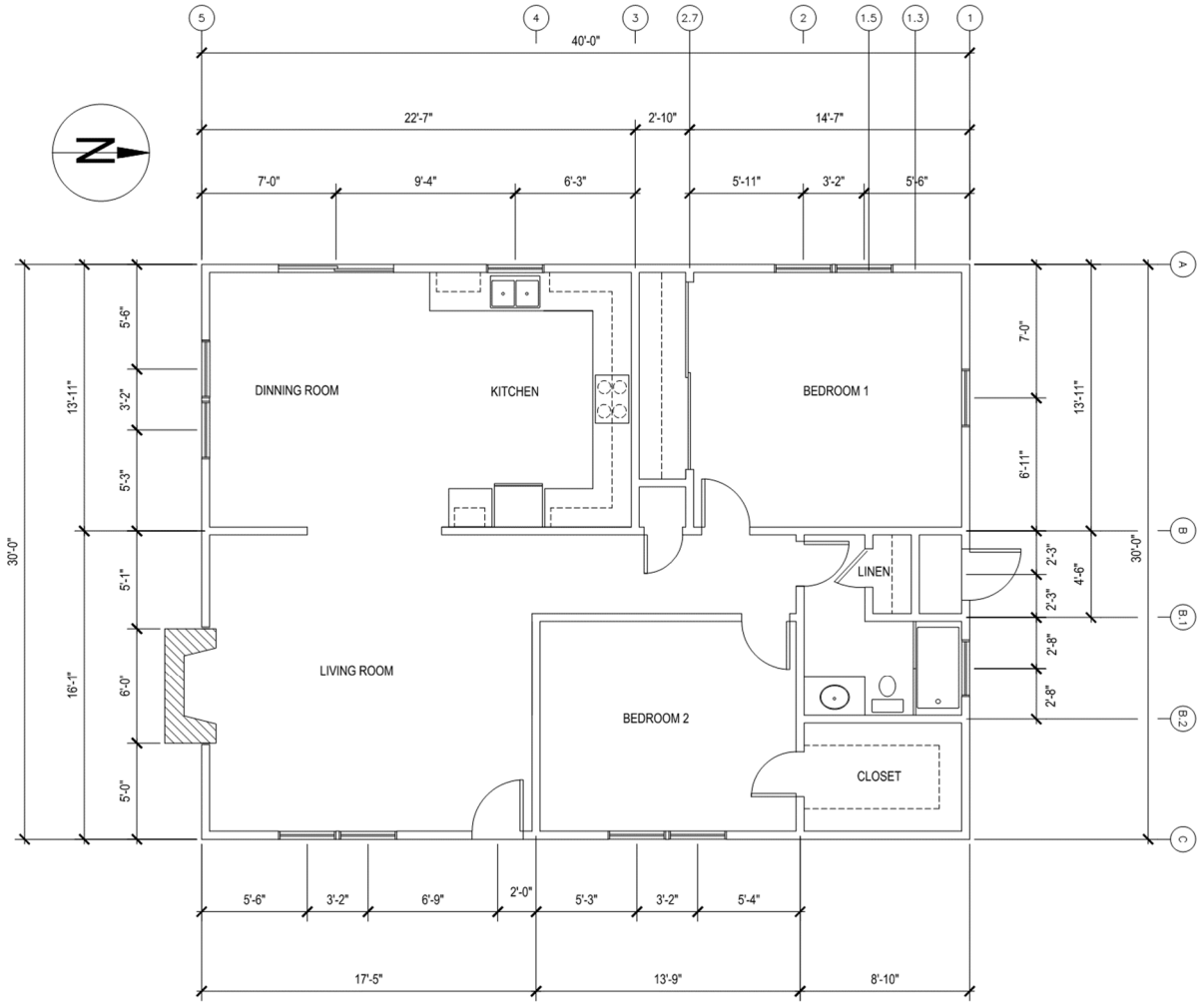
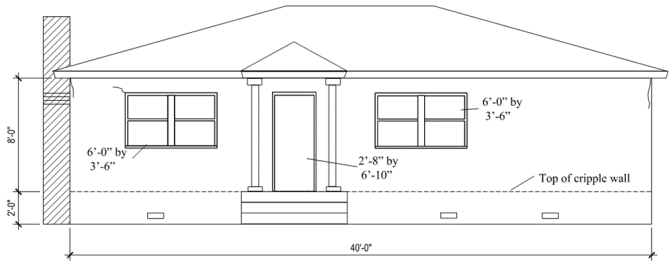
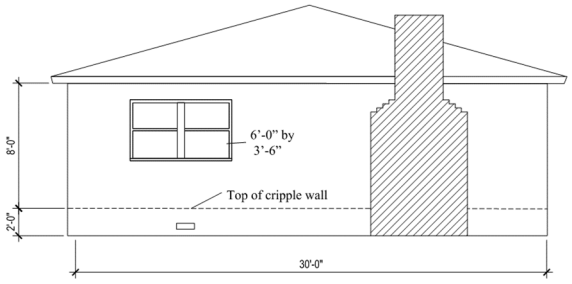


Figure A-3 Plan view of Case Study Building 1.

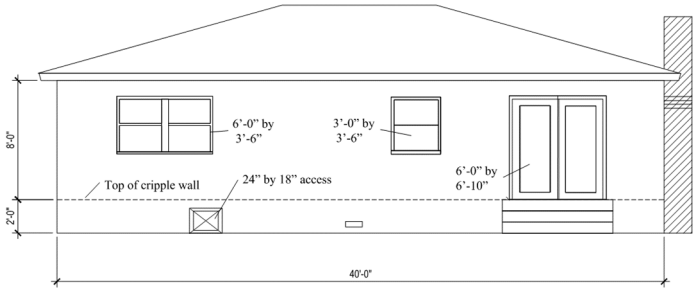
East (Front Facade)



South (Left Façade)



West (Rear Façade)



North (Right Façade)

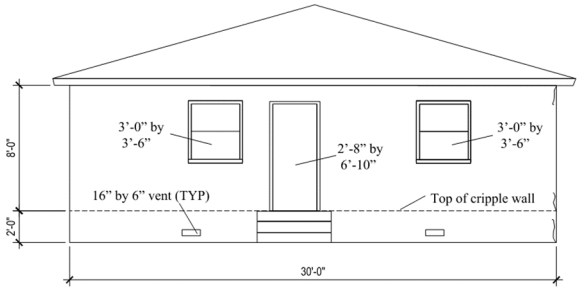


Figure A-4 Exterior elevations of the house (east, south, west, and north); rough opening sizes are annotated

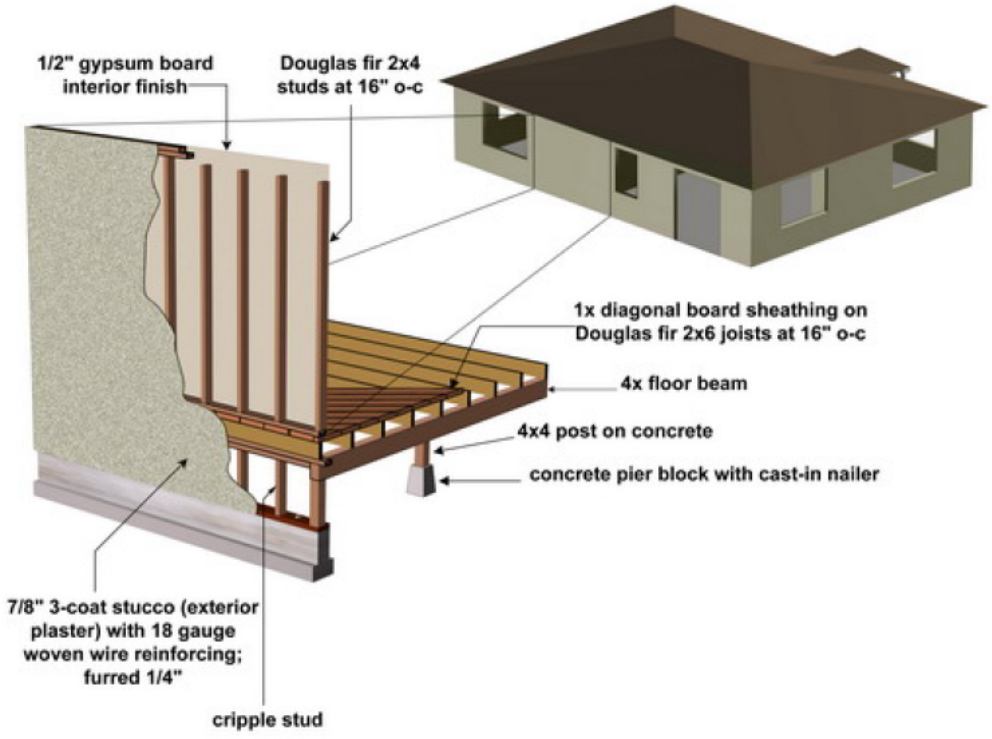


Figure A-5 **Typical framing and finish components for the target home (horizontal wood sheathing not shown behind stucco). Image from CUREE [2010].**

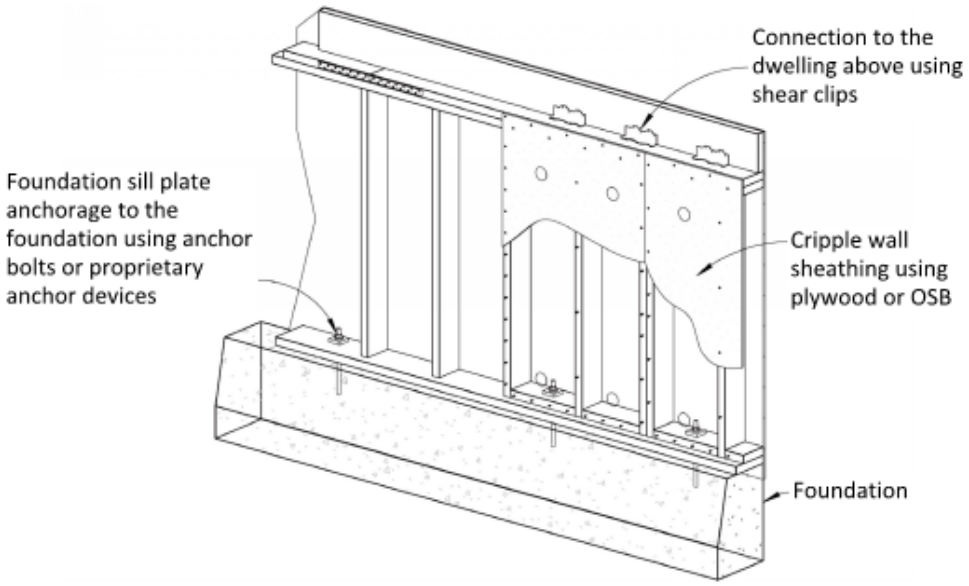


Figure A-6 **Example of cripple wall and sill anchorage strengthening (from Figure 4.1-1 of FEMA [2018]).**

Damage and Repair Effort Descriptions for the *Unretrofitted* Case Study Building 1

Damage State 1 (CS1-UN-DS1)

Description of the Earthquake

The magnitude 6 earthquake occurred on the San Andreas Fault some distance away from San Carlos and caused an approximate peak ground acceleration of about 0.15g at the site. There was minor to moderate damage along the Peninsula and no deaths. Utilities and transportation corridors are generally operational.

Damage at the Cripple Wall and Foundation Level

Damage to the cripple wall consists of cracks (approximately 1/64" to 1/8") in stucco near the corners of the house, similar to Figure A-7. Cracking is also found at the corners of access openings that provide entry to the crawlspace. Crack lengths are 6" to 12" in length. There is no damage to framing or underlying sheathing. There is no obvious residual displacement of the cripple wall or the post and beam supports. The building paper cannot be seen through exterior damage; it is visible at the interior in the crawl space but shows no signs of tearing between the studs. Interior post and beam supports remain connected and supporting the floor framing. The concrete foundation does not show any obvious signs of damage or settlement.

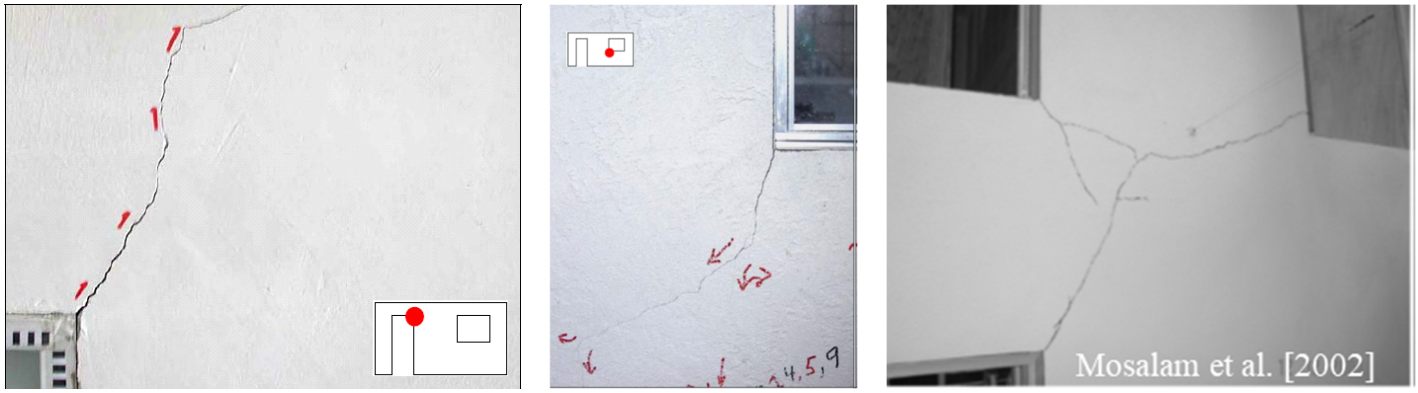
Figure A-7 **Minor cracking in cripple wall stucco near corners (Damage State 1). Photos: UCSD specimen A-3 (left), UC Berkeley specimen AL-1 (right).**

Repairs consist of cleaning out (beveling) stucco cracks in the cripple wall and patching. The total lengths of cracks requiring cleaning and patching can be assumed to be 30 LF. Painting of stucco is done as necessary to maintain consistent appearance. Damage State 1 crack distributions for the cripple wall are provided in Figure A-9.

Damage at the Superstructure Level

In the superstructure, the interior and exterior nonstructural finishes are cracked to the extent that this could be described as cosmetic damage. There is no structural damage to the framing of the house, and no obvious residual displacement between the floor level and top of the wall level

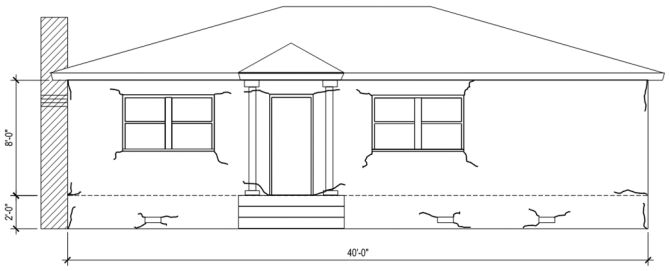
- Exterior Damage: The exterior damage consists of stucco cracks near the corners of windows and doorways, similar to Figure A-8. Cracking also occurs at the wall ends (i.e., house corners) near the base of the wall. Cracks are typically 1/32" to 1/16" in width and can be as large as 1/8". Some hairline cracking (less than 1/64" wide) extends from large corner cracks and also appears in continuous sections of solid stucco where there are no openings. Stucco repairs consist of repairing significant cracks with width greater than 1/64" of an inch by routing or beveling the crack to the brown coat and patching with a flexible (e.g., vinyl-based) compound. Stucco is applied to patches to maintain surface finish continuity with adjacent areas. Painting of stucco is required to maintain consistent appearance. The total length of superstructure cracks to be repaired by beveling and patching is 70 LF. Damage State 1 crack distributions for the superstructure are provided in Figure A-9.



(a) (b) (c)

Figure A-8 Examples of cracking in stucco at window and door openings (Damage State 1). Photos: Arnold et al. [2003] (a,b), Mosalam et al. [2002] (c).

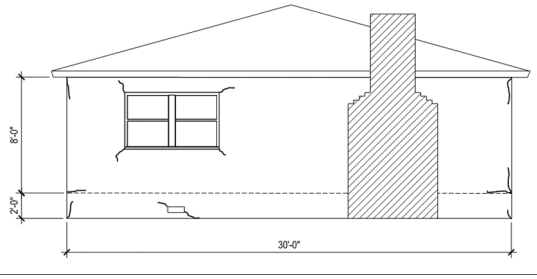
East (Front Façade)



Superstructure
$L_{crack,SS}$ = 23 LF

Cripple Wall
$L_{crack,CW}$ = 10 LF

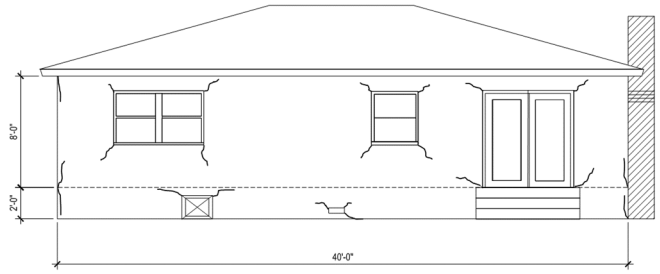
South (Left Façade)



Superstructure
$L_{crack,SS}$ = 18 LF

Cripple Wall
$L_{crack,CW}$ = 6 LF

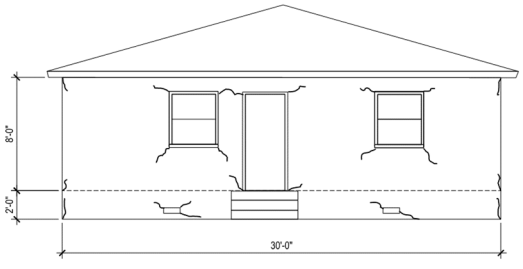
West (Rear Façade)



Superstructure
$L_{crack,SS}$ = 17 LF

Cripple Wall
$L_{crack,CW}$ = 8 LF

North (Right Façade)



Superstructure
$L_{crack,SS}$ = 12 LF

Cripple Wall
$L_{crack,CW}$ = 6 LF

~ = Stucco cracks between 1/64" and 1/8" wide requiring beveling back to brown coat to accept patching

Figure A-9 Exterior elevations showing cracking distribution (Damage State 1).

- Interior Wall Damage: Interior wall damage consists of cracking of interior drywall near corners of doors and windows, similar to Figure A-10**Figure** and Figure A-11. The interior wall damage is concentrated in the living room and the dining room. Drywall cracks are typically less than 1/64" wide (up to 1/32" wide) and can include small amount of surface paper curling and buckling. Wallboard panels without openings that are more than 6' long have "popped" fasteners near the center of the panel. Horizontal and vertical joints of wallboard panels can have visible damage to taping. Inside corner tape joints and cornerbead show cosmetic damage. Trim is in generally good condition, yet it will require removal to conduct repairs. Wallboard repair consists of cutting back gypsum paper to expose cracks around windows and doors to allow for patching and sanding. Locations with popped fasteners require additional fasteners within an inch of original and patching and sanding. Cracked tape joints need to be removed and replaced with new tape and joint compound. In the living room, the rough proportions of wall area that need repair correspond to 5% (20 SF) of wall area for cracks at openings and popped fasteners and 10% (10 LF) of joints and cornerbead need replacing. In the dining room, roughly 5% (10 SF) of wall area for cracks at openings and popped fasteners and 10% (6 LF) of joints and cornerbead need replacing. The finish painting will require that a consistent color is achieved within line of sight.

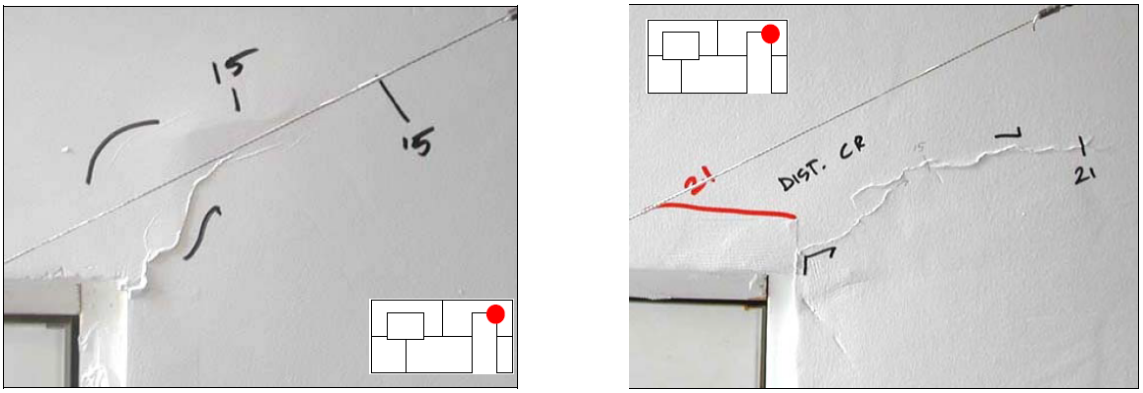
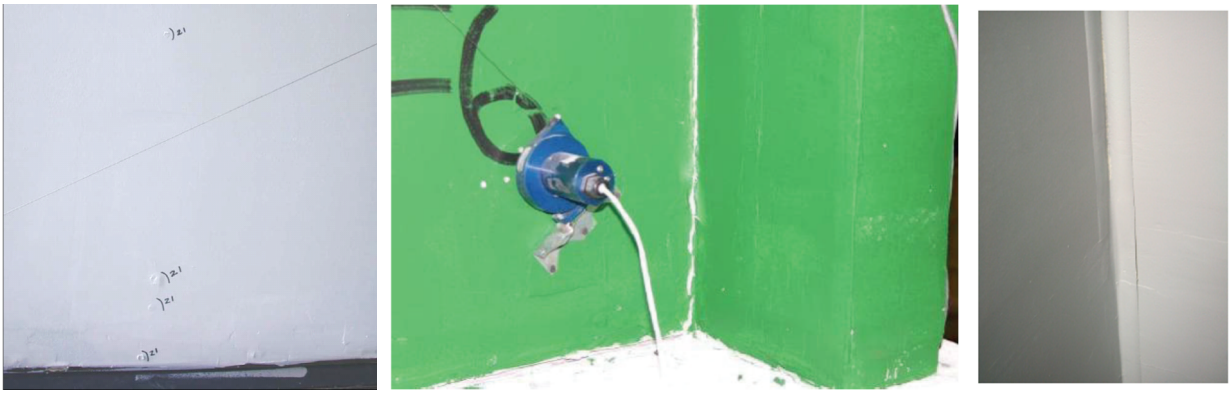


Figure A-10 Examples of minor cracking in gypsum drywall at window and door openings (Damage State 1). Photos: Arnold et al. [2003].



(a) (b) (c)

Figure A-11 Fastener popping (a), minor joint damage (b), and corner bead damage (c) in drywall (Damage State 1). Photos: Arnold et al. 2003 (a), Davies et al. 2011 (b)

- Windows and Doors: There are no cracked windows, and doors are still functional.
- Ceilings: Ceilings are not damaged.
- Floors: Floors are not damaged.
- Roof: The roof is not damaged and asphalt shingles remain in their original location. The roofing is assumed to remain able to provide a waterproof barrier.
- Miscellaneous: Areas with tiled walls (kitchen and bathroom) have some damage to grouting and a few cracked tile units. Most cracked tile will be near interior corners. Repairs consist of repairing approximately 10% of tiled areas in each room (5 SF in the kitchen and 15 SF in the bathroom). It can be assumed that the cement board remains intact and functional and that only the wall tile is affected.
- Residual displacement: There is no obvious superstructure residual displacement.

Chimney: The unreinforced brick chimney is undamaged at this damage state.

Stairs and Patio: There is no damage to the stairs up to the front entrance and its landing or to the landing, the stairs and the concrete patio at the rear.

Mechanical, Electrical and Plumbing Damage: Utility services to the building and within the building remain functional with no apparent damage. The braced water heater is still upright; gas lines have no apparent leaks. The seismic shutoff value for the gas line was not triggered.

Access: The exterior and interior of the superstructure and the crawl space can be safely accessed for visual review by post-earthquake safety evaluators and claims adjustors.

ATC-20 Post-Earthquake Safety Evaluation: The building was given a green, INSPECTED placard which permits occupancy.

Damage State 2 (CS1-UN-DS2)

Description of the Earthquake

The magnitude 6.5 earthquake occurred on the San Andreas Fault some distance away from San Carlos and caused an approximate peak ground acceleration of about 0.20g at the site. There was moderate damage along the Peninsula and no deaths. Some unreinforced masonry and nonductile concrete buildings closer to the epicenter were significantly damaged. Some buildings have been red-tagged and their occupants have been displaced. Only a handful of wood-frame homes were damaged such that they could not be occupied. Some bridges and overpasses have moderate damage and have restrictions that limit traffic capacity. Some utilities were initially out of service, but they are now generally operational.

Damage at the Cripple Wall and Foundation Level

The cripple walls have significant cracking and spalling near the exterior corners of the house where cracking and spalling have penetrated to the underlying metal lath. See Figure A-12. Spalling is also expected near the corners of crawl space openings, yet the spalling can be assumed to only penetrate the first two layers of stucco in these areas; leaving the metal lath intact. The underlying sheathing is intact and may have nails loosened in the same areas with stucco spalling. There is no obvious residual displacement of the cripple wall and at the post and beam supports. Framing of cripple wall is not damaged. The building paper (weatherproofing) cannot be seen through exterior damage; it is visible at the interior in the crawl space but shows no signs of tearing between the studs. Interior post and beam supports remain connected despite the lean and continue to support the floor framing. The concrete foundation does not show any obvious signs of damage or settlement.

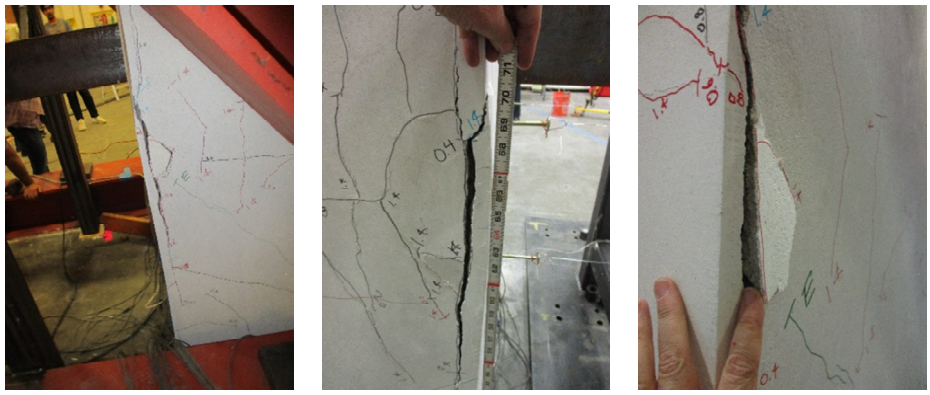


Figure A-12 Severe cracking and spalling of cripple wall stucco at wall ends (Damage State 2). Photos: UC Berkeley specimen AL-1.

Repairs involve cutting spalled stucco sections at building corners back to securely attached stucco. Areas with damaged metal lath should be cut back to overlap new lath with existing by 6". Minor repairs (resetting of nails) may be necessary in horizontal wood sheathing in areas requiring metal lath repair for stucco. Approximately ten percent (10%) of the total cripple wall area (25 SF) requires spalling and lath repair. Stucco crack repairs consist of repairing significant cracks with width greater than 1/64" of an inch by routing or beveling the crack to the brown coat and patching with a flexible (e.g., vinyl-based) compound. The sections requiring cracking repair involve 20-25% of the length of the cripple wall in each wall line (about 30 LF) where areas requiring spalling repair are not included in the total crack length. All stucco repairs must match the texture of existing stucco and be painted or colored to maintain a constant appearance. Damage State 2 crack and spall distributions for the cripple wall are provided in Figure A-14. In addition to the above deeper cracks, there is an array of hairline cracks that do not require repair, but this can be addressed by painting the cripple wall.

Damage at the Superstructure Level

At the superstructure level, the damage to interior and exterior nonstructural finishes is significant yet repairable. No appreciable structural damage is expected to framing members or connections.

- Exterior Damage: The exterior damage consists of stucco cracks near the corners of windows and doorways. Cracking will also occur at the wall ends (i.e., house corners) near the base of the wall (i.e., above floor joists). In some locations near corners of openings, stucco sections will have local spalling. The underlying sheathing is intact and may have nails loosened in the same areas with stucco spalling. See Figure A-13 for an example. Framing of superstructure is not damaged, and underlying building paper (weatherproofing) is assumed to still be functional.

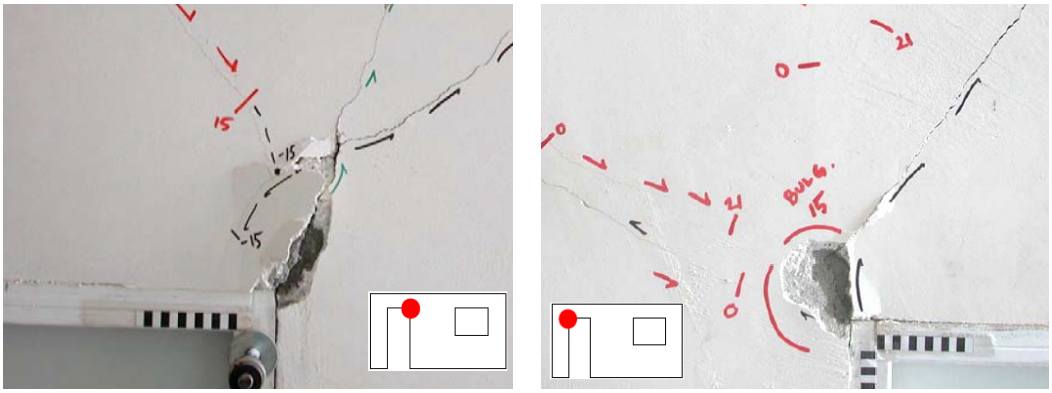


Figure A-13 Examples of local spalling in exterior stucco (Damage State 2). Photos: Arnold et al. [2003].

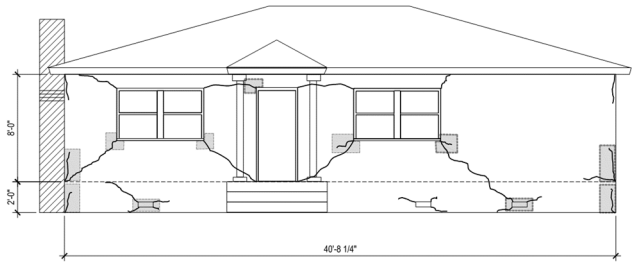
Stucco repairs involve cutting spalled stucco sections at building corners back to securely attached stucco. Areas with damaged metal lath should be cut back to overlap new lath with existing by 6". Minor repairs (resetting of nails) may be necessary in horizontal wood sheathing in areas requiring metal lath repair for stucco. Four percent (4%) of the total wall area (40 SF) requires spalling and lath repair. Stucco crack repairs consist of repairing

significant cracks with width greater than 1/64" of an inch by routing or beveling the crack to the brown coat and patching with a flexible (e.g., vinyl-based) compound. The sections requiring cracking and local (minor) spalling repair involve roughly 50% of the length of the wall in each exterior wall line (85 LF) where the total length does not include cracks in areas to be removed for spalling repair. All stucco repairs must match the texture of existing stucco and be painted or colored to maintain a constant appearance. Exterior stucco damage distributions for Damage State 2 are shown in Figure 14. In addition to the above spalls and deeper cracks, there is an array of hairline cracks that do not require repair, but this can be addressed by painting the walls.

- Interior Wall Damage: The interior wall damage is concentrated in living room and the dining room. The damage to gypsum wallboard finish includes significant cracking (widths greater than 1/64" through drywall and longer than 6" in length) that extends from corners of window and door openings. Wallboard panels without openings that are more than 6' long have "popped" fasteners near the center of the panel. Horizontal and vertical joints of wallboard panels can have visible damage to taping. Inside corner tape joints and cornerbead show cosmetic damage. Trim is in generally good condition, yet it will require removal to conduct repairs. Examples of gypsum wallboard damage are shown in Figure A-15 and Figure A-16..

  Gypsum wallboard repair consists of cutting back cracked gypsum sections to nearby studs or corners. New sections of drywall must be installed with proper treatment of non-factory edges to tie in with existing panel joints followed by patching, taping and sanding of joints and fasteners. Locations with popped fasteners in drywall sections that are not removed require additional fasteners within an inch of original followed by patching and sanding. Cracked tape joints need to be removed and replaced with new tape and joint compound. In the living room, the rough proportions of wall area that need repair correspond to 10% of wall area requiring gypsum removal and replacement (40 SF), 10% of area requiring repair of popped fasteners (40 SF), and 25% of joints and cornerbead needing refinishing (25 LF). In the dining room, roughly 10% of wall area requires gypsum removal and replacement (20 SF), 10% of area requiring repair of popped fasteners (20 SF), and 25% of joints and cornerbead needing refinishing (15 LF). The finish painting will require that a consistent color is achieved within line of sight.

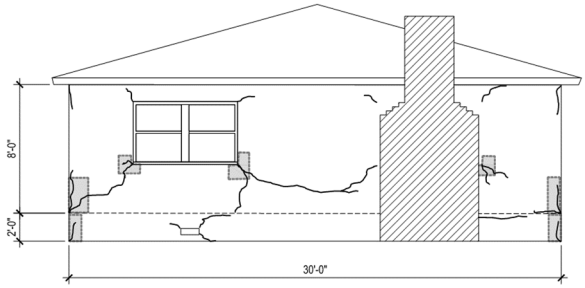
East (Front Façade)



Superstructure
$A_{spall,SS}$= 11 SF
$L_{crack,SS}$ = 22 LF

Cripple Wall
$A_{spall,CW}$= 8 SF
$L_{crack,CW}$ = 7 LF

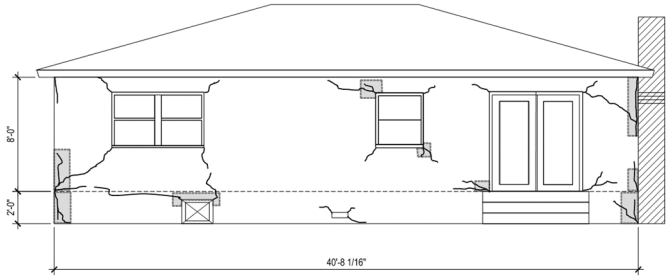
South (Left Façade)



Superstructure
$A_{spall,SS}$= 9 SF
$L_{crack,SS}$ = 20 LF

Cripple Wall
$A_{spall,CW}$= 5 SF
$L_{crack,CW}$ = 10 LF

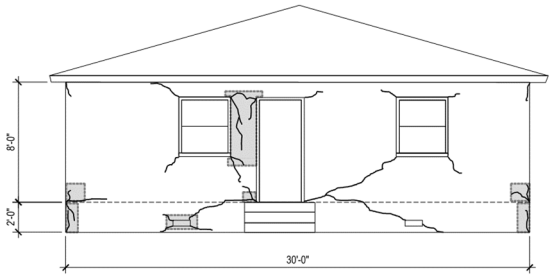
West (Rear Façade)



Superstructure
$A_{spall,SS}$= 10 SF
$L_{crack,SS}$ = 25 LF

Cripple Wall
$A_{spall,CW}$= 7 SF
$L_{crack,CW}$ = 6 LF

North (Right Façade)



Superstructure
$A_{spall,SS}$= 10 SF
$L_{crack,SS}$ = 18 LF

Cripple Wall
$A_{spall,CW}$= 5 SF
$L_{crack,CW}$ = 7 LF

= Areas of stucco spalling including cutting back 6" to well adhered stucco for lath repair and patching

~ = Stucco cracks between 1/64" and 1/8" wide requiring beveling back to brown coat to accept patching (Reported crack lengths do not include cracks within areas to be cut out for spalling)

Figure A-14 Exterior elevations showing cracking and spalling of stucco (Damage State 2).

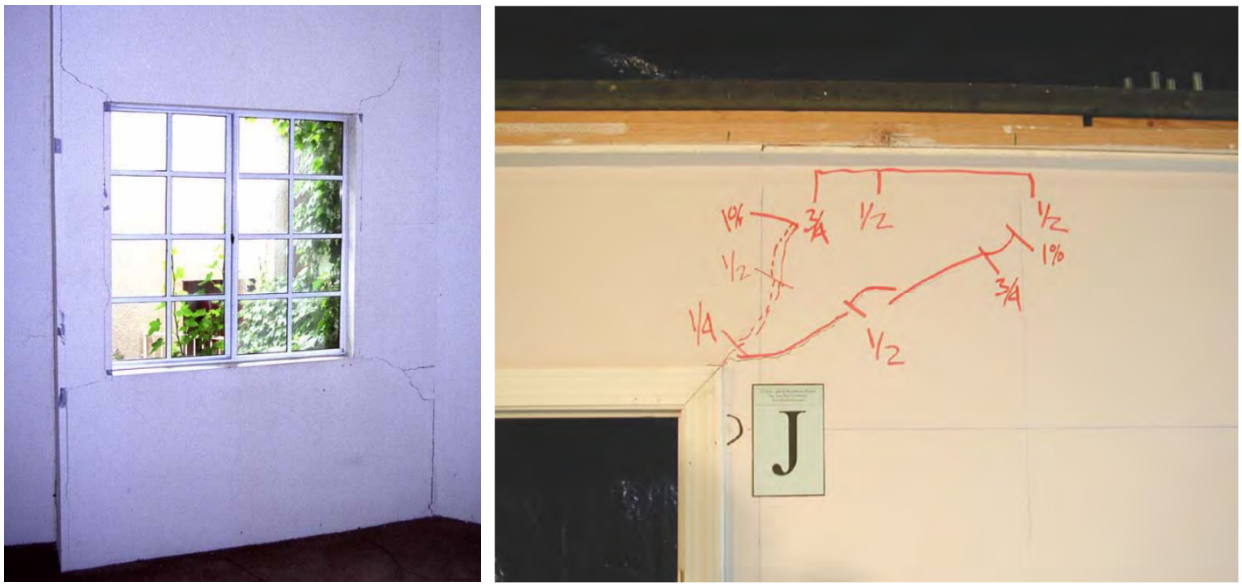


Figure A-15 **Gypsum wallboard cracks extending from openings to cornerbead and wall junction joints (Damage State 2). Photos: CUREE, 2010 (left), McMullin and Merrick, 2002 (right)**

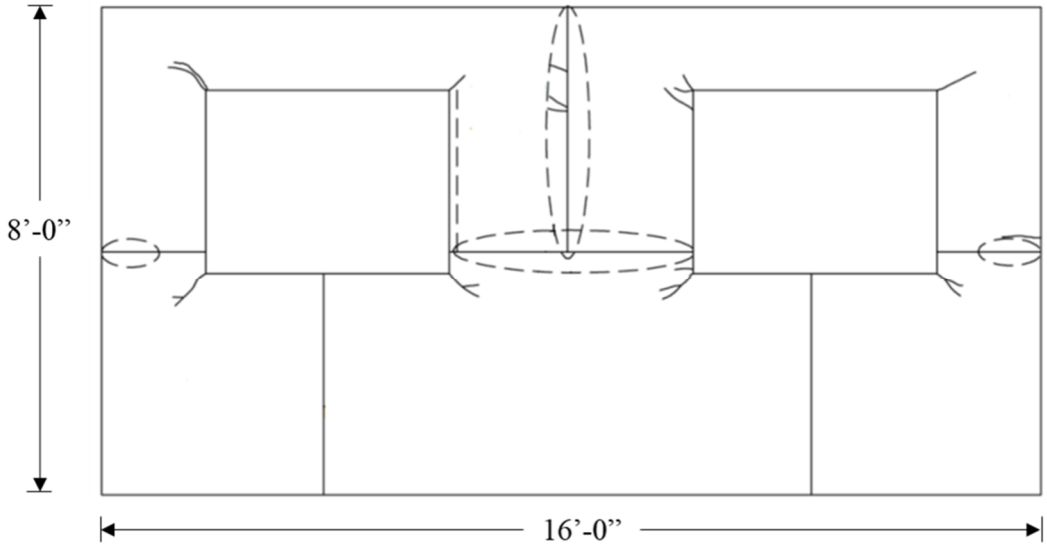


Figure A-16 **Possible damage distribution of interior gypsum drywall in Damage State 2 (Crack lines (solid) indicate cracks wider than 1/64", Dashed lines represent damaged joint and corner bead areas). Image modified from Arnold et al. [2003].**

- Windows and Doors: There are no cracked windows, and doors are still functional.
- Ceilings: In Bedroom 1, there is ceiling damage that needs repair of 10 LF of cracks and 6 SF of spalling, plus repainting to maintain a consistent appearance. In other rooms, ceilings are not damaged.
- Floors: Floors are not damaged.
- Roof: The roof is not damaged and asphalt shingles remain in their original location. The roofing is assumed to remain able to provide a waterproof barrier.
- Miscellaneous Damage: Areas with tiled walls (kitchen and bathroom) have significant damage to grouting and tile units. The damage to tiled areas is such that half the existing square footage needs to be fully replaced (25 SF in the kitchen and 75 SF in the bathroom). Repairs include removal of the tile and cement backing board and replacing with similar tile and grout. Only the wall tile is affected.
- Residual displacement: There is no obvious residual displacement in the superstructure.

Chimney: The unreinforced brick chimney has cracks, a few bricks have fallen, there is some rotation of the chimney on a crack plane where it meets the top of the roof above the firebox, and some small separation between the chimney and the adjacent wall is visible. The chimney needs replacement above the firebox or complete replacement including the firebox. Assume the shingles around the chimney and the flashing both need repair when the chimney is replaced.

Stairs and Patio: There is no damage to the stairs up to the front entrance and its landing or to the landing, the stairs and the concrete patio at the rear.

Mechanical, Electrical and Plumbing Damage: Utility services to the building and within the building remain functional with no apparent damage. The braced water heater is still upright. The gas supply is undamaged, the gas service is still operational, the gas lines have no apparent leaks.

Access: The exterior and interior of the superstructure and the crawl space can be safely accessed for visual review by post-earthquake safety evaluators and claims adjustors.

ATC-20 Post-Earthquake Safety Evaluation: The building was given a yellow, RESTRICTED USE placard which permits occupancy, but limits access around the damaged chimney.

Damage State 3 (CS1-UN-DS3)

Description of the Earthquake

The magnitude 7 earthquake occurred on the San Andreas Fault some distance away from San Carlos and caused an approximate peak ground acceleration of about 0.30g at the site. There was moderate to major damage along the Peninsula and 10 deaths. Unreinforced masonry and nonductile concrete buildings closer to the epicenter were significantly damaged. Many buildings, including those of wood-frame construction, have been red-tagged, and their occupants have been displaced. Some bridges and overpasses have moderate damage with one suffering significant damage and have restrictions that limit traffic capacity. Some utilities were initially out of service, but most are now operational, including those at the site.

Damage at the Cripple Wall and Foundation Level

The cripple walls are severely damaged and exhibit a large residual displacement (i.e., lean) of approximately 1". This type of damage is sufficient to trigger a red tag following preliminary post-earthquake inspection. The cripple wall is severely cracked and spalled near the corners of the house. The cripple wall stucco is detached from the lower sill plate along the bottom of the cripple wall. Underlying horizontal sheathing is damaged by loosening of nails and cracking of board ends where nails are located. The building paper (weatherproofing) is damaged. The interior posts are leaning, but they are still supporting the floor. Figure A-17 shows example of damage to the cripple wall at Damage State 3.

The repair effort involves the necessary preparation and precautions to safely re-plumb the cripple wall. The stucco and horizontal sheathing must be completely removed. Assume that 75% (600 SF) of the horizontal sheathing boards can be salvaged, and 25% (200 SF) needs to be replaced. The cripple wall studs must be replaced in localized areas near the corners of the house and around crawlspace vents or openings. Building paper (weatherproofing), sheathing, and stucco must be installed with the stucco creating a continuous appearance (e.g., paint) and texture with the existing stucco in the superstructure. Repair effort includes the temporary removal or relocation of utilities. An allowance should be included if there is an expectation that jacking the wall back to plumb could cause additional damage in the superstructure.

~~Alternatively, the building can be shored, and the plywood cripple wall framing, siding and retrofit can be completely replaced. In the replacement option, the horizontal sheathing can be replaced with plywood.~~

Figure A-17 **Significant residual lean of cripple wall where the wall is leaning with the top to the left (a), Delamination of the stucco at the sill plate where the figure shows the underside of a cripple wall test specimen (b) (Damage State 3). Photos: UB Berkeley specimen AL-1 (a), UCSD specimen A-2 (b)**

Damage at the Superstructure Level

The damage to the superstructure in Damage State 3 corresponds to the need for complete replacement of 50% of the exterior and interior nonstructural finishes. The superstructure walls are leaning in one direction of the building. Residual displacement is roughly 1" across the height of the first story walls. Damage at the more heavily damaged walls is described below; damage the less damaged walls is similar to that described in Damage State 2.

- Exterior Damage: For the exterior stucco, the area requiring replacement is 400 SF. The damage to the exterior stucco consists of widespread cracking and spalling near corners of exterior openings. The spalling of stucco exposes the underlying metal lath in numerous locations. The lateral movement of the superstructure is significant enough to allow individual stucco sections between major cracks to rotate independently and partially detach from underlying metal lath. Stucco near the first floor sill plate and floor joists has delaminated and buckled outward near building corners and near doorways. See Figure A-18, Figure A-19 and Figure A-20 for examples of stucco damage at Damage State 3.

  Exterior stucco repairs can assume that the damage is widespread enough to require removal of existing stucco, horizontal sheathing, and weatherproofing. Assume that 75% of the horizontal sheathing boards can be salvaged, and 25% needs to be replaced (300 SF). Stucco must be replaced over repaired sheathing and new building paper.

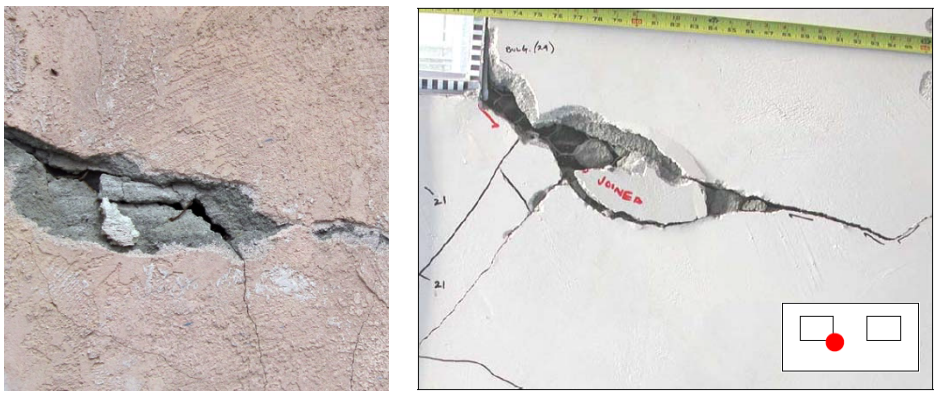


Figure A-18 Significant spalling of stucco where wire lath is exposed (Damage State 3). Photo: Arnold et al. 2003 [right].

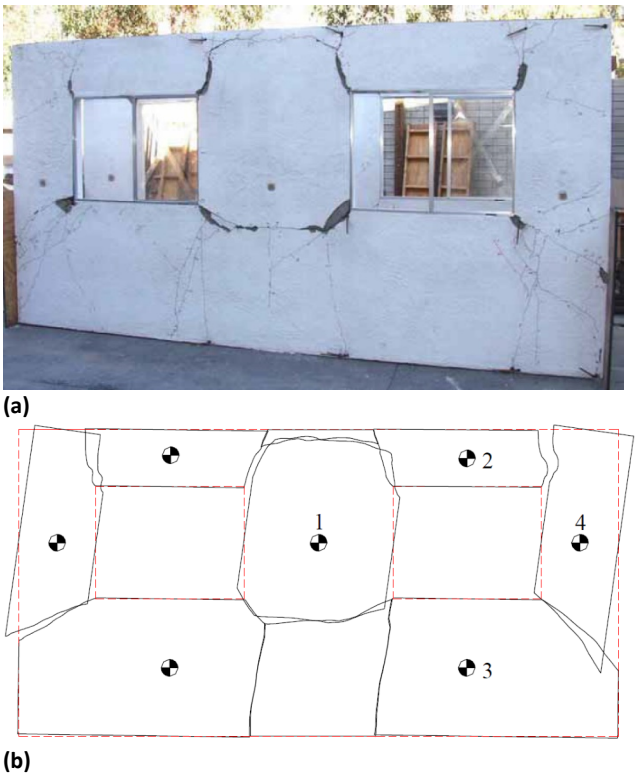


Figure A-19 **Illustration of accumulated stucco damage around windows (a) where combination of cracking and spalling allows stucco to break into individual sections that partially detach from metal lath and framing through local rotations (b) (Damage State 3). Images from Arnold et al. [2003].**

Figure A-20 **Delamination of stucco near doorway also causing doorframe damage (Damage State 3). Photo: CUREE [2010].**

The structural damage to the exterior wall framing system in the superstructure consists of localized connection failures of studs to top and bottom plates. The wall lines of framing will require re-plumbing after the removal of damaged nonstructural finishes and prior to application of new finishes. Stud connections will require repair or replacement near openings with doubled studs (i.e., trimmer and king studs) and near exterior corners of the house. Only a few studs and sill plates will need full replacement due to splitting and can

be assumed to be 10% of a given wall line (4' for each wall in the north-south direction and 3' for each wall in the east-west direction). Realignment and repair of framing will require temporary removal, relocation, and replacement of embedded utilities as required to replace framing and nonstructural finishes. See Figure A-21 for examples of stud pullout.

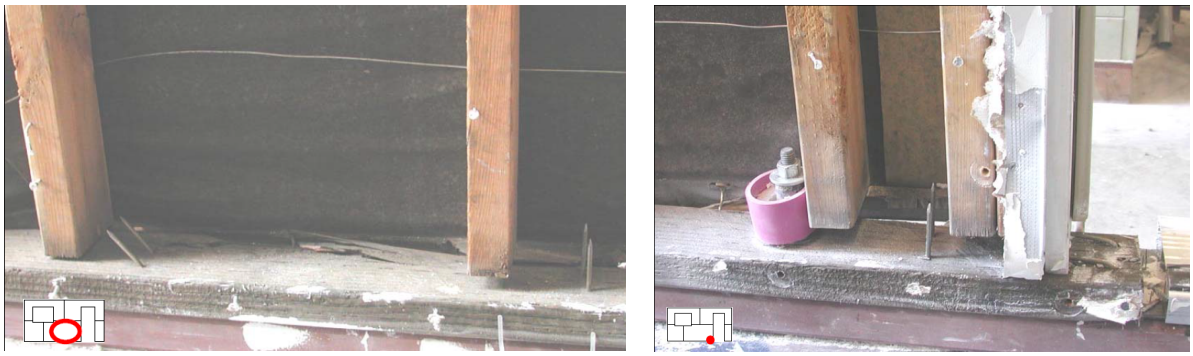


Figure A-21 Examples of stud pullout from end nailing (Damage State 3). Photos: Arnold et al. [2003].

- Interior Wall Damage: The interior gypsum wallboard requires the following square footage to be replaced in each room:
  - Living room – 200 SF
  - Dining room – 100 SF
  - Bedroom 1 – 175 SF
  - Closet 1 –75 SF
  - Bedroom 2 – 175 SF
  - Closet 2 – 100 SF
  - Kitchen – 50 SF
  - Hallway – 100 SF
  - Hall closet – 25 SF
  - Bathroom – 100 SF
  - Linen closet – 35 SF
  - Utility closet – 35 SF

  Of the remaining nonstructural finishes (same square footage), the living room and dining room require the Damage State 2 repairs, and rest of the rooms require the Damage State 1 repairs. Interior gypsum wallboard has significant cracking at corners of openings, widespread tearing and buckling of wallboard joints and distributed fastener popping in larger areas of wallboard without openings. See Figure A-22. The interior wall tile in kitchen and bathroom also has widespread damage. In the bathroom, the towel bar, toilet, tub, and other elements attached to the wall can all be salvaged and reset. Trim has been damaged in some areas and can be assumed that 25% of all trim (window and doors, baseboard, quarter round, etc.) needs replacement (200 LF). All trim must be removed prior to re-finishing of interior. Damage to the partition framing is the same as the exterior walls. Assume that 10% of the partition studs and sill plates need replacement (40 LF).

Figure A-22 Extensive drywall damage examples (Damage State 3). Photos: Arnold et al. [2003].

- Windows and Doors: The glazing in 5 windows is cracked and needs replacement. These are one window on the east façade (21 SF in the living room), one on the south façade (21 SF in the living room), one on the west façade (21 SF in Bedroom 1), and one on the north façade (10.5 SF in Bedroom 1) totaling 73.5 SF. Window frames for these windows also need repair. The rear (west façade) sliding doors are jammed and need repair of both glass and door framing. The front and side doors are still functional. Three of the six interior doors (hall to Bedroom 1, hall to Bedroom 2, and Bedroom 2 closet) require complete replacement including door frames.

- Ceilings: In the living room, dining room, kitchen, and main hallway, there is ceiling damage that needs replacement. In Bedroom 1, a total of repair of 100 LF of cracks and 50 SF of spalling is needed, plus repainting to maintain a consistent appearance. In other rooms, ceilings are not damaged.

- Floors: Floors are not damaged.

- Roof: There is some damage to the roof, with about 50 SF of asphalt shingles and the underlying sheathing boards and/or nailing needing repair. The roof membrane locally needs repair below the 50 SF area, and flashing repairs are needed at the 3 vent stacks and the chimney.

- Miscellaneous Damage: Areas with tiled walls (kitchen and bathroom) have significant damage to grouting and tile units. The damage to tiled areas is such that all of the existing square footage needs to be fully replaced (50 SF in the kitchen and 150 SF in the bathroom). Repairs include removal of the tile and cement backing board and replacing with similar tile and grout. For the bathroom, bathroom wall tile and tub tile surround will need replacing.

- Residual displacement: There is 1” of residual displacement in the superstructure between the top of the first floor and the top of the walls in one direction and about 1/2” in the other direction.

Chimney: The portion of the unreinforced brick chimney above the roof has fallen to the ground and needs replacement above the firebox or complete replacement including the firebox. Noticeable separation between the chimney and the adjacent wall is visible. Assume the shingles around the chimney and the flashing both need repair when the chimney is replaced.

Stairs and Patio: The brick paving on the top of the concrete stair landings at the front and rear entrances is cracked and loose. Assume all of the brick paving can be salvaged and the underlying concrete is undamaged, but the brick needs to be reset on a new mortar bed. The rear concrete patio has cracks, but no vertical offsets. Assume 20 LF of 1/8" wide concrete cracks that need to be repaired with epoxy injection.

Mechanical, Electrical and Plumbing Damage: The braced water heater is still upright though leaning since the wall to which it is attached has racked. The gas meter and piping need some repair, but the gas lines have no apparent leaks. Electrical lines within walls that need repair as identified above will have to be temporarily moved and then reinstalled. For the purposes of this exercise, assume the impacted electrical work will not trigger any code upgrades. 30 LF of drain line is damaged in the crawl space and needs repairs and reconnection at joints. 30 LF of insulated ductwork in the crawl space is torn and needs to be patched.

Access: The exterior and interior of the superstructure was visually reviewed claims adjustors; racking in the crawl space is sufficient that review was done from the exterior as the adjustor did not consider it safe. The UNSAFE placard was posted after the claims adjustor's visit.

ATC-20 Post-Earthquake Safety Evaluation: The building was given a red, UNSAFE placard. Occupancy is not allowed until repairs are made.

Damage State 4 *(CS1-UN-DS4)*

Description of the Earthquake

The magnitude 7.9 earthquake occurred on the San Andreas Fault some distance away from San Carlos and caused an approximate peak ground acceleration of about 0.40g at the site. There was moderate to major damage along the Peninsula and 500 deaths. Unreinforced masonry and nonductile concrete buildings closer to the epicenter were significantly damaged, with many collapses. A few buildings of other types collapsed. Many buildings, including those of wood-frame construction, have been red-tagged, and their occupants have been displaced. Bridges and overpasses have moderate damage to major damage with several collapses; there are significant restrictions that limit traffic capacity. Most utilities were initially out of service, and service has only partially returned in most cases. Power has now returned to the project site; water and sewer remain out of service; but they are expected to return within one month.

Damage at the Cripple Wall and Foundation Level

The cripple wall has completely collapsed. The interior post and pier supports under the first floor beams have also failed laterally. Services and utility supplies that are run below the first floor framing within the crawlspace are damaged. The shutoff valve for the natural gas line triggered, but exterior gas meter connections are damaged. See Figure A-23.

(a) (b)

Figure A-23 **(a) Interior post and pier supports that would fail laterally along with failed perimeter cripple wall; (b) Piping and utilities within a crawlspace that would be damaged by complete cripple wall collapse (Damage State 4). Photos: CUREE [2010] (a)**

Damage at the Superstructure Level

The superstructure of the house has undergone significant lateral displacement and is either collapsed or in an imminent collapse condition. The repair costs should include the additional costs of demolition of the existing house before reconstruction of a new structure.

Chimney: The full height of the chimney has fallen to the ground.

Mechanical, Electrical and Plumbing Damage: MEP damage is significant due to the superstructure damage, but a fire from gas line damage did not occur. MEP replacement/upgrades will be needed as part of the reconstruction of the house.

Stairs and Patio: The concrete stairs and brick landing at the front and rear entrances need to be removed and rebuilt with the house. The rear patio is cracked and needs to be replaced as well.

Access: Due to the level of damage, only the exterior of the superstructure and crawl space could be visually reviewed by claims adjustors and post-earthquake safety evaluators.

ATC-20 Post-Earthquake Safety Evaluation: The building was given a red, UNSAFE placard. Occupancy is not allowed until the building is replaced.

Instructions to adjustors

For Damage State 4, damage is considered so extensive that the entire house needs replacement. A separate Xactimate estimate is not required for this damage state, only the cost per square foot for replacement. The estimate should also include the additional costs of demolition of the existing house before reconstruction of a new structure, and MEP replacement/upgrades that will be needed as part of the reconstruction. Interior nonstructural finishes will use gypsum wallboard, not lath and plaster.

Damage and Repair Effort Descriptions for the *Retrofitted* Case Study Building 1

Damage state scenarios for the retrofitted Case Study Building 1 are the same as the unretrofitted scenarios except as follows. The levels of shaking at the site are in general are higher than they were for the unretrofitted scenarios.

Damage State 1 (CS1-R-DS1)

Damage is the same as for the unretrofitted Damage State 1 scenario. **BECAUSE THE DAMAGE IS THE SAME; THE SAME ESTIMATE AS FOR THE UNRETROFITTED CASE CS1-UN-DS1 WILL BE USED; NO UNIQUE ESTIMATE IS REQUIRED.**

Damage State 2 (CS1-R-DS2)

Damage is the same as for the unretrofitted Damage State 2 scenario. **THE SAME ESTIMATE AS FOR THE UNRETROFITTED CASE CS1-UN-DS2 WILL BE USED; NO UNIQUE ESTIMATE IS REQUIRED.**

Damage State 3 (CS1-R-DS3)

Damage to the original building is worse than it was for the unretrofitted Damage State 3 scenario. Strengthening of the cripple wall has led to damage being pushed up into the superstructure.

Damage at the Cripple Wall and Foundation Level

Residual displacement of the cripple wall is the same 1" as the unretrofitted scenario. This has caused damage and separation of the plywood retrofit from the studs, tearing of the plywood, and nail pullout. There is some splitting of the sill and retrofit blocking as well. Replacement of the retrofit, including the sill, anchor bolts, plywood, nailing and clips is required after the cripple wall is jacked back to plumbl~~, or the building can be shored and the plywood cripple wall framing, siding and retrofit completely replaced. In the replacement option, the horizontal sheathing can be replaced with plywood.~~

Damage at the Superstructure Level

Residual displacement at the superstructure is 2" in both directions rather than the ½" in one direction and 1" in the other direction in the unretrofitted scenario. Complete replacement of interior and exterior nonstructural finishes is needed (rather than half of the finishes in the unretrofitted scenario).

Damage State 4 (CS1-R-DS4)

Damage is the same as it was in the unretrofitted scenario. **THE SAME $/SF ESTIMATE AS FOR THE UNRETROFITTED CASE CS1-UN-DS4 WILL BE USED; NO UNIQUE ESTIMATE IS REQUIRED.**

Case Study Building 2: One-Story, 1200 sf, 1940-1955, 2' Cripple Wall, Horizontal Siding Over Studs

Building Description

Case Study Building 2 is identical to Case Study Building 1, except as follows.

Exterior Materials: Exterior material is 1x6 horizontal tongue and groove redwood siding nailed to exterior studs. Siding boards are nailed with two 8d nails at each stud. The siding construction occurs both above the first floor and on the cripple wall between the first floor and foundation. The exterior trim details are 4" wood corner trim and 4" wood window and door trim.

Cripple Wall Details

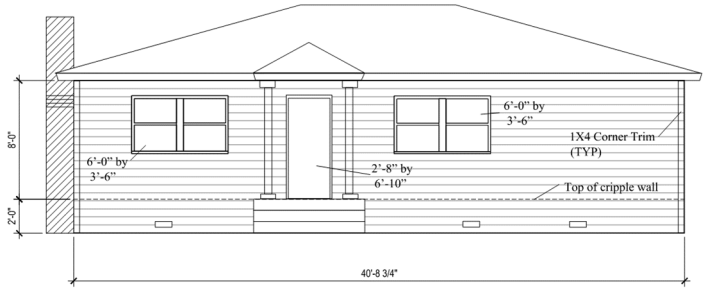
- Existing Unretrofitted Condition: The cripple wall has 2x4 studs at 16" o.c. bearing on a 2x6 sill plate supported by a strip footing. The sill plate is anchored to the foundation with ½" diameter anchor bolts at 6' o.c. cast into the footing. The outboard face of the sill is aligned with the outboard face of the concrete foundation.
- Retrofitted Condition: The retrofit is the same as in Case Study Building 1.

Interior Materials: Interior material is 7/8" plaster on wood lath (3/8" lath with 1/2" plaster), instead of gypsum wallboard with normal painted finish unless specified otherwise. Baseboard is 5-1/4" wide with quarter round molding. Interior door and window trim is 3-1/4" wide. Standard trim materials and styles can be assumed (there is no crown molding, for example). Dining room has chair rail with no cabinetry or countertops. Floors in kitchen and bathroom are standard grade ceramic tile. All other flooring is common oak flooring. The kitchen has typical laminate countertops and 6" backsplash. Kitchen wall ceramic tile is placed between countertops and upper cabinetry units. All cabinetry is assumed to be of typical quality. The bathroom has sliding shower door with tiled surround including window sill. Bathroom also has a tiled half wall around the perimeter.

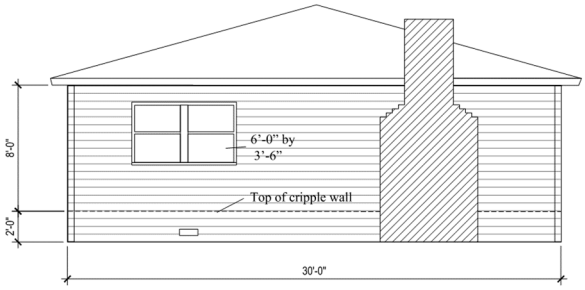
Figures: Examples of representative buildings covered by this case study are shown in Figure A-24. See Figure A-25 for exterior elevations and Figure A-26 for images of the structure and finish materials. Figure A-27 shows a detail of the cripple wall retrofit. The plan layout is the same as Figure A-21 for Case Study Building 1.

Figure A-24 Examples of buildings similar to Case Study Building 2.

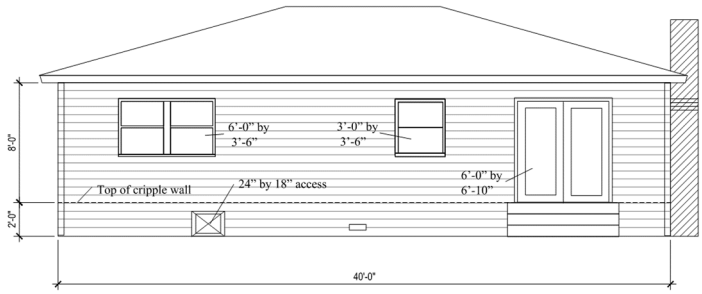
East (Front Façade)



South (Left Façade)



West (Rear Façade)



North (Right Façade)

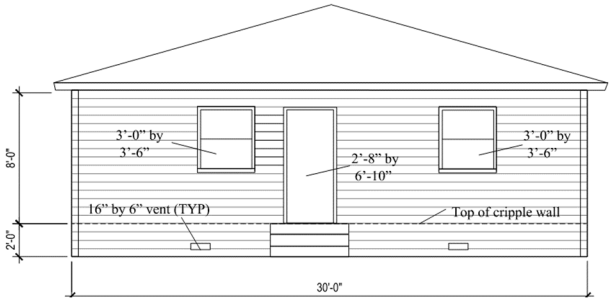


Figure A-25 Exterior elevations of the Case Study 2 house (east, south, west, and north); rough opening sizes are annotated.

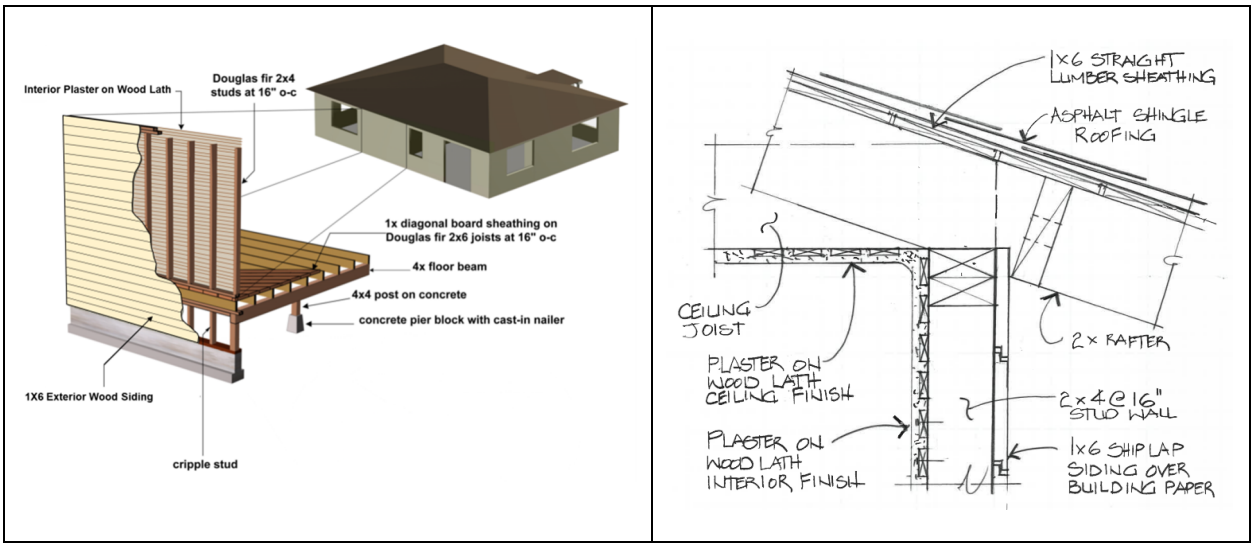


Figure A-26 **Typical framing and finish components for Case Study Building 2 showing a) left: 3-D rendering of wall finish and framing materials (Image adapted from CUREE [2010]) and b) right: top of first story wall.**

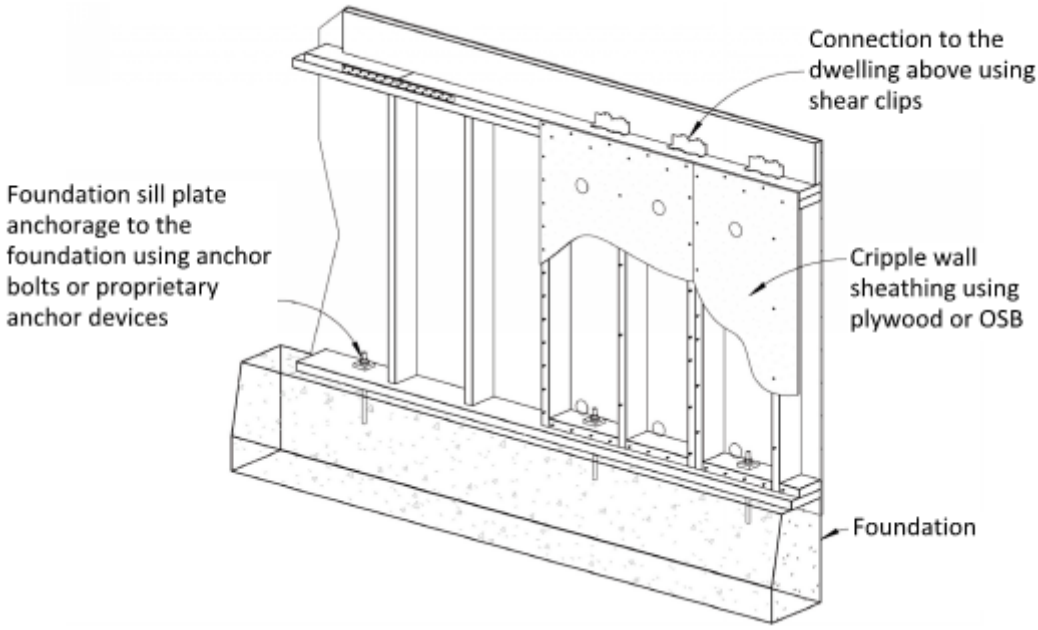


Figure A-27 **Example of cripple wall and sill anchorage strengthening (from Figure 4.1-1 of FEMA [2018]). The approach is similar to that of Case Study Building 1.**

Damage and Repair Effort Descriptions for the *Unretrofitted* Case Study Building 2

Damage state scenarios for the unretrofitted Case Study Building 2 are the same as the unretrofitted Case Study Building 1 scenarios except as follows.

Damage State 1 (CS2-UN-DS1)

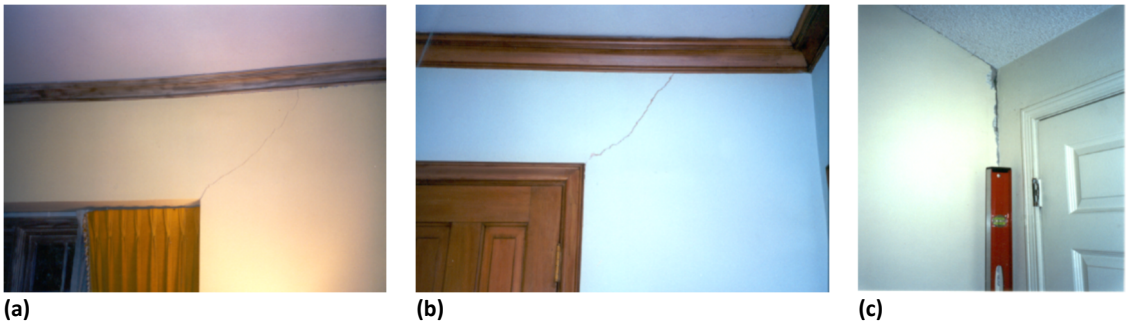
Damage at the Cripple Wall and Foundation Level

There is no quantifiable damage to the cripple wall or foundation at this damage state.

Damage at the Superstructure Level

- Exterior Damage: The exterior of the house is not damaged in this damage state.

- Interior Damage: General interior damage at the superstructure in this damage state for Case Study Building 2 is the same as it was for Case Study Building 1. The interior wall damage is concentrated in living room and the dining room. Repairs to interior wall nonstructural finishes can assume similar damaged areas, i.e., the rough proportions of wall area that need repair correspond to 5% of wall area for cracks at openings (20 SF in the living room and 10 SF in the dining room) and 10% of joints (10 LF in the living room and 6 LF in the dining room) and cornerbead need replacing. However, for the Case Study Building 2, repair work needs to account for repairs for plaster on wood lath. Damage to lath and plaster walls consists of cracks of 1/64" to 1/8" wide protruding from corners of windows and doors. There is also damage to plaster at intersecting walls. See Figure A-28 Repair of plaster cracks requires that the plaster be re-adhered to the underlying lath within approximately 1" on either side of the crack when necessary. The crack is prepared by predrilling holes through plaster to inject bonding agent into the holes and then placing temporary setting screws into the holes to allow the bonding agent to set up. Setting screws are removed and the crack is cleaned and filled with plaster patching material and reinforced joint tape. A final skim coat is placed over the crack to allow for sanding and repainting to achieve a uniform appearance. ~~Areas with tiled walls (kitchen and bathroom) have some damage to grouting and a few cracked tile units. Most cracked tile will be near interior corners. Repairs consist of repairing approximately 10% of tiled areas in each room (5 SF in the kitchen and 15 SF in the bathroom). It can be assumed that the cement board remains intact and functional.~~



(a) (b) (c)

Figure A-28 Wood lath and plaster (Damage State 1): (a) Cracking at window corner; (b) cracking at doorway; (c) damage at interior corner. Photos: Schierle [2001].

- Miscellaneous: Areas with tiled walls (kitchen and bathroom) have some damage to grouting and a few cracked tile units. Most cracked tile will be near interior corners. Repairs consist of repairing approximately 10% of tiled areas in each room (5 SF in the kitchen and 15 SF in the bathroom). It can be assumed that the cement board remains intact and functional and that only the wall tile is affected.

Damage State 2 (CS2-UN-DS2)

Damage at the Cripple Wall and Foundation Level

There is no damage at the cripple wall or foundation at this damage state.

Damage at the Superstructure Level

There is about 1/4" of residual displacement at the superstructure level in the east-west direction.

- Exterior Damage: Some trim boards and siding boards need readjustment.

- Interior Damage: The extent of interior damage for this damage state can be assumed similar to the damage descriptions for interior nonstructural finishes for Case Study Building 1 Damage State 2. The interior wall damage is concentrated in living room and the dining room. The lath and plaster damage can be described as wide spread cracking with minor spalling in some areas. Areas with distributed cracking or spalling must be cut back to securely fastened plaster. The existing lath may need to be repaired or replaced before applying the brown coat to the lath. A final finish coat is applied allowing for sanding and repainting to achieve uniform appearance. The rough proportions of wall area that need repair correspond to 10% of wall area requiring removal and replacement (40 SF in the living room and 20 SF in the dining room) and 25% of joints and cornerbead needing refinishing (25 LF in the living room and 15 LF in the dining room).

- Miscellaneous: Areas with tiled walls (kitchen and bathroom) have significant damage to grouting and tile units. The damage to tiled areas is such that half the existing square footage needs to be fully replaced (25 SF in the kitchen and 75 SF in the bathroom). ~~The damage to tiled areas is such that half the existing square footage needs to be fully replaced.~~ Repairs include removal of the tile and cement backing board and replacing with similar tile and grout. Only the wall tile is affected.

Windows and Doors: The glazing in 3 windows is cracked and needs replacement. These are one window on the east façade (21 SF in the dining room), one on the west façade (21 SF in Bedroom 1), and one on the north façade (10.5 SF in Bedroom 1) totaling 52.5 SF. Window frames for these windows also need repair.

Damage State 3 (CS2-UN-DS3)

Damage at the Cripple Wall and Foundation Level

Residual displacement of the cripple wall is about 1" in both directions. All corner trims are damaged, some studs have begun to pull out at corners, and substantial portions of the siding have

pulled away from the studs. Jacking the wall to replumb it to vertical is needed. On the south façade about 25 SF of siding cannot be salvaged and needs to be replaced. The remaining siding on the south façade (35 SF), west façade (80 SF), north façade (60 SF), and east facades (80 SF) will need to be renailed. The building paper will need to be replaced on each facade. An allowance should be included if there is an expectation that jacking the wall back to plumb could cause additional damage in the superstructure. ~~Alternatively, the cripple wall can be shored, and the wall framing, siding and paper can be completely replaced.~~ See Figure A-29.

Damage at the Superstructure Level

Residual displacement at the superstructure is 1" to 2" in both directions. The superstructure has been badly racked and will require removal of interior and exterior nonstructural finishes in order to inspect structural framing and re-plumb the superstructure.

1. Exterior Damage: The exterior of the house requires that the trim boards (corner, window, and door) be removed. The trim can be assumed to be 50% salvageable (110 LF). Exterior wood siding will require removal. Siding can be assumed 75% salvageable (600 SF) with the remaining 25% (200 SF) being damaged from earthquake loading and the removal process and not salvageable. The structural framing must be inspected, repaired and re-plumbed. It can be assumed that 10% of framing (studs, top plates, sill plates) near openings and building corners needs replacement (50 LF). All other framing is salvageable. The weatherproofing must be replaced prior to re-siding the house. Trim must be replaced, and new trim material must be used for doors and openings that require replacement. The exterior of the house must be repainted to achieve a uniform appearance following repairs.

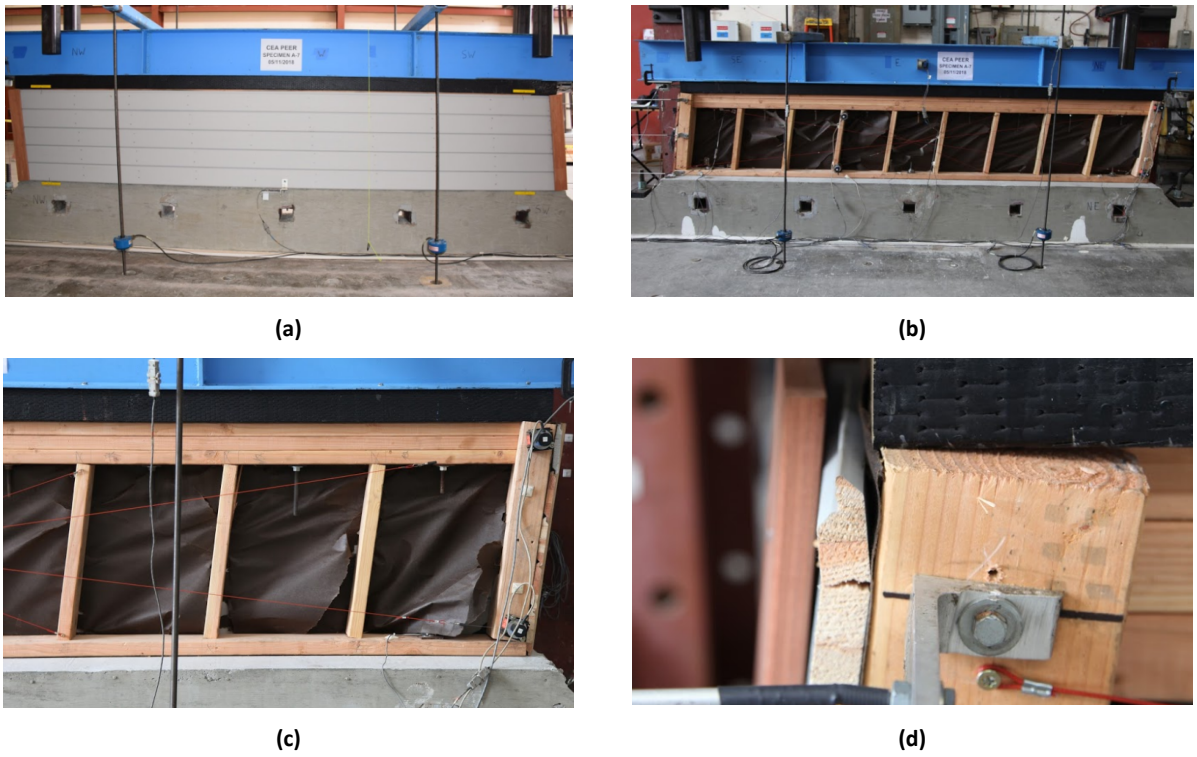
- Interior Damage: Interior damage for Case Study Building 2 is the same as that described for the **retrofitted** Case Study Building 1 Damage State 3 scenario. The damage to the interior lath and plaster is severe enough to require that all interior nonstructural finishes be replaced including tiled areas. The replacement of the interior can assume that modern gypsum drywall will be used to replace the interior. Plaster on wood lath needs to be removed. Framing will need to be furred out an additional 3/8" to maintain existing finish edge to match door framing, hardwood flooring, etc. such that the same trim sizes can be used. This can be done with 3/8" plywood sheathing under they drywall, rather than individually shimming each framing member. It can be assumed that all other repair costs required for replacing and finishing gypsum drywall are applicable to this case.

- Windows and Doors: The glazing in 5 windows is cracked and needs replacement. These are one window on the east façade (21 SF in the living room), one on the south façade (21 SF in the living room), one on the west façade (21 SF in Bedroom 1), and one on the north façade (10.5 SF in Bedroom 1) totaling 73.5 SF. Window frames for these windows also need repair. The entrance door on the east façade in the living room and the closet door on the north façade require new door frames, hinges and lock sets, yet the doors are salvageable. The rear (west façade) sliding door requires complete replacement. The front and side doors are still functional. Three of the six interior doors (hall to Bedroom 1, hall to Bedroom 2, and Bedroom 2 closet) require complete replacement including door frames.

- Miscellaneous: Miscellaneous damage for Case Study Building 2 is the same as that described for the **retrofitted** Case Study Building 1 Damage State 3 scenario. The damage to the interior lath and plaster is severe enough to require that all interior nonstructural finishes be replaced including tiled areas. For the bathroom, wall tile and tub tile surround will need replacing.

Mechanical, Electrical and Plumbing Damage: The braced water heater has toppled due to severe damage to the wall to which it was attached, but the gas line is not leaking, and a fire did not occur. The water heater will need to be replaced. Electrical lines within walls that need repair will have to be temporarily moved and then reinstalled. For the purposes of this exercise, assume the impacted electrical work will not trigger any code upgrades. 30 LF of drain line is damaged in the crawl space and needs repairs and reconnection at joints. 30 LF of insulated ductwork in the crawl space is torn and needs to be patched.

Access: The exterior and interior of the superstructure was visually reviewed claims adjustors; racking in the crawl space is sufficient that review was done from the exterior as the adjustor did not consider it safe. The UNSAFE placard was posted after the claims adjustor's visit.
ATC-20 Post-Earthquake Safety Evaluation: The building was given a red, UNSAFE placard. Occupancy is not allowed until repairs are made.



(a) (b)

(c) (d)

Figure A-29 **Cripple wall damage for Damage State 3 (12% total drift = 2.88 inches; residual drift = 2 inches at end of cycle grouping): (a) exterior elevation (b) interior elevation (c) close-up of building paper damage and stud rotation (d) close-up of cracking siding boards and end of wall. Photos taken at the first cycle of max drift for UCSD Specimen A-7.**

Damage State 4 (CS2-UN-DS4)

Damage is the same as it was for Case Study Building 1. The cripple wall collapsed and the superstructure either collapsed or is in an imminent collapse condition. The entire house needs replacement. A separate Xactimate estimate is not required for this damage state, only the cost per square foot of replacement. The estimate should also include the additional costs of demolition of the existing house before reconstruction. Replacement costs would be the same as the unretrofitted scenario. The replacement house uses gypsum wallboard, not lath and plaster.

Damage and Repair Effort Descriptions for the *Retrofitted* Case Study Building 2

Damage state scenarios for the retrofitted Case Study Building 2 are the same as the unretrofitted Case Study Building 2 scenarios except as follows. The levels of shaking at the site are in general are higher than they were for the unretrofitted scenarios.

Damage State 1 (CS2-R-DS1)

Damage to the original building is the same as for the Damage State 1 unretrofitted scenario. The cripple wall and sill anchorage retrofit has no visible damage. **THE SAME ESTIMATE AS FOR THE UNRETROFITTED CASE CS2-UN-DS1 WILL BE USED; NO UNIQUE ESTIMATE IS REQUIRED.**

Damage State 2 (CS2-R-DS2-CW)

Damage at the Cripple Wall and Foundation Level

Damage to the original building is the same as for the Damage State 2 unretrofitted scenario. The cripple wall and sill anchorage retrofit has undergone racking and has ½" of residual displacement. This has caused nail bending and pullout in some locations. Renailing of the plywood will be necessary. Anchor bolts are undamaged.

Damage at the Superstructure Level

THE SAME ESTIMATE AS FOR THE UNRETROFITTED CASE CS2-UN-DS2 WILL BE USED FOR THE SUPERSTRUCTURE AND INCLUDED AS PART OF THE CS2-UN-DS2 ESTIMATE; NO UNIQUE ESTIMATE IS REQUIRED FOR THE SUPERSTRUCTURE.

Damage State 3 (CS2-R-DS3)

Damage to the original building is similar to what it was for the Damage State 3 unretrofitted scenario. Strengthening of the cripple wall has led to damage being pushed up into the superstructure.

Damage at the Cripple Wall and Foundation Level

Residual displacement of the cripple wall is the same 1" as the unretrofitted scenario. This has caused damage and separation of the plywood retrofit from the studs, tearing of the plywood, and nail pullout. There is some splitting of the sill and retrofit blocking as well. ~~Replacement of the retrofit, including the sill, anchor bolts, plywood, nailing and clips is required after the cripple wall is jacked back to plumb or~~ T~~t~~he building is to~~can~~ be shored and the plywood cripple wall framing, siding and retrofit completely replaced.

Damage at the Superstructure Level

Residual displacement at the superstructure is the same 2" in both directions as it was in the unretrofitted scenario. Complete replacement of interior and exterior nonstructural finishes is needed.

Damage State 4 (CS2-R-DS4)

Damage is the same as it was in the unretrofitted scenario. **THE SAME $/SF ESTIMATE AS FOR THE UNRETROFITTED CASE CS2-UN-DS4 WILL BE USED; NO UNIQUE ESTIMATE IS REQUIRED.**

Case Study Building 3: Two-Story, 2464 sf, 1956-1970, 6' Cripple Wall, T1-11 Sheathing Over Studs

Building Description

Case Study Building 3 has the following characteristics.

Geometry: The building is a two-story house with out-to-out plan dimensions of 44' by 28' at each story, for a total of 2,464 SF, not including the garage square footage. The plan is rectangular with no re-entrant corners. The story height is 8'. There is a hip roof with a 4:12 pitch with an 18" eave overhang around the entire perimeter. There is a garage at grade attached to the front façade of the main house. Steps lead up 6' from grade to the front porch and first floor. A back deck off the dining room has steps down to the back yard. Building square footage also does not include the exterior stairs, porch, or deck.

Construction Period: The building is representative of 1956-1970 construction in California. It was built in 1965. Examples of representative buildings covered by this case study are shown in Figure A-30. In 2004, the roofing was replaced, and the exterior was repainted.

Structural System: Asphalt shingle laminate roofing is supported by straight 1x6 sheathing which in turn is supported by wood 2x6 rafters which span to interior and exterior stud walls. Stud walls at both stories are 2x4 at 16" o.c. Second story 2x6 ceiling joists are supported by interior and exterior walls. Diagonal 1x8 floor sheathing is used at both the first and second floor; it is supported by 2x10 wood joists. Second floor joists bear on interior and exterior bearing walls. First floor joists bear on a perimeter wood cripple wall and interior post and beam framing. See Figure A-31 and Figure A-32 for first and second floor plans. The front and rear stairs, front porch, and rear deck are all wood framed with pressure treated sawn lumber.

Exterior Materials: Exterior material is T1-11 plywood siding with half-lap ("ship-lap") vertical edges. T1-11 sheets are nominally 4' X 8' with a thickness of 5/8". Vertical lap joints have a 3/8" lip at each side of the panel. Vertical grooves in the siding are spaced at 8" and are the locations of 8d common nails along the perimeter of each panel. Field nailing of the panels is 8d common nails spaced at 12" o.c. Metal flashing (i.e. "Z flashing") is placed between vertical courses of siding. This occurs both above the first floor (i.e. between first and second stories) and on the cripple wall between the first floor and foundation. There is a 1"X12" belly band fascia trim piece that covers the horizontals joint between vertical T1-11 courses except where there is an exterior deck or porch. All trim is 1"x4" wood that includes corners, windows, and doors for all openings. See Figure A-33 and Figure A-34 for exterior wall elevations. Typical framing and finish components are shown in Figure A-35. Details at the vertical joint are shown in Figure A-36 While the outer board is nailed into the stud, the tongue of the inner board is typically not adequately nailed.

Cripple Wall Details

- Existing Unretrofitted Condition: The cripple wall is 6' tall instead of the 2' tall cripple walls in Case Study Buildings 1 and 2. The cripple wall has 2x4 studs at 16" o.c. bearing on a 2x6 sill plate supported by a strip footing. The sill plate is anchored to the foundation with ½" diameter anchor bolts at 6' o.c. cast into the footing. The outboard face of the sill is aligned with the outboard face of the concrete foundation.

- Retrofitted Condition: For the retrofitted condition, in lieu of interior plywood strengthening like Case Study Building 1 or Case Study Building 2, the T1-11 siding nailing is improved to 8d at 4" o.c. The cripple wall top plate is connected to the floor rim joists (23 shear clips each cripple wall, 92 total, A35, L50 or similar). Anchor bolts are added to the sill (15 bolts each wall, 60 total). When the inner board at the vertical joint is sufficiently aligned with the existing stud, nailing can be added directly through the tongue into the stud as shown in Figure A-37. This occurs on the short sides of the building. For the long sides of the building, the tongue and stud do not align sufficiently, and the approach shown in Figure A-38 is implemented.

Interior Materials: Interior materials are the same as Case Study Building 1.

Mechanical, Electrical, and Plumbing: Standard electrical and plumbing services are assumed for the two-story house. The kitchen stove, water heater, and forced-air furnace use natural gas. There is no seismic shutoff valve for the natural gas line at the meter. The water heater is braced and located in the garage. The stove and water heater are 10 years old; the furnace is 20 years old.

Location: The home is located in San Carlos, CA at ZIP Code 94070.

Site and Soil Conditions: The site is on a flat site but is elevated on a 6' cripple wall for flood control. The garage slab floor is at grade. The soil at the site is alluvial fill, and it is categorized as Site Class D per the 2016 CBC.

Figure A-30 **Examples of buildings similar to Case Study Building 3. Note that some of the photos are of buildings from an earlier era than the 1956-1970 target era for this case study, but they are included to give a sense of the tall cripple wall.**

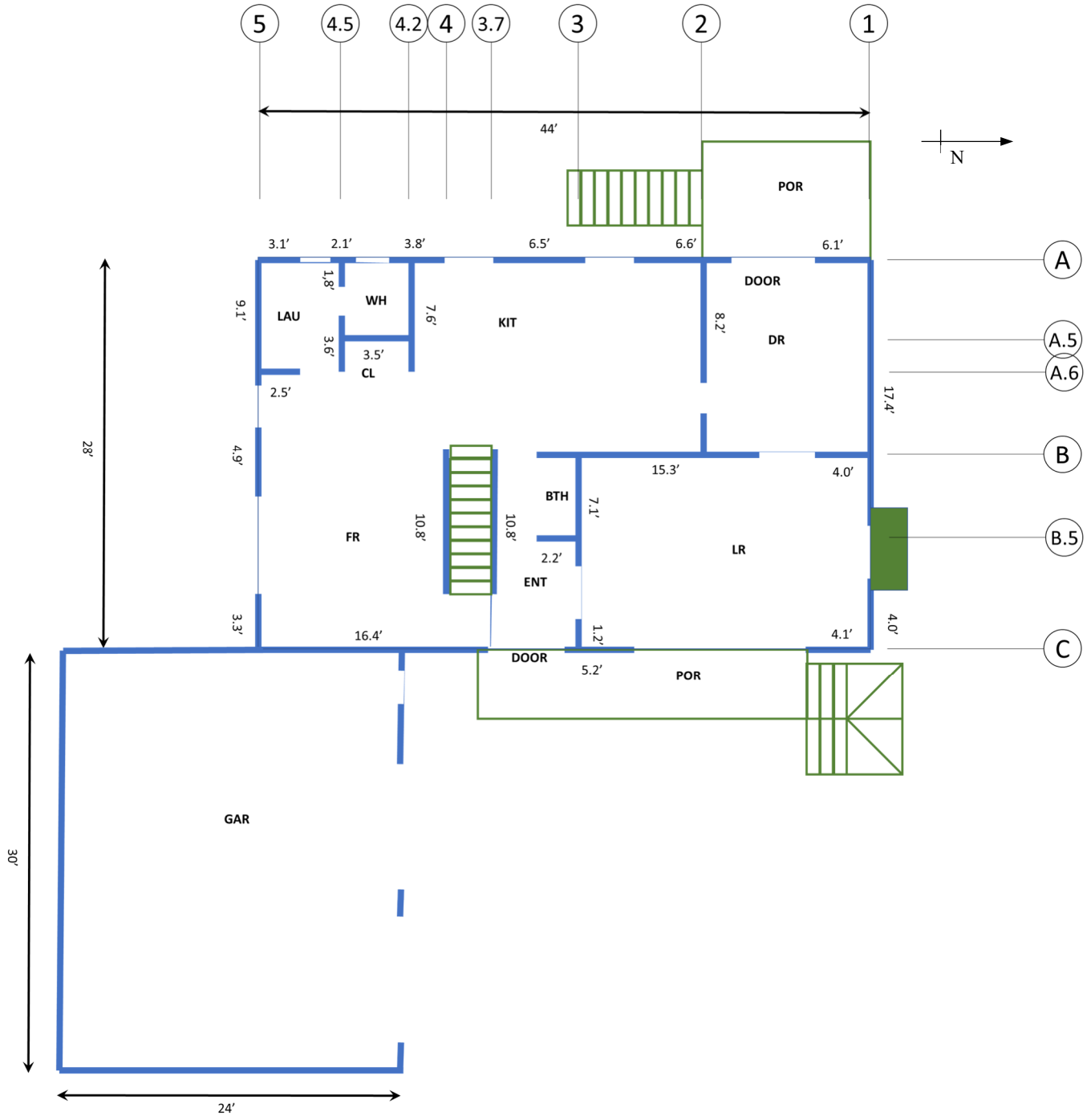


Figure A-31 Plan view of Case Study Building 3 – First Floor.

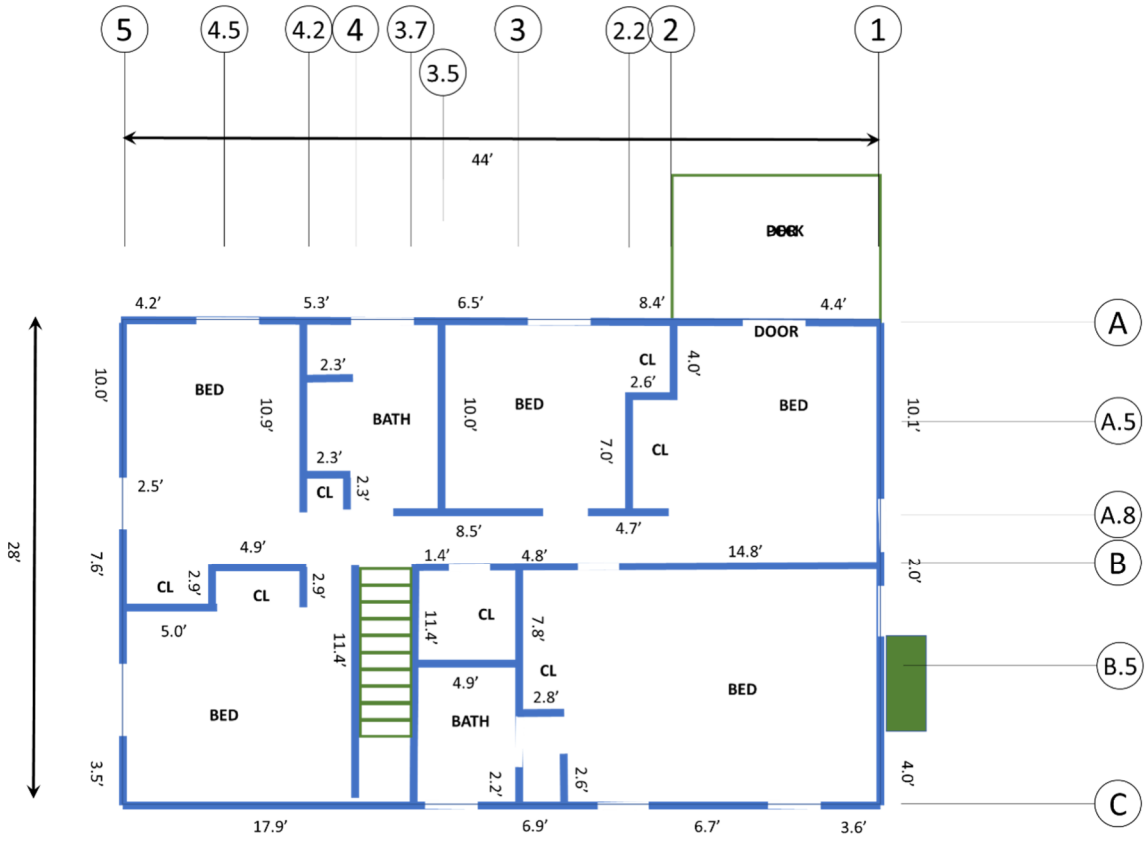
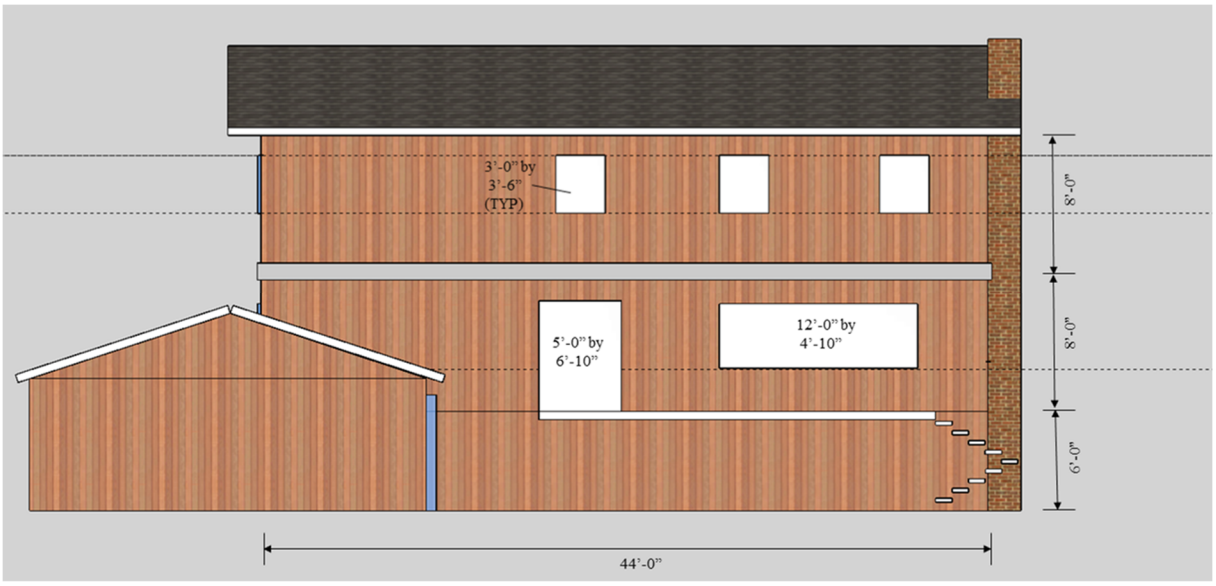
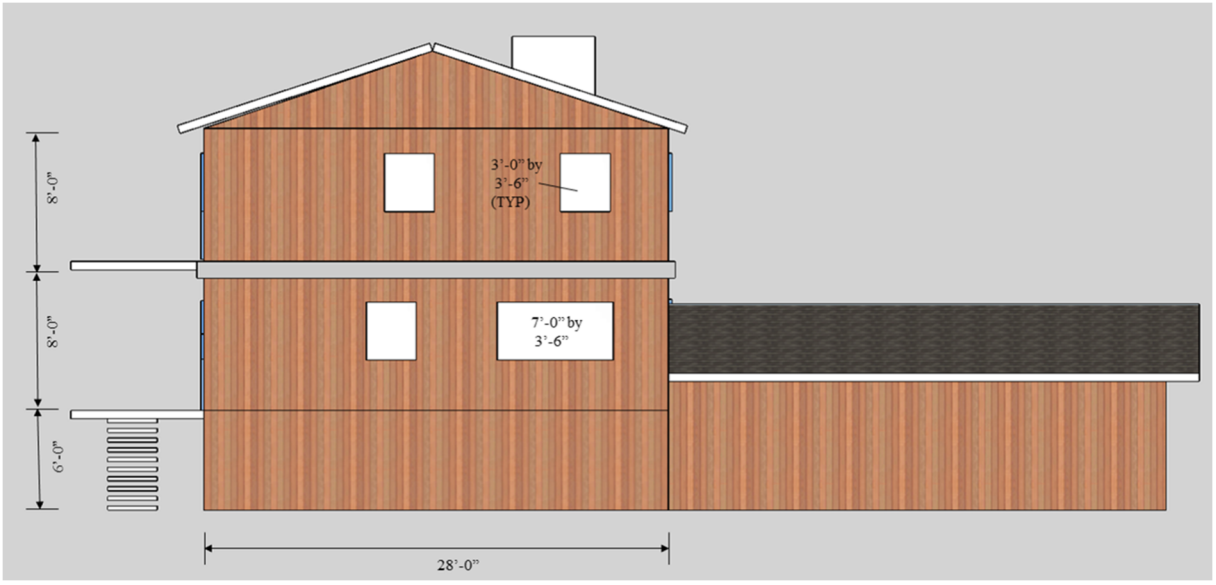


Figure A-32 Plan view of Case Study Building 3 – Second Floor.

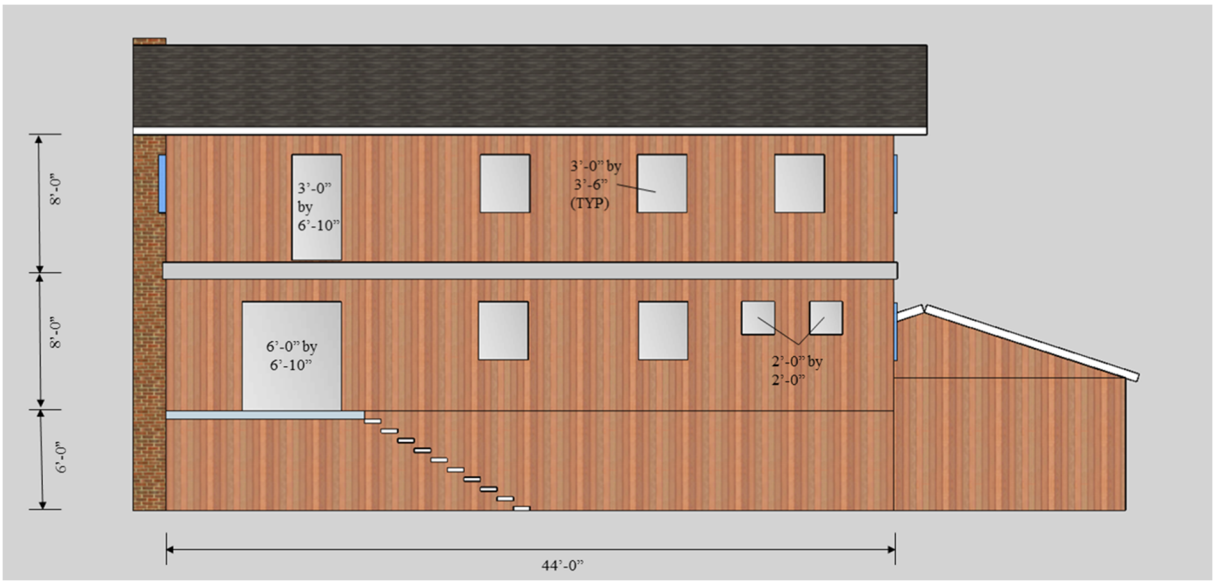


(a) East (front façade)



(b) South (left façade)

Figure A-33 East and south elevations for Case Study Building 3.



(a) West (rear façade)

(b) North (right façade)

Figure A-34 West and north elevations for Case Study Building 3.

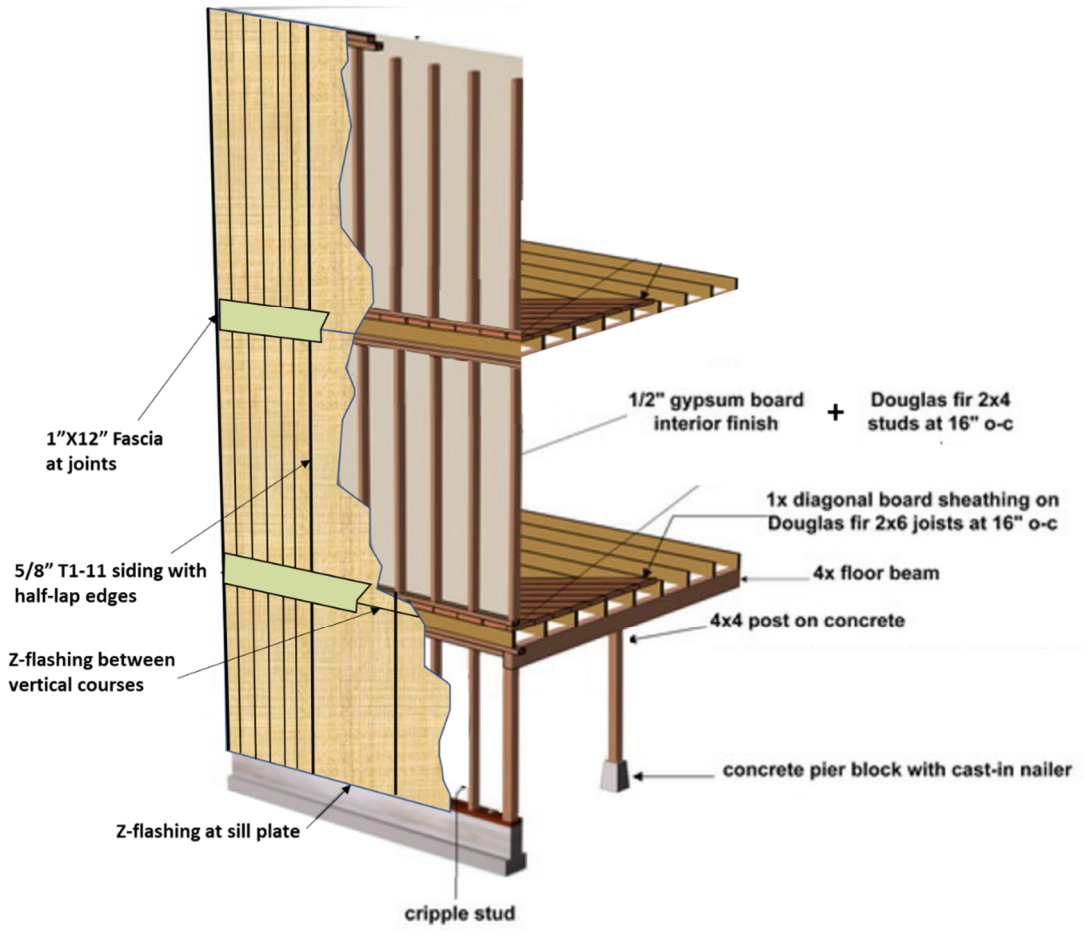


Figure A-35 Typical framing and finish components for the Case Study Building 3. Image adapted from CUREE [2010].

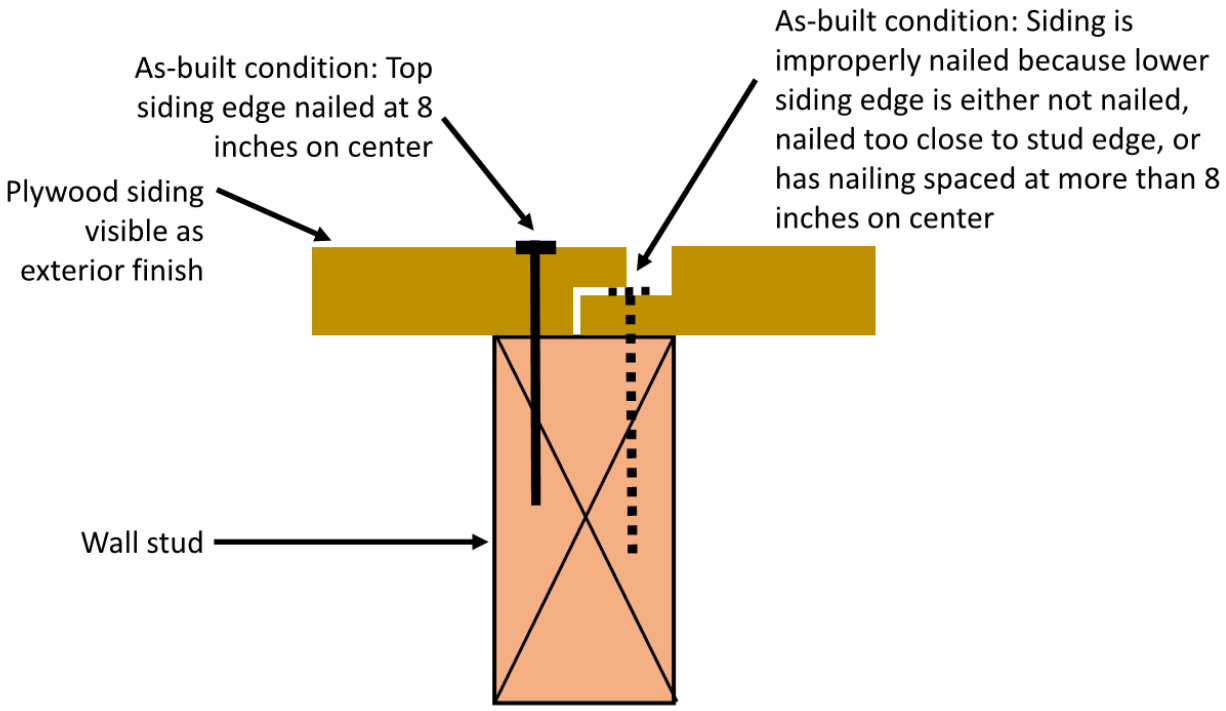


Figure A-36 Plan detail of T1-11 vertical joints.

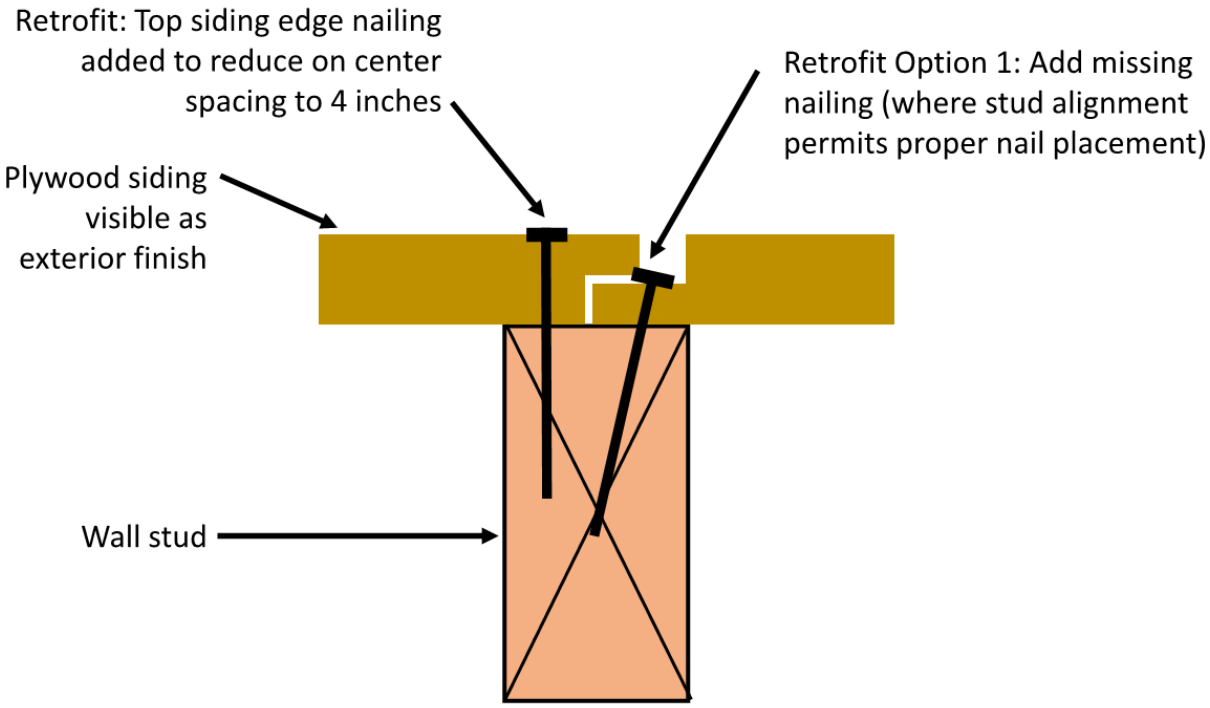


Figure A-37 Cripple wall strengthening when T1-11 vertical joints align adequately with existing studs.

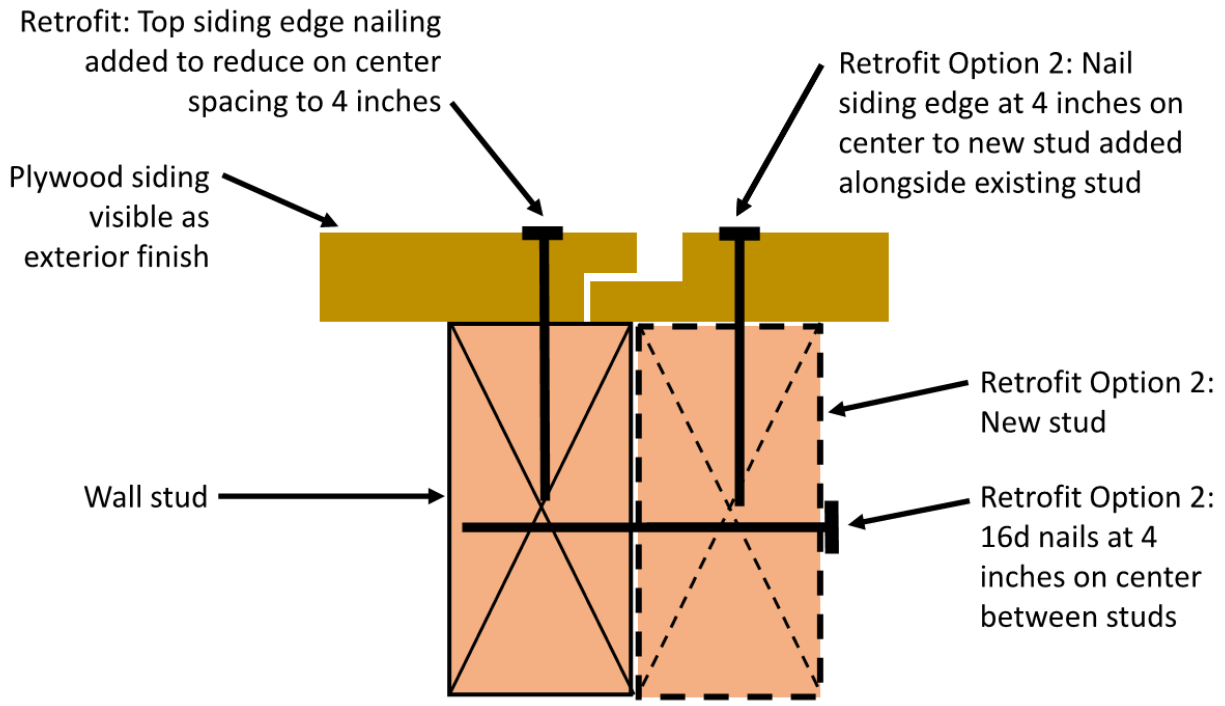


Figure A-38 Cripple wall strengthening when T1-11 vertical joints do not align adequately with existing studs.

Damage and Repair Effort Descriptions for the *Unretrofitted* Case Study Building 3

Damage state scenarios for the unretrofitted Case Study Building 3 are the same as the unretrofitted Case Study Building 2 scenarios except as follows.

Damage State 1 (CS3-UN-DS1)

Damage at the Cripple Wall and Foundation Level

There is no observable damage to the cripple wall or foundation at this damage state. See Figure A-39.

Damage at the Superstructure Level

- Exterior Damage: There is no observable damage to the exterior of the house for this damage state.

- Interior Damage: Interior damage at the superstructure at this damage state for Case Study Building 3 is the same as it was for Case Study Building 1 (gypsum wallboard repairs). Repairs reflect the different building size and wall layout for Case Study Building 3. At the first story, the interior wall damage is concentrated in living room and the dining room. At the second story, the interior wall damage is concentrated in Bedroom 1 and Bedroom 2.

The rough proportions of wall area that need repair correspond to 5% of wall area for cracks at openings and popped fasteners and 10% of joints and cornerbead need replacing in each of the affected rooms. The following is a list of nonstructural finish items to be replaced in each room:

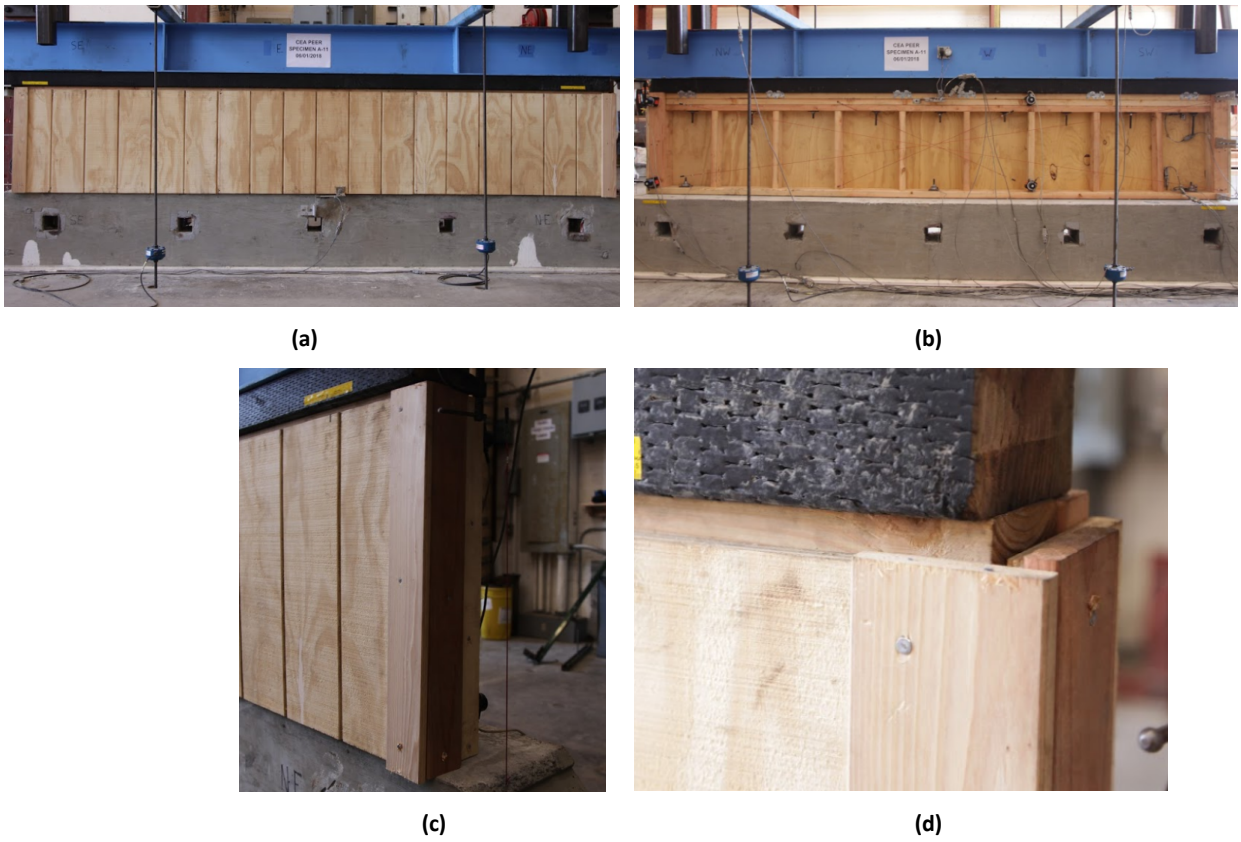
- Living room – 20 SF of wall area, 7 LF of joints
- Dining room – 20 SF of wall area, 5 LF of joints
- Bedroom 1 – 25 SF of wall area, 10 LF of joints
- Bedroom 2 – 20 SF of wall area, 5 LF of joints

- Miscellaneous: Areas with tiled walls in the kitchen and Bathroom 1 have some damage to grouting and a few cracked tile units. Most cracked tile will be near interior corners. Repairs consist of repairing approximately 10% of tiled areas in each room (20 SF in the kitchen and 10 SF in Bathroom 1). It can be assumed that the cement board remains intact and functional and that only the wall tile is affected.

- ~~*It can be assumed that the cement board remains intact and functional.*~~

- *Stairs, Porches, and Deck*: There is no damage to the wood-framed front and rear wood stairs, front porch, or rear deck

.



(a) (b)

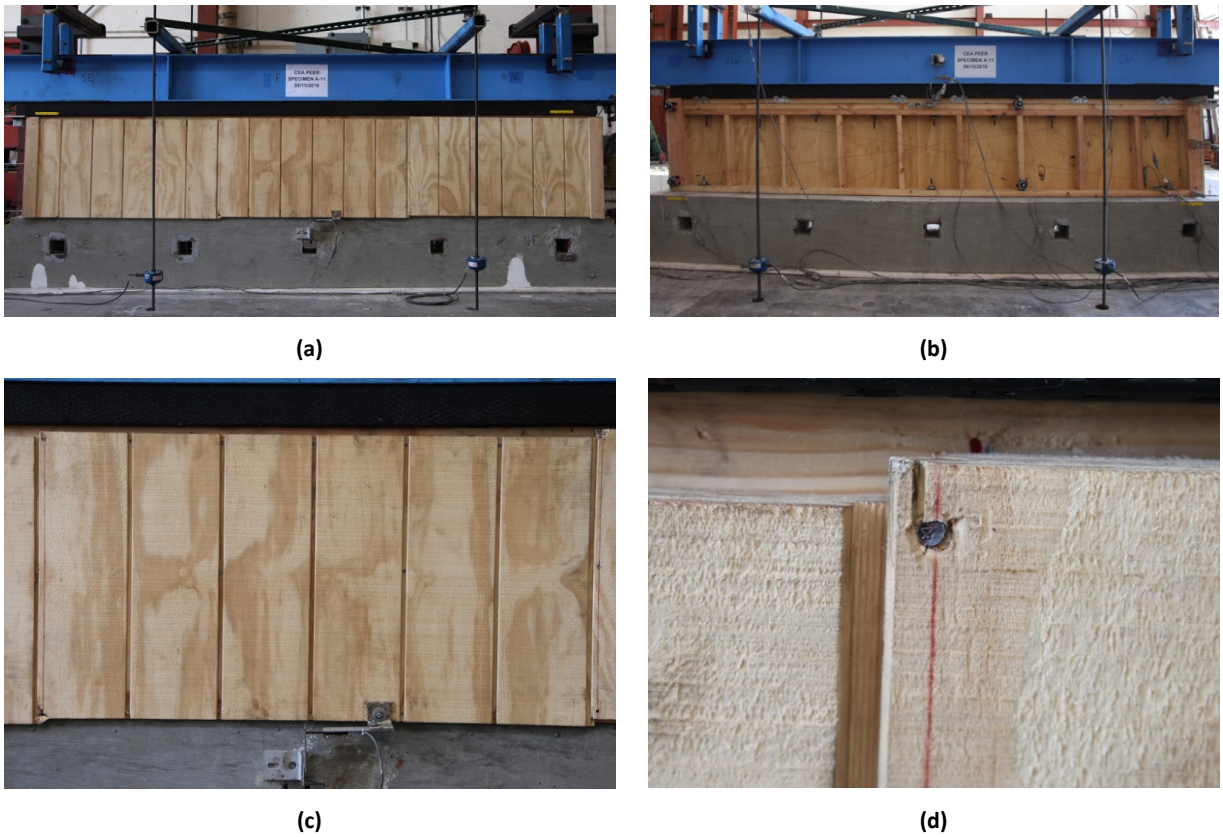
(c) (d)

Figure A-39 **Cripple wall damage for Damage State 1 (1.4% total drift = 0.34 inches; residual drift = 0 inches at end of cycle grouping): (a) exterior elevation (b) interior elevation (c) corner view (d) close-up of corner showing differential displacement in trim boards. Photos taken at the end of cycle grouping for UCSD Specimen A-11.**

Damage State 2 (CS3-UN-DS2)

Damage at the Cripple Wall and Foundation Level

There is some damage at corner trim pieces. The siding itself has nails loosened by the panel movement and nails that have torn through the ship lap edges in the vertical joints in some locations. The siding has begun to separate from the studs in some locations, but there is no damage to the stud framing or sill anchorage. The building paper does not appear torn from the interior. There is 1/2" of residual displacement in both directions. Jacking the wall to replumb it to vertical is needed, and about 50 SF of siding will need to be renailed. An allowance should be included if there is an expectation that jacking the wall back to plumb could cause additional damage in the superstructure. See Figure A-40 for Damage State 2 for the cripple wall.



(a) (b)

(c) (d)

Figure A-40 Cripple wall damage for Damage State 2 (5% total drift = 1.2 inches; residual drift = 0.5 inches at end of cycle grouping): (a) exterior elevation (b) interior elevation (c) close-up of T1-11 panel rotation (d) close-up relative panel rotation and nail withdrawal. Photos taken at the first cycle of max drift for UCSD Specimen A-11.

Damage at the Superstructure Level

There is no residual displacement at the superstructure level.

- Exterior Damage: The general extent of exterior damage is caused by the local rotation of each T1-11 siding panel. The siding itself has nails loosened by the panel movement and nails that have torn through the ship lap edges in the vertical joints in some locations. The movement of the siding fasteners has ovalized or torn the Z-flashing behind the siding which compromises the weatherproofing function of the exterior at the horizontal joints between panel courses. There is no significant damage to the structural framing and the gable ends of the roof can be assumed undamaged. The repair effort involves a visual inspection of the exterior to identify locations where panel damage has occurred and where weatherproofing may be compromised. The 1x12 fascia, corner trim, window trim and door trim needs to be removed for half of the length of each exterior wall line (72 LF of fascia for each floor and 100 LF of trim for each story). All trim is salvageable but must be re-caulked when replaced. Half of the siding panels must be removed to access the flashing for each story (The perimeter of the house requires 36 vertical panels to make up the horizontal dimensions at each story level). The Z-flashing needs to be replaced for 25% of

the perimeter at each level (36 LF at each floor). The remaining flashing behind removed siding panels can be repaired using caulking for enlarged holes. Of the removed siding panels, half of these (9 total; 288 SF) require replacement due to tearing of the vertical lap joints. The siding will require repainting of replaced panels to achieve a uniform appearance.

- Interior Damage: Interior damage descriptions for Case Study 1 in Damage State 2 can be assumed here for Case Study Building 3. Quantities reflect the differences in plan and room sizes for Case Study Building 3. The interior wall damage is concentrated in living room and the dining room at the first story and Bedroom 1 and Bedroom 2 at the second story. The rough proportions of wall area that need repair correspond to 10% of wall area requiring gypsum removal and replacement, 10% of area requiring repair of popped fasteners, and 25% of joints and cornerbead needing refinishing. The following is a list of nonstructural finish items to be replaced in each room:
    - Living room – 40 SF of wall area, 18 LF of joints
    - Dining room – 40 SF of wall area, 15 LF of joints
    - Bedroom 1 – 50 SF of wall area, 25 LF of joints
    - Bedroom 2 – 40 SF of wall area, 15 LF of joints

- Windows and Doors: There is no observable damage to the windows and doors of the house for this damage state.

- Ceilings: In Bedroom 1, there is ceiling damage that needs repair of 10 LF of cracks and 6 SF of spalling, plus repainting to maintain a consistent appearance. In other rooms, ceilings are not damaged.
-
- Miscellaneous: Areas with tiled walls in the kitchen and Bathroom 1 have significant damage to grouting and tile units. The damage to tiled areas is such that half the existing square footage needs to be fully replaced (100 SF in the kitchen and 50 SF in Bathroom 1). Repairs include removal of the tile and cement backing board and replacing with similar tile and grout. Only the wall tile is affected.

Chimney: The unreinforced brick chimney has cracks, a few bricks have fallen, there is some rotation of the chimney on a crack plane where it meets the top of the roof above the firebox, and some small separation between the chimney and the adjacent wall is visible. The chimney needs replacement above the firebox or complete replacement including the firebox. Assume the shingles around the chimney and the flashing need repair when the chimney is replaced.

Stairs, Porches, and Deck: **There is no damage to the wood-framed front and rear stairs, front porch, or rear deck.**

Mechanical, Electrical and Plumbing Damage: Utility services to the building and within the building remain functional with no apparent damage. The braced water heater is still upright. The gas supply is undamaged, the gas service is still operational, the gas lines have no apparent leaks.

Damage State 3 (CS3-UN-DS3)

Damage at the Cripple Wall and Foundation Level

Residual displacement of the cripple wall is about 1.5". All corner trims are damaged, and some have fallen off. Some studs have begun to pull out at corners; and substantial portions of the siding have torn through the ship lap edges and pulled away from the studs. Jacking the wall to replumb it to vertical is needed and about 150 SF of siding will need to be renailed. About 75 SF of siding cannot be salvaged and needs to be replaced. The building paper will need to be replaced. There is cross-grain bending damage at the sill, and 50 LF will need to be replaced. ~~An allowance should be included if there is an expectation that jacking the wall back to plumb could cause additional damage in the superstructure. Alternatively,~~Assume the house can be shored, and the cripple wall, studs, sill, and siding are completely replaced. See Figure A-41.

Damage at the Superstructure Level

Residual displacement at the superstructure is 2" in both directions at the first story. There is no residual displacement at the second story.

- Exterior Damage: The superstructure has been severely racked in both directions at the first story. The second story can be assumed to be in Damage State 2. The remaining description pertains to the first occupied story of the house. The T1-11 siding has completely ripped the lap edges in a majority of panels. Top and bottom nailing of siding panels has caused splitting of top and bottom plates in the first story. The repair effort for the lower story involves removal of all trim and fascia which can be assumed to be 75% salvageable (150 LF for each story) with 25% (50 LF for each story) requiring replacement. All T1-11 siding panels require removal and eventual replacement. The Z flashing must be completely replaced at the first story totaling 144 LF. The structural framing must be repaired and re-plumbed. Twenty percent (20%) of studs in each exterior wall line require replacement (30 LF of stud framing at each story; half of which are doubled studs near openings/headers). Top and sill plates must be replaced in various locations around the perimeter corresponding to 25% (36 LF) of the perimeter. Once the framing has been repaired and re-plumbed, the exterior siding must be replaced followed by the trim and fascia. The exterior of the first story will require re-painting in order to achieve a uniform appearance.

- Interior Damage: Interior damage descriptions for Case Study 1 in Damage State 3 can be assumed here for Case Study Building 3. Quantities reflect the differences in plan and room sizes for Case Study Building 3. The damage to the superstructure in Damage State 3 corresponds to the need for complete replacement of 50% of the interior nonstructural finishes. For the interior gypsum wallboard, this corresponds to the following square footage to be replaced in each room:

Story 1

- Living room – 200 SF
- Dining room – 175 SF
- Kitchen – 100 SF
- Bathroom 1 –55 SF
- Entry/Foyer – 60 SF
- Hallway 1 – 50 SF
- Family room – 200 SF
- Closet 1 – 55 SF
- Laundry room – 85 SF
- Utility room – 70 SF

Story 2

- Bedroom 1 – 200 SF
- Closet 2 – 65 SF
- Bathroom 2 –110 SF
- Bedroom 2 – 150 SF
- Closet 6 – 50 SF
- Bedroom 3 – 150 SF
- Closet 7 – 35 SF
- Hallway 3 – 125 SF
- Hall closet – 90 SF
- Bathroom 3 – 100 SF
- Closet 3 –30 SF
- Bedroom 6 – 190 SF
- Closet 4 – 40 SF
- Closet 5 – 40 SF
- Bedroom 5 – 150 SF

Of the remaining nonstructural finishes (same square footage), the living room, dining room, Bedroom 1 and Bedroom 2 require the Damage State 2 repairs, and rest of the rooms require the Damage State 1 repairs.

- Windows and Doors: Half of all exterior windows and doors in the first story need full replacement. These are the living room window on the east façade (60 SF), smaller family room window on the south façade (10.5 SF), and one of the kitchen windows on the west façade (10.5 SF). Three of the interior doors at the first story need replacement. These are the family room to laundry door, family room to closet door, and entry to hall bathroom door.

- Ceilings: In the living room, dining room, kitchen, and main hallway in front of Bathroom 1 on the first story, there is ceiling damage that needs replacement. In Bedroom 1, a total of repair of 100 LF of cracks and 50 SF of spalling is needed, plus repainting to maintain a consistent appearance. In other rooms, ceilings are not damaged.

- Roof: There is some damage to the roof, with about 50 SF of asphalt shingles and the underlying sheathing boards and/or nailing needing repair. The roof membrane locally needs repair below the 50 SF area, and flashing repairs are needed at the 3 vent stacks and the chimney.

- Miscellaneous Damage: Areas with tiled walls in the kitchen and Bathroom 1 have significant damage to grouting and tile units. The damage to tiled areas is such that all of the existing square footage needs to be fully replaced (200 SF in the kitchen and 100 SF in Bathroom 1). Repairs include removal of the tile and cement backing board and replacing with similar tile and grout. For the bathroom, bathroom wall tile and tub tile surround will need replacing.

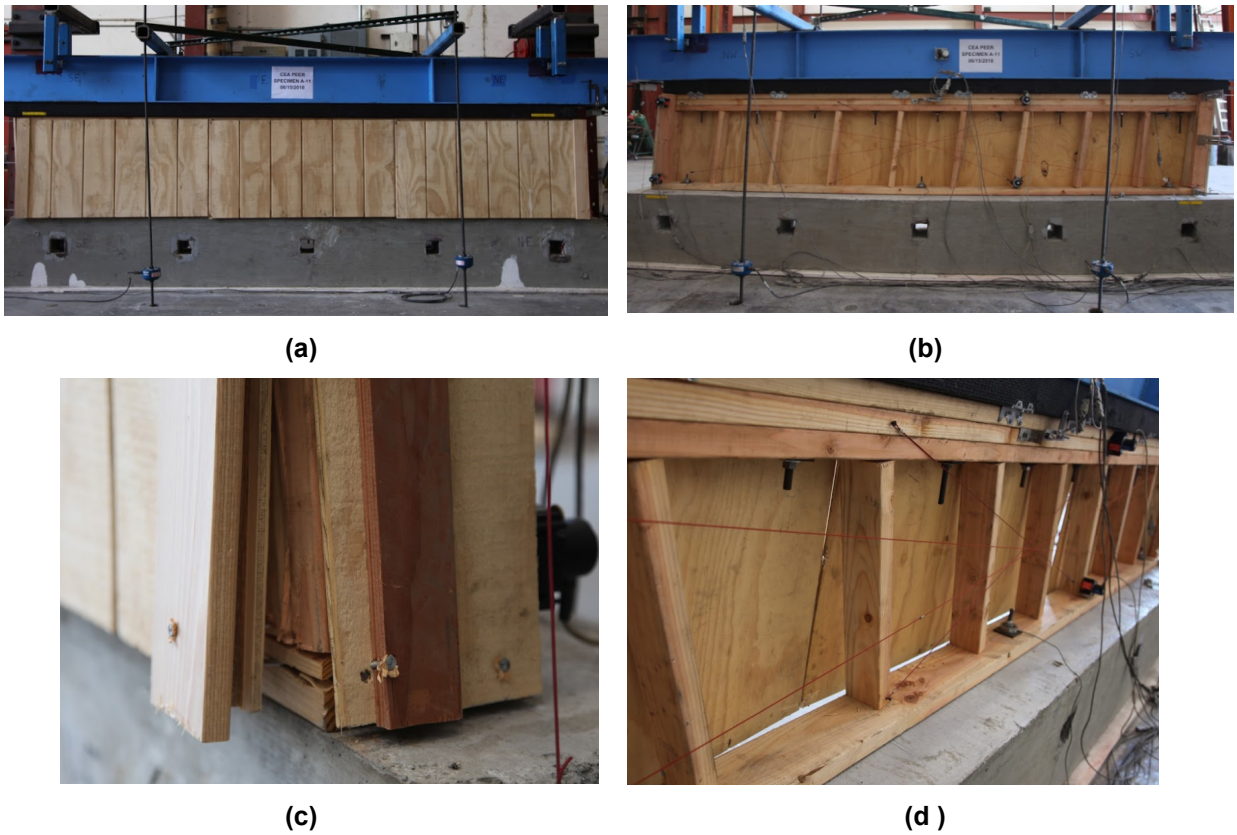
Chimney: The portion of the unreinforced brick chimney above the roof has fallen to the ground and needs replacement above the firebox or complete replacement including the firebox. Noticeable separation between the chimney and the adjacent wall is visible. Assume the shingles around the chimney and the flashing both need repair when the chimney is replaced.

Stairs, Porches, and Deck: Connections between the deck and porch and their supporting wood columns need to be repaired; the posts can be salvaged. Six 2x8 joists at the front porch and six 2x10 joists at the rear deck need new joist hangers where they connect to the wood ledger at the faces of the exterior walls of the house.

Mechanical, Electrical and Plumbing Damage: The braced water heater has toppled due to severe damage to the garage/cripple wall to which it was attached, but the gas line is not leaking, and a fire did not occur. It will need to be replaced. Electrical lines within walls that need repair as noted above will have to be temporarily moved and then reinstalled. For the purposes of this exercise, assume the impacted electrical work will not trigger any code upgrades. 30 LF of drain line is damaged in the crawl space and needs repairs and reconnection at joints. 30 LF of insulated ductwork in the crawl space is torn and needs to be patched.

Access: The exterior and interior of the superstructure was visually reviewed claims adjustors; racking in the crawl space is sufficient that review was done from the exterior as the adjustor did not consider it safe. The UNSAFE placard was posted after the claims adjustor's visit.

ATC-20 Post-Earthquake Safety Evaluation: The building was given a red, UNSAFE placard. Occupancy is not allowed until repairs are made.



(a) (b)

(c) (d)

Figure A-41 **Cripple wall damage for Damage State 3. (11% total drift = 2.64 inches; residual drift = 2 inches at end of cycle grouping): (a) exterior elevation (b) interior elevation (c) close-up of cross grain splitting in sill plate and split trim boards (d) close-up of T1-11 panels detached from sill plate and studs. Photos taken at the first cycle of maximum, drift for UCSD Specimen A-11.**

Damage State 4 (CS3-UN-DS4)

Damage is the same as it was for Case Study Building 2. The cripple wall collapsed and the superstructure either collapsed or is in an imminent collapse condition. The entire house needs replacement, including the exterior stairs, porches, and decks. Replacement costs would be the same as the unretrofitted scenario.

Damage and Repair Effort Descriptions for the *Retrofitted* Case Study Building 3

Damage state scenarios for the retrofitted Case Study Building 3 are the same as the unretrofitted Case Study Building 3 scenarios except as follows. The levels of shaking at the site are in general are higher than they were for the unretrofitted scenarios.

Damage State 1 (CS3-R-DS1)

Damage to the original building is the same as for the unretrofitted scenario. **THE SAME ESTIMATE AS FOR THE UNRETROFITTED CASE CS3-UN-DS1 WILL BE USED; NO UNIQUE ESTIMATE IS REQUIRED.**

Damage State 2 (CS3-R-DS2-CW)

Damage at the Cripple Wall and Foundation Level

Damage to the original building is the same as for the unretrofitted scenario, except that the cripple wall and sill anchorage retrofit has undergone racking and has ½" of residual displacement. This has caused nail bending and pullout in some locations. Renailing of the plywood will be necessary. Anchor bolts are undamaged.

Damage at the Superstructure

THE SAME ESTIMATE AS FOR THE UNRETROFITTED CASE CS3-UN-DS2~~3~~ -IS TO BE USED FOR THE SUPERSTRUCTURE AND INCLUDED AS PART OF THE CS2-UN-DS2 ESTIMATE; NO UNIQUE ESTIMATE IS REQUIRED FOR THE SUPERSTRUCTURE.

Damage State 3 (CS3-R-DS3-CW)

Damage to the original building is similar to what it was for the unretrofitted scenario. Strengthening of the cripple wall has led to damage being pushed up into the superstructure.

Damage at the Cripple Wall and Foundation Level

Residual displacement of the cripple wall is the same 1.5" as the unretrofitted scenario. This has caused damage and separation of the plywood retrofit from the studs, tearing of the plywood and nail pullout There is some splitting of the sill and retrofit blocking as well. Replacement of the retrofit, including the sill, anchor bolts, plywood, nailing and clips is required after the cripple wall is jacked back to plumb. Alternatively, the building can be shored, and the cripple wall—including framing, siding, and retrofit—can be completely replaced.

Damage at the Superstructure Level

Residual displacement and damage at the superstructure are the same in the retrofitted scenario as it was in the unretrofitted scenario. **THE SAME ESTIMATE AS FOR THE**

UNRETROFITTED CASE CS3-UN-DS3 WILL BE USED FOR THE SUPERSTRUCTURE AND INCLUDED AS PART OF THE CS2-UN-DS3; NO UNIQUE ESTIMATE IS REQUIRED FOR THE SUPERSTRUCTURE.

Damage State 4 (CS3-R-DS4)

Damage is the same as it was in the unretrofitted scenario. Only the replacement cost per square foot is needed. **THE SAME $/SF ESTIMATE AS FOR THE UNRETROFITTED CASE CS3-UN-DS4 WILL BE USED; NO UNIQUE ESTIMATE IS REQUIRED.**

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Attachment 1: Summary of Case Study Scenarios that Are Estimated

Case Study Building	Unretrofitted or Retrofitted	Damage State DS1		Damage State DS2		Damage State DS3		Damage State DS4[1]	Number of Xactimate Estimates
		Cripple Wall	Superstructure	Cripple Wall	Superstructure	Cripple Wall	Superstructure	Complete Building	
1	Unretrofitted	**CS1-UN-DS1: Estimate**	**CS1-UN-DS1: Estimate**	**CS1-UN-DS2: Estimate**	**CS1-UN-DS2: Estimate**	**CS1-UN-DS3: Estimate**	**CS1-UN-DS3: Estimate**	**CS1-UN-DS4: $/SF**	3
	Retrofitted	From CS1-UN-DS1	From CS1-UN-DS1	From CS1-UN-DS2	From CS1-UN-DS2	**CS1-R-DS3: Estimate**	**CS1-R-DS3: Estimate**	From CS1-UN-DS4	1
2	Unretrofitted	**CS2-UN-DS1: Estimate**	**CS2-UN-DS1: Estimate**	**CS2-UN-DS2: Estimate**	**CS2-UN-DS2: Estimate**	**CS2-UN-DS3: Estimate**	**CS2-UN-DS3: Estimate**	**CS2-UN-DS4: $/SF**	3
	Retrofitted	From CS2-UN-DS1	From CS2-UN-DS1	**CS2-R-DS2-CW: Estimate**	From CS2-UN-DS2	**CS2-R-DS3: Estimate**	**CS2-R-DS3: Estimate**	From CS2-UN-DS4	2
3	Unretrofitted	**CS3-UN-DS1: Estimate**	**CS3-UN-DS1: Estimate**	**CS3-UN-DS2: Estimate**	**CS3-UN-DS2: Estimate**	**CS3-UN-DS3: Estimate**	**CS3-UN-DS3: Estimate**	**CS3-UN-DS4: $/SF**	3
	Retrofitted	From CS3-UN-DS1	From CS3-UN-DS1	**CS3-R-DS2-CW: Estimate**	From CS3-UN-DS2	**CS3-R-DS3-CW: Estimate**	From CS3-UN-DS3	From CS3-UN-DS4	2
								Total:	14

Notes

1. Damage State DS4 is for full replacement of the building. There is no need to distinguish cripple wall and superstructure costs. No Xactimate estimate is done. Only a $/sf estimate is given on the survey form for demolition of the damaged home and replacement with a new home.
2. Scenarios shaded in **bold** receive an Xactimate estimate.
3. Scenarios shaded in blue are assumed to be identical to the referenced estimated scenarios.
4. Scenarios with "CW" at the end of the identifier only receive an estimate for the cripple wall damage repair, as the superstructure is assumed to be the same as the referenced scenario.

Building Case Study 1 Scenarios "Cheat" Sheet

(Cost categories with green shading to be included.)

Case Study 1												
	Total ACV	Cripple Wall and Foundation	Exterior Damage	Interior Damage	Windows and Doors	Ceilings	Floors	Roof	Miscellaneous	Chimney	Stairs and Porch	MEP
CS1-UN-DS1	$	$	$	$					$			
CS1-UN-DS2	$	$	$	$		$			$	$		
CS1-UN-DS3	$	$	$	$	$	$		$	$	$	$	$
CS1-UN-DS4	$	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
CS1-R-DS3	$	$	$	$	$	$		$	$	$	$	$

Building Case Study 2 Scenarios "Cheat" Sheet

(Cost categories with green to be included; those in yellow are to be copied into the scenario.)

Case Study 2												
	Total ACV	Cripple Wall and Foundation	Exterior Damage	Interior Damage	Windows and Doors	Ceilings	Floors	Roof	Miscellaneous	Chimney	Stairs and Porch	MEP
CS2-UN-DS1	$			$					Same as CS1-UN-DS1			
CS2-UN-DS2	$		$	$	$	Same as CS1-UN-DS2			$	Same as CS1-UN-DS2		
CS2-UN-DS3	$	$	$	Same as **CS1-R-DS3**	$	Same as CS1-UN-DS3		Same as CS1-UN-DS3	Same as **CS1-R-DS3**	Same as CS1-UN-DS3	Same as CS1-UN-DS3	Same as CS1-UN-DS3
CS2-UN-DS4	$	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
CS2-R-DS2-CW	$	$	Same as CS2-UN-DS2	Same as CS2-UN-DS2	Same as CS2-UN-DS2	Same as CS2-UN-DS2			Same as CS2-UN-DS2	Same as CS2-UN-DS2		
CS2-R-DS3	$	$	$	$	Same as CS2-UN-DS3	Same as CS2-UN-DS3		Same as CS2-UN-DS3	Same as CS2-UN-DS3	Same as CS2-UN-DS3	Same as CS2-UN-DS3	Same as CS2-UN-DS3

Building Case Study 2 Scenarios "Cheat" Sheet

(Cost categories with green to be included; those in yellow are to be copied into the scenario.)

Case Study 3												
	Total ACV	Cripple Wall and Foundation	Exterior Damage	Interior Damage	Windows and Doors	Ceilings	Floors	Roof	Miscellaneous	Chimney	Stairs and Porch	MEP
CS3-UN-DS1	$			$					$			
CS3-UN-DS2	$	$	$	$		$			$	$		
CS3-UN-DS3	$	$	$	$	$	$		$	$	$	$	$
CS3-UN-DS4	$	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
CS3-R-DS2-CW	$	$	Same as CS3-UN-DS2	Same as CS3-UN-DS2		Same as CS3-UN-DS2			Same as CS3-UN-DS2	Same as CS3-UN-DS2		
CS3-R-DS3-CW	$	$	Same as CS3-UN-DS3	Same as CS3-UN-DS3	Same as CS3-UN-DS3	Same as CS3-UN-DS3		Same as CS3-UN-DS3	Same as CS3-UN-DS3	Same as CS3-UN-DS3	Same as CS3-UN-DS3	Same as CS3-UN-DS3

Attachment 2: Survey Questions

Complete the following survey questions <u>in the Excel file</u> for <u>each</u> case study building.

Number	Question
1a	For Damage State 4, what is is the replacement cost in $/sf and source of the value?
1b	What portion of the replacement cost was for demolition and removal of the existing home ($/sf)?
1c	What portion of the replacement cost was for the garage in Case Study 3 ($/sf)?
2a	For Damage State 3, did you replace the entire structure the rather than repair/upgrade the damage?
2b	If you answered yes, why did you replace the entire structure?
3a	For Damage State 1, 2, or 3, did you upgrade rather than repair the damage?
3b	If you answered yes, which damage state(s) were upgraded and which elements?
3c	Why did you upgrade or not upgrade?
4a	For Damage State 1, 2, or 3, did you locally replace rather than repair the damage?
4b	If you answered yes, which damage state(s) had local replacement and which elements?
4c	Why did you locally replace instead of repair?
5a	For Case Study Building 1, did you replace the horizontal sheathing under the stucco with plywood?
5b	What rules or approach did you use for triggered collateral extenthow far to extend repair or replacement of damaged elements to obtain a consistent appearance?
6	If there is local damage to an interior wall finish, at what point (if any) do you repair/repaint the entire wall or room?
7	What additional information would help you refine your estimate?
8	Are there assumptions with which you disagree?
9	Any other comments or suggestions?
See instructions for definitions of repair, upgrade, locally replace, and replacement of the entire structure.	

A snapshot of the full Excel survey form is shown below, with the response columns for the three case study buildings.

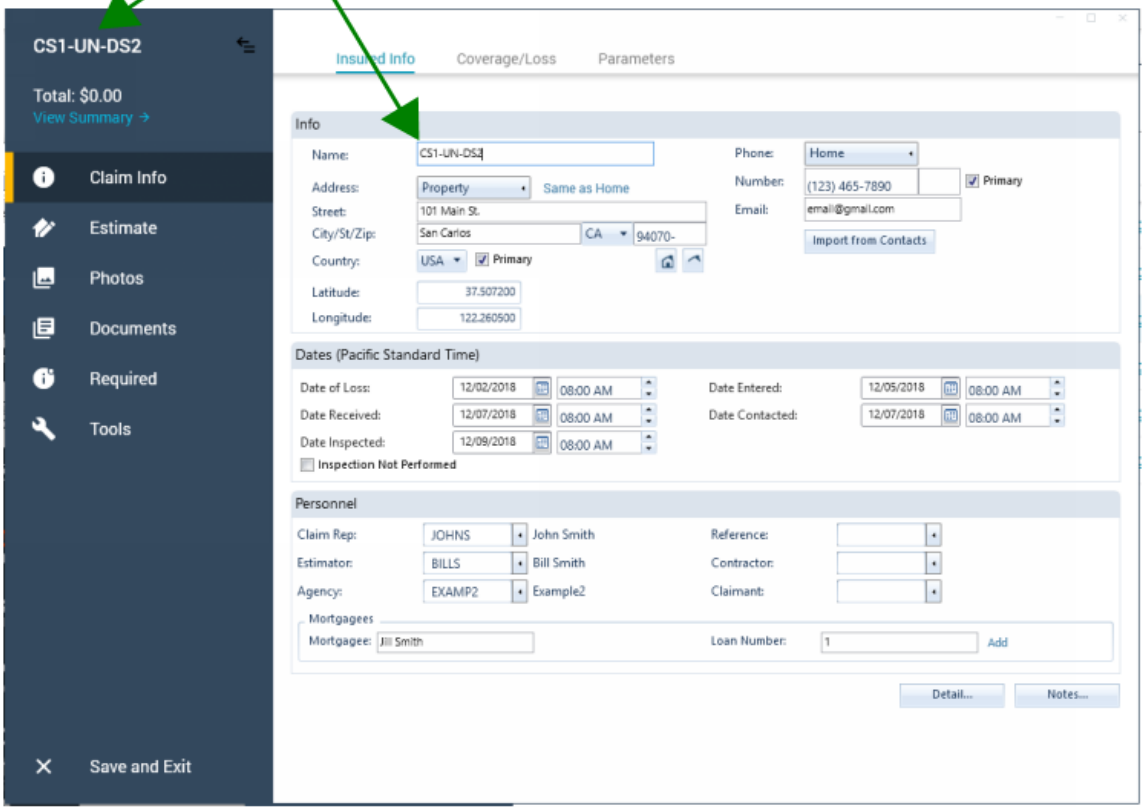
Number	Question	Response for Case Study 1	Response for Case Study 2	Response for Case Study 3
1a	For Damage State 4, what is is the replacement cost in $/sf and source of the value?			
1b	What portion of the replacement cost was for demolition and removal of the existing home ($/sf)?			
1c	What portion of the replacement cost was for the garage in Case Study 3 ($/sf)?			
2a	For Damage State 3, did you replace the entire structure the rather than repair/upgrade the damage?			
2b	If you answered yes, why did you replace the entire structure?			
3a	For Damage State 1, 2, or 3, did you upgrade rather than repair the damage?			
3b	If you answered yes, which damage state(s) were upgraded and which elements?			
3c	Why did you upgrade or not upgrade?			
4a	For Damage State 1, 2, or 3, did you locally replace rather than repair the damage?			
4b	If you answered yes, which damage state(s) had local replacement and which elements?			
4c	Why did you locally replace instead of repair?			
5a	For Case Study Building 1, did you replace the horizontal sheathing under the stucco with plywood?			
5b	What rules or approach did you use for triggered collateral extenthow far to extend repair or replacement of damaged elements to obtain a consistent appearance?			
6	If there is local damage to an interior wall finish, at what point (if any) do you repair/repaint the entire wall or room?			
7	What additional information would help you refine your estimate?			
8	Are there assumptions with which you disagree?			
9	Any other comments or suggestions?			
See Instructions for definitions of repair, upgrade, locally replace, and replacement of the entire structure.				

Attachment 3: Example Xactimate Output Form

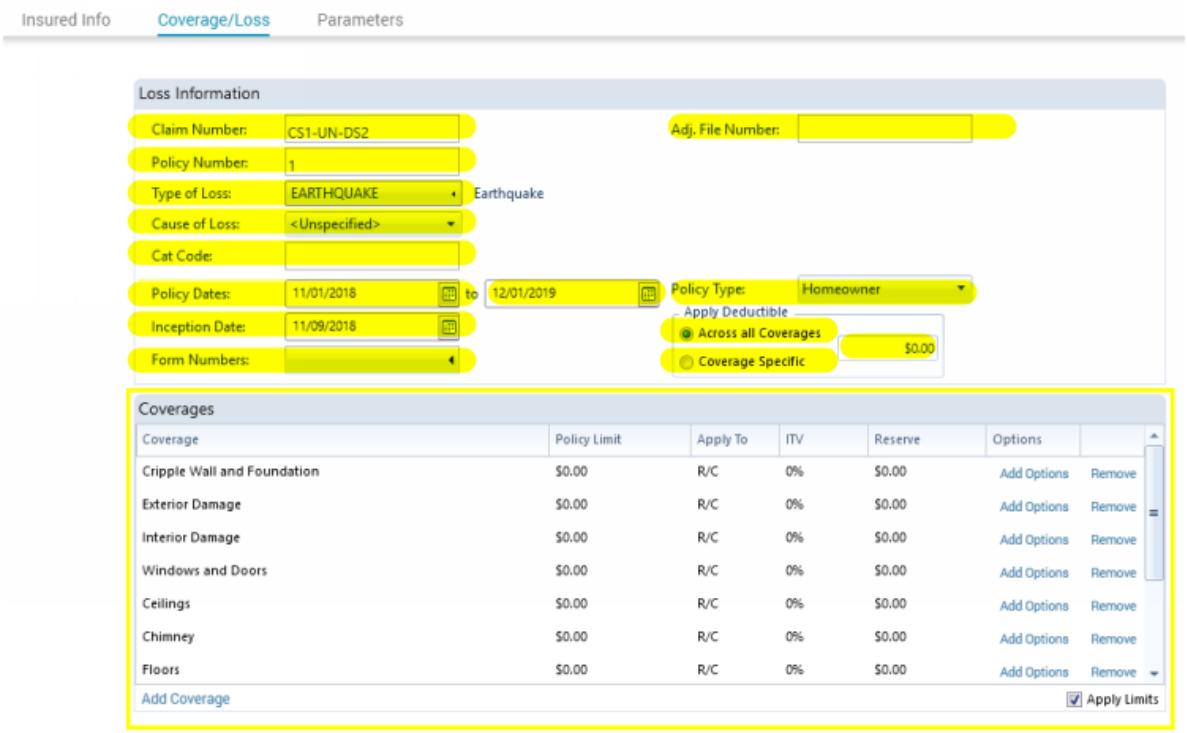
Xactimate Input Instructions

After opening the case study file, CS2-UN-DS1, you should see this screen.

This matches the specific case study name for the Case Study 1 - Unretrofitted - Damage State 2 scenario.

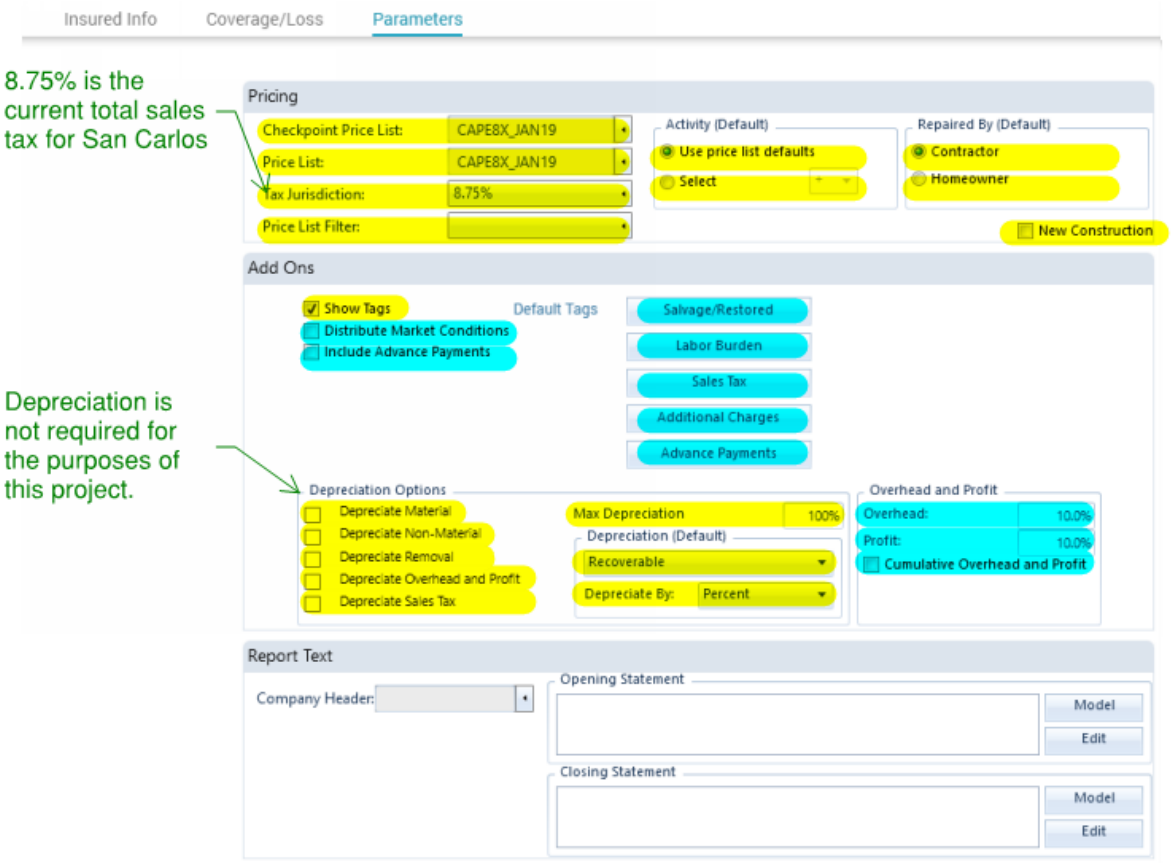



This matches the specific case study scenario name
Insured Info
Coverage/Loss
Parameters
Info
Name:
CS1-UN-DS2
Address:
Property
Same as Home
Street:
101 Main St.
City/St/Zip:
San Carlos
CA
94070-
Country:
USA
Primary
Latitude:
37.507200
Longitude:
122.260500
Phone:
Home
Number:
(123) 465-7890
Primary
Email:
email@gmail.com
Import from Contacts
Dates (Pacific Standard Time)
Date of Loss:
12/02/2018
08:00 AM
Date Received:
12/07/2018
08:00 AM
Date Inspected:
12/09/2018
08:00 AM
Inspection Not Performed
Date Entered:
12/05/2018
08:00 AM
Date Contacted:
12/07/2018
08:00 AM
Your name
Your company
Personnel
Claim Rep:
JOHNS
John Smith
Estimator:
BILLS
Bill Smith
Agency:
EXAMP2
Example2
Reference:
Contractor:
Claimant:
Mortgagees
Mortgagee:
Jill Smith
Loan Number:
1
Add
Detail...
Notes...
Do not change
Your input



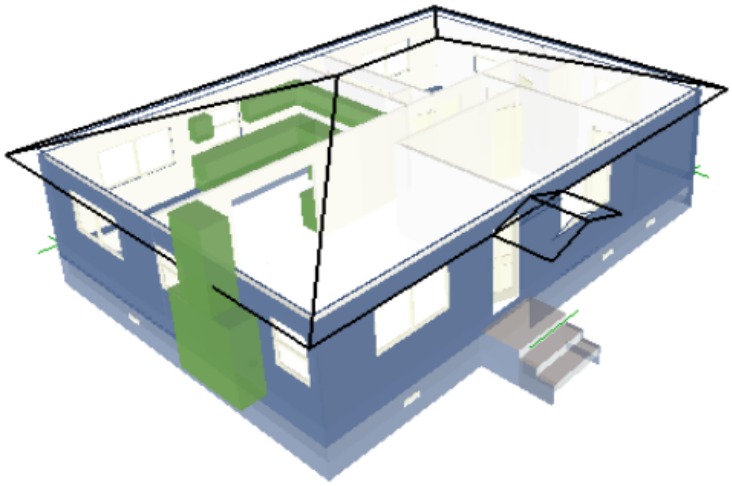
Case study estimate results will be aggregated by PEER research team into specific categories for damage. Coverages correspond to these categories of interest. See examples ahead for assigning line items to a specific coverage.

Do not change

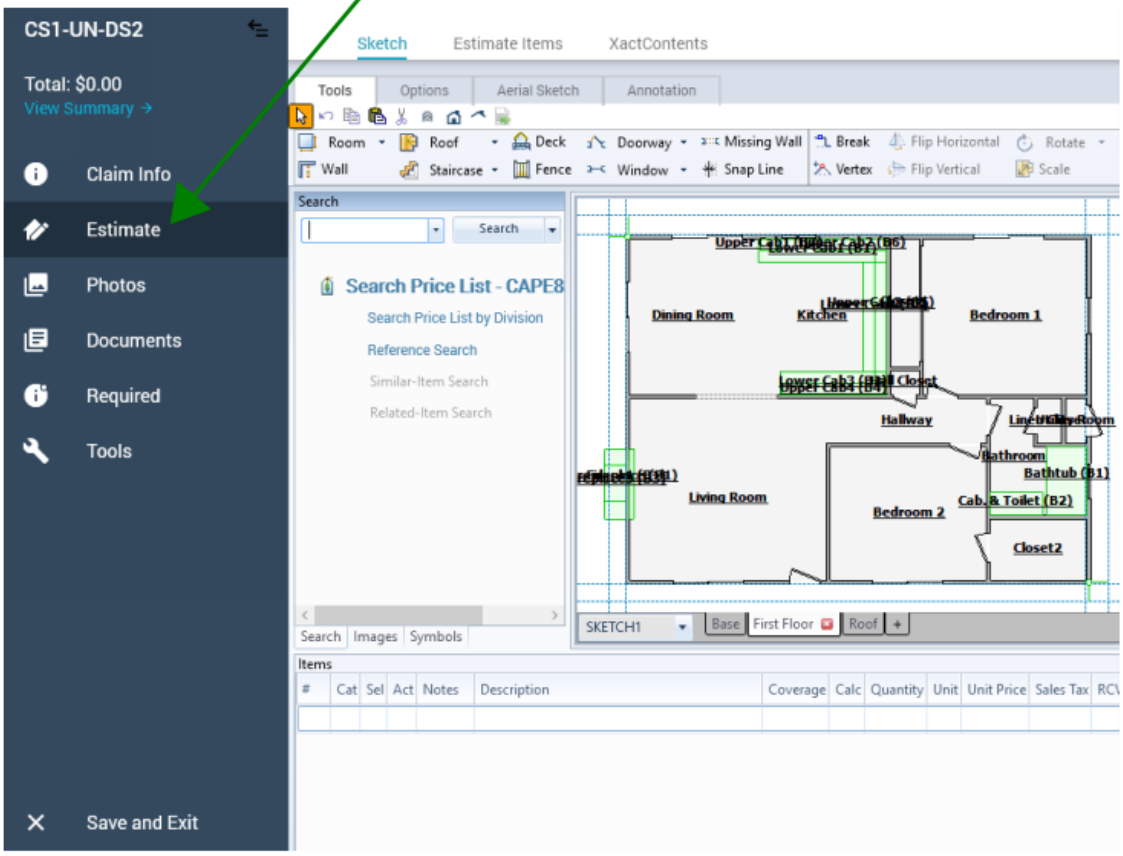


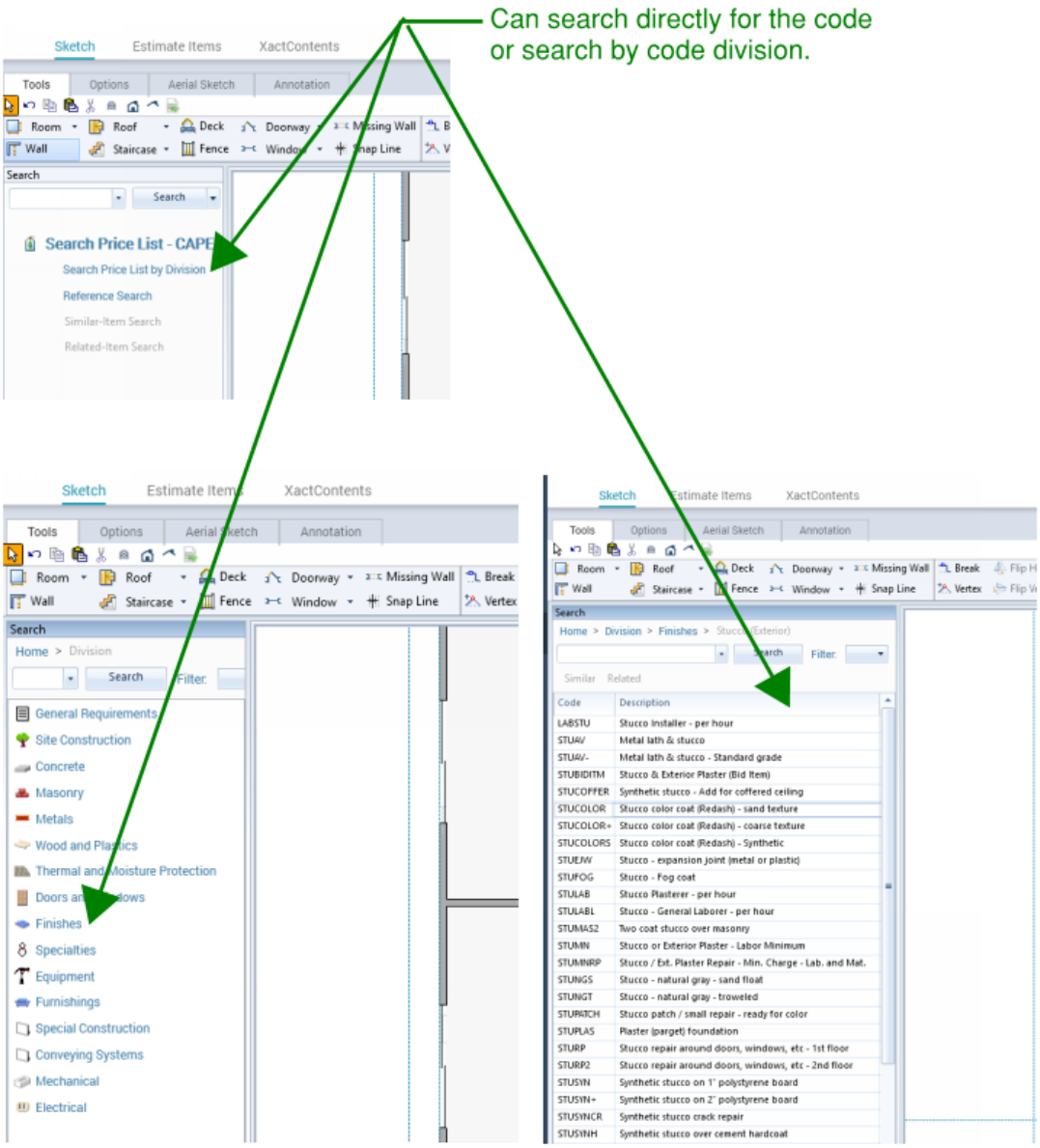
Do not change

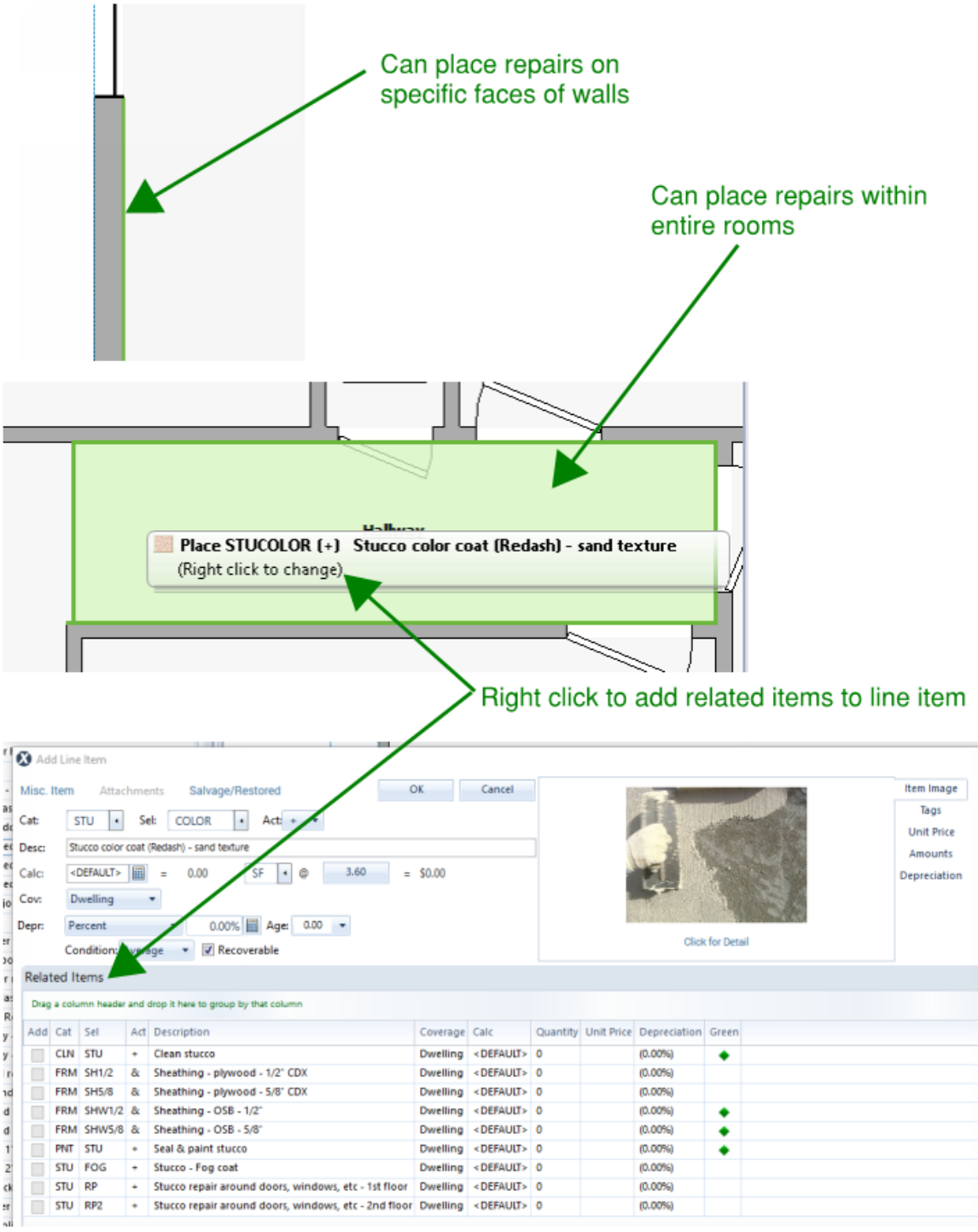
Your input



The geometry is complete; do not alter. The next step is to start assigning repair scope.



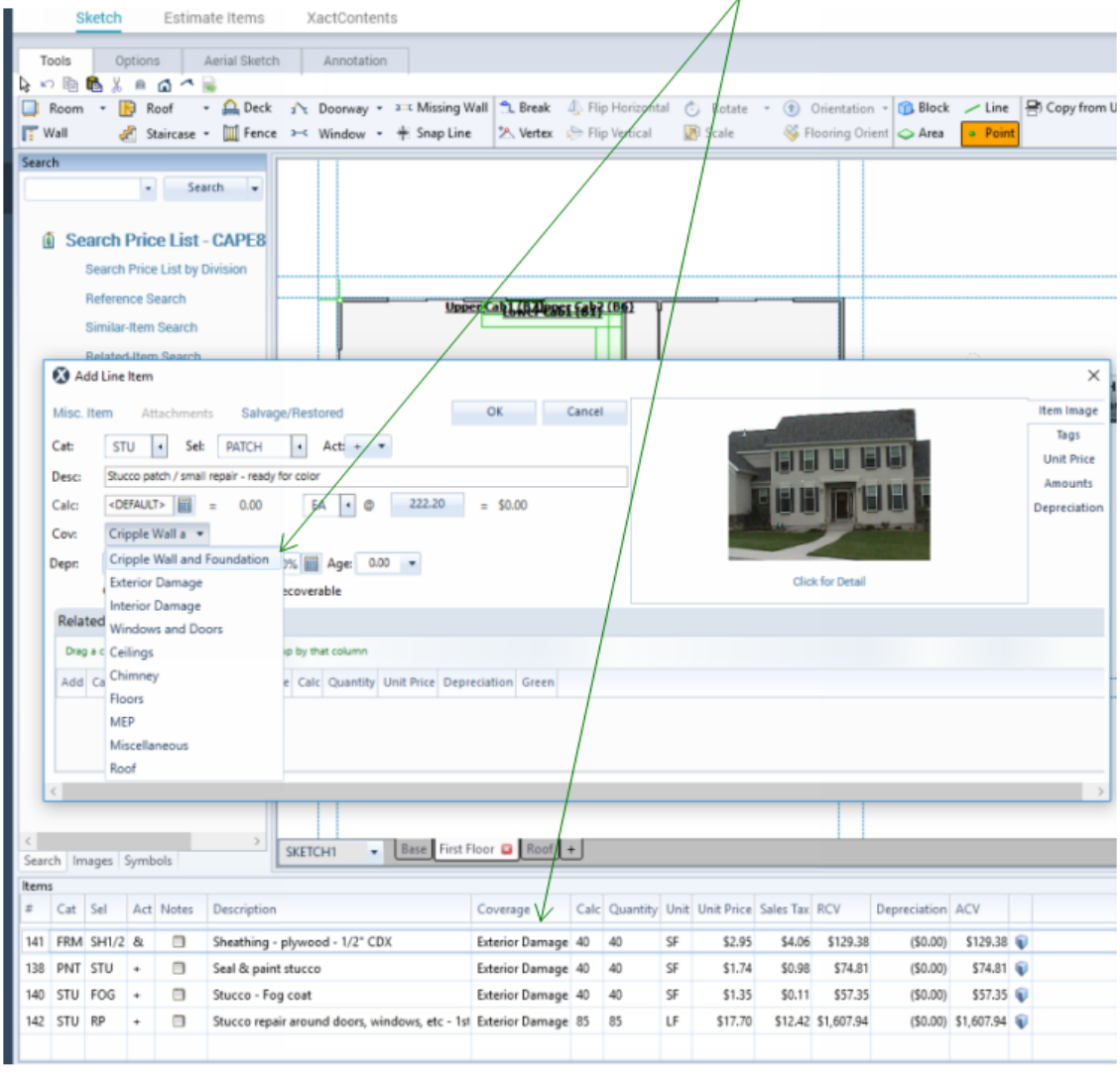

Can search directly for the code or search by code division.
Sketch
Estimate Items
XactContents
Tools
Options
Aerial Sketch
Annotation
Search
Search Price List - CAPE
Search Price List by Division
Reference Search
Similar-Item Search
Related-Item Search
Home > Division
General Requirements
Site Construction
Concrete
Masonry
Metals
Wood and Plastics
Thermal and Moisture Protection
Finishes
Specialties
Equipment
Furnishings
Special Construction
Conveying Systems
Mechanical
Electrical
Home > Division > Finishes > Stucco (Exterior)
Code
Description
LABSTU Stucco Installer - per hour
STUAV Metal lath & stucco
STUAV- Metal lath & stucco - Standard grade
STUBIDITM Stucco & Exterior Plaster (Bid Item)
STUCOFFER Synthetic stucco - Add for coffered ceiling
STUCOLOR Stucco color coat (Redash) - sand texture
STUCOLOR+ Stucco color coat (Redash) - coarse texture
STUCOLORS Stucco color coat (Redash) - Synthetic
STUEJW Stucco - expansion joint (metal or plastic)
STUFOG Stucco - Fog coat
STULAB Stucco Plasterer - per hour
STULABL Stucco - General Laborer - per hour
STUMAS2 Two coat stucco over masonry
STUMN Stucco or Exterior Plaster - Labor Minimum
STUMNRP Stucco / Ext. Plaster Repair - Min. Charge - Lab. and Mat.
STUNGS Stucco - natural gray - sand float
STUNGT Stucco - natural gray - troweled
STUPATCH Stucco patch / small repair - ready for color
STUPLAS Plaster (parget) foundation
STURP Stucco repair around doors, windows, etc - 1st floor
STURP2 Stucco repair around doors, windows, etc - 2nd floor
STUSYN Synthetic stucco on 1" polystyrene board
STUSYN+ Synthetic stucco on 2" polystyrene board
STUSYNCR Synthetic stucco crack repair
STUSYNH Synthetic stucco over cement hardcoat


Can place repairs on specific faces of walls
Can place repairs within entire rooms
Place STUCOLOR (+) Stucco color coat (Redash) - sand texture
(Right click to change)
Right click to add related items to line item
Add Line Item
Misc. Item
Attachments
Salvage/Restored
OK
Cancel
Cat: STU
Sel: COLOR
Act: +
Desc: Stucco color coat (Redash) - sand texture
Calc: <DEFAULT> = 0.00 SF @ 3.60 = $0.00
Cov: Dwelling
Depr: Percent 0.00% Age: 0.00
Condition:
Recoverable
Item Image
Tags
Unit Price
Amounts
Depreciation
Click for Detail
Related Items
Drag a column header and drop it here to group by that column
Add Cat Sel Act Description Coverage Calc Quantity Unit Price Depreciation Green
CLN STU + Clean stucco Dwelling <DEFAULT> 0 (0.00%)
FRM SH1/2 & Sheathing - plywood - 1/2" CDX Dwelling <DEFAULT> 0 (0.00%)
FRM SH5/8 & Sheathing - plywood - 5/8" CDX Dwelling <DEFAULT> 0 (0.00%)
FRM SHW1/2 & Sheathing - OSB - 1/2" Dwelling <DEFAULT> 0 (0.00%)
FRM SHW5/8 & Sheathing - OSB - 5/8" Dwelling <DEFAULT> 0 (0.00%)
PNT STU + Seal & paint stucco Dwelling <DEFAULT> 0 (0.00%)
STU FOG + Stucco - Fog coat Dwelling <DEFAULT> 0 (0.00%)
STU RP + Stucco repair around doors, windows, etc - 1st floor Dwelling <DEFAULT> 0 (0.00%)
STU RP2 + Stucco repair around doors, windows, etc - 2nd floor Dwelling <DEFAULT> 0 (0.00%)

Xactimate Line Item Coverage Assignment

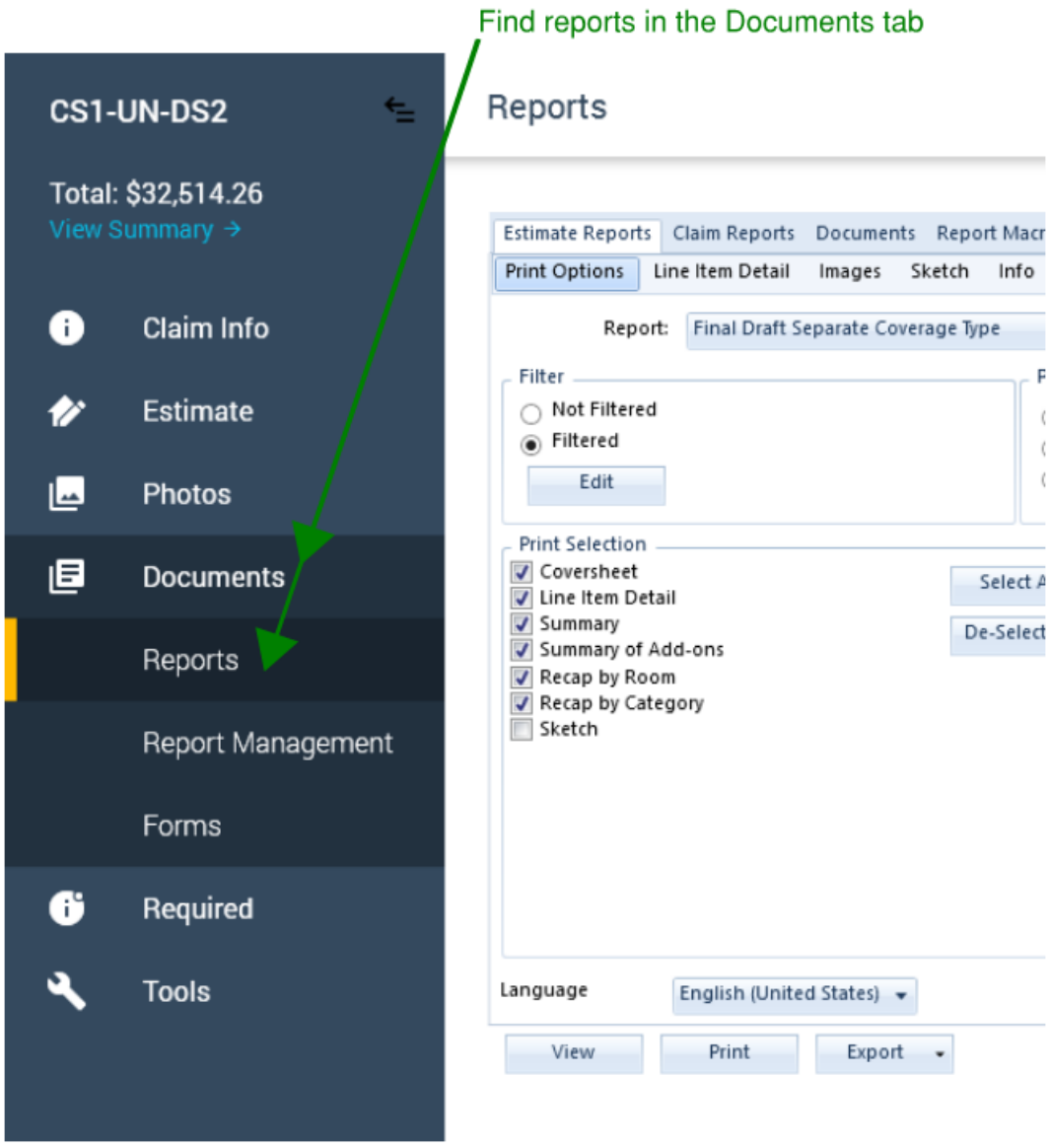
When you begin to add repairs in Xactimate, select the corresponding Coverage. This is critical for the final output to display the line items grouped into the same categories.

You can assign a coverage type when you add a line item, or change a coverage type within the list of existing line items as well.

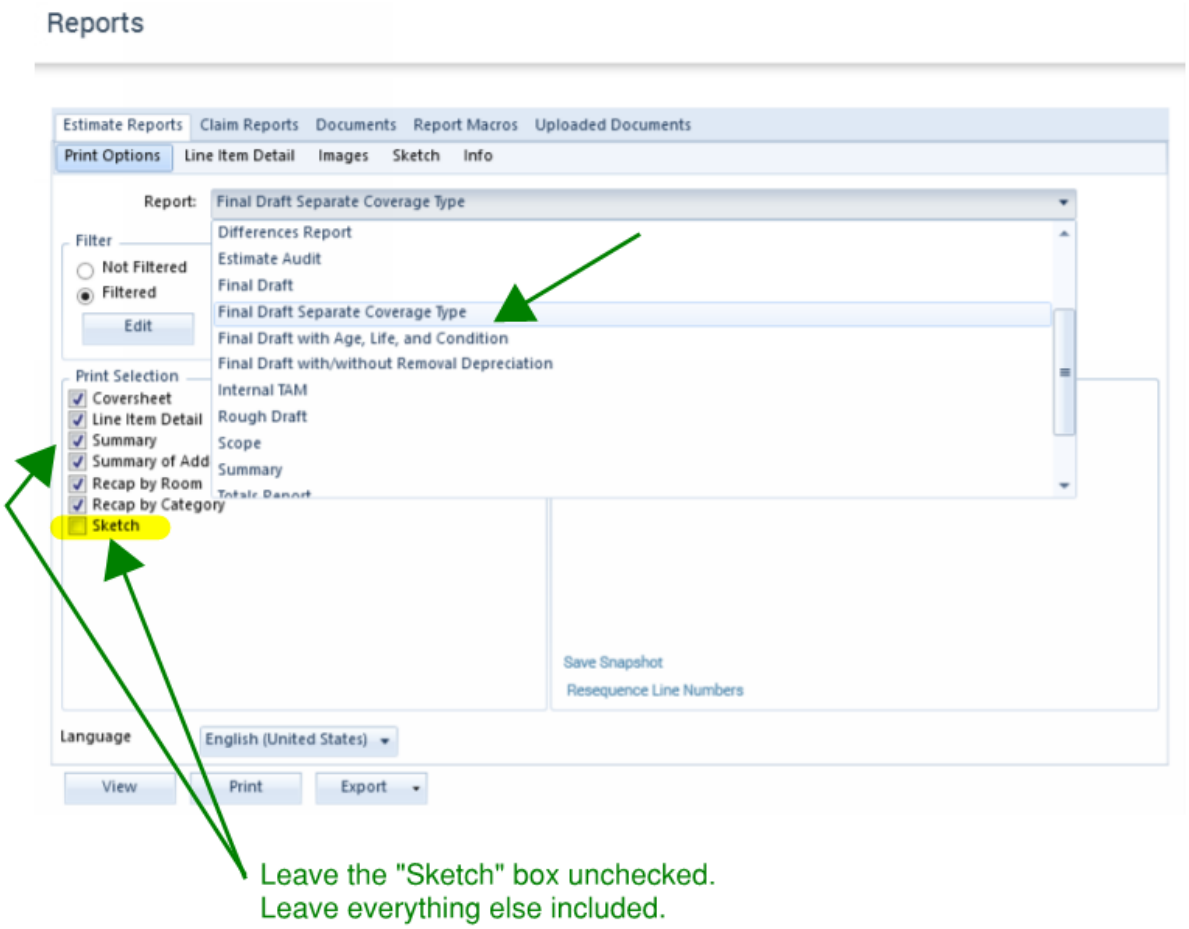


Xactimate Report Instructions

After finishing the estimate, create the following specific report and print to pdf for delivery. Name the file the case study nomenclature followed by your last name. For example, CS2-UN-DS1_Smith.



The report required for this project is the "Final Draft Separate Coverage Type" report.



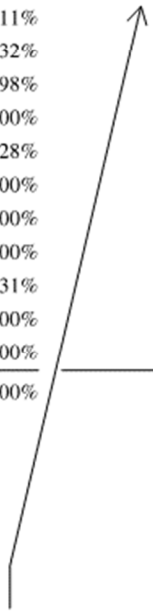
Leave the "Sketch" box unchecked.
Leave everything else included.

After printing the pdf with the proper file name, from your perspective this case study scenario is complete.

How Your Data Will be Used

The data from the case study estimates you produce will ultimately be aggregated and compared with other estimates using the coverage categories below.

Coverage	Item Total	%	ACV Total	%
Cripple Wall and Foundation	2,636.86	8.11%	2,636.86	8.11%
Exterior Damage	3,031.90	9.32%	3,031.90	9.32%
Interior Damage	25,353.80	77.98%	25,353.80	77.98%
Windows and Doors	0.00	0.00%	0.00	0.00%
Ceilings	741.96	2.28%	741.96	2.28%
Floors	0.00	0.00%	0.00	0.00%
Roof	0.00	0.00%	0.00	0.00%
Miscellaneous	0.00	0.00%	0.00	0.00%
Chimney	749.74	2.31%	749.74	2.31%
Stairs and Porch	0.00	0.00%	0.00	0.00%
MEP	0.00	0.00%	0.00	0.00%
Total	32,514.26	100.00%	32,514.26	100.00%



Since depreciation is set to zero, ACV (Actual Cash Value) = RCV (Replacement Cost Value). It is RCV that is being summarized for the purposes of this exercise.

SAMPLE CS1-UN-DS2 FINAL DRAFT SEPARATE COVERAGE REPORT

Insured:	CS1-UN-DS2	Home:	(123) 465-7890
Home:	101 Main Street San Carlos 94070	E-mail:	email@gmail.com
Property:	101 Main Street San Carlos 94070		

Claim Rep.:	John Smith	Business:	(123) 456-7891
Position:	Manager	E-mail:	email2@gmail.com
Company:	Example		
Business:	0 Case St. San Carlos, CA 94070		

Estimator:	Bill Smith	Business:	(123) 456-7891
Position:	Manager	E-mail:	email2@gmail.com
Company:	Example		
Business:	0 Case St. San Carlos, CA 94070		

Claim Number: CS1-UN-DS2 **Policy Number:** 1 **Type of Loss:** Earthquake

Date Contacted:	12/7/2018 8:00 AM		
Date of Loss:	12/2/2018 8:00 AM	Date Received:	12/7/2018 8:00 AM
Date Inspected:	12/9/2018 8:00 AM	Date Entered:	12/5/2018 8:00 AM

Price List:	CAPE8X_JAN19 Restoration/Service/Remodel
Estimate:	CS1-UN-DS2

CS1-UN-DS2

Cripple Wall

Cripple Wall

DESCRIPTION	QTY	UNIT PRICE	TAX	O&P	RCV	DEPREC.	ACV
CRIPPLE WALL AND FOUNDATION							
69. Stucco repair around doors, windows, etc - 1st floor	85.00 LF	17.70	12.42	303.38	1,820.30	(0.00)	1,820.30
143. R&R Metal lath & stucco	40.00 SF	8.02	4.13	64.98	389.91	(0.00)	389.91
144. Clean stucco	40.00 SF	0.60	0.04	4.80	28.84	(0.00)	28.84
145. Seal & paint stucco	40.00 SF	1.73	0.98	14.04	84.22	(0.00)	84.22
146. Stucco - Fog coat	40.00 SF	1.35	0.11	10.82	64.93	(0.00)	64.93
Cripple Wall and Foundation Totals:			**17.68**	**398.02**	**2,388.20**		**2,388.20**
Total: Cripple Wall			**17.68**	**398.02**	**2,388.20**	**0.00**	**2,388.20**

Superstructure

Superstructure

DESCRIPTION	QTY	UNIT PRICE	TAX	O&P	RCV	DEPREC.	ACV
EXTERIOR DAMAGE							
133. R&R Metal lath & stucco	40.00 SF	8.02	4.13	64.98	389.91	(0.00)	389.91
134. Clean stucco	40.00 SF	0.60	0.04	4.80	28.84	(0.00)	28.84
136. R&R Sheathing - plywood - 1/2" CDX	40.00 SF	2.89	3.78	23.88	143.26	(0.00)	143.26
141. R&R Sheathing - plywood - 1/2" CDX	40.00 SF	2.89	3.78	23.88	143.26	(0.00)	143.26
138. Seal & paint stucco	40.00 SF	1.73	0.98	14.04	84.22	(0.00)	84.22
140. Stucco - Fog coat	40.00 SF	1.35	0.11	10.82	64.93	(0.00)	64.93
142. Stucco repair around doors, windows, etc - 1st floor	85.00 LF	17.70	12.42	303.38	1,820.30	(0.00)	1,820.30
Exterior Damage Totals:			**25.24**	**445.78**	**2,674.72**		**2,674.72**
Total: Superstructure			**25.24**	**445.78**	**2,674.72**	**0.00**	**2,674.72**

Bedrooms

Bedroom 2 **Height: 8'**

341.44	SF Walls	153.17	SF Ceiling
494.62	SF Walls & Ceiling	153.17	SF Floor
17.02	SY Flooring	44.50	LF Floor Perimeter
49.67	LF Ceil. Perimeter		

Missing Wall - Goes to Floor	**2' 8" X 6' 10"**	**Opens into HALLWAY**
Missing Wall - Goes to Floor	**2' 6" X 6' 8"**	**Opens into CLOSET2**
Missing Wall - Goes to neither Floor/Ceiling	**6' X 3' 6"**	**Opens into Exterior**

DESCRIPTION	QTY	UNIT PRICE	TAX	O&P	RCV	DEPREC.	ACV
INTERIOR DAMAGE							
154. R&R 1/2" drywall - hung, taped, with smooth wall finish	55.00 SF	4.72	2.74	52.46	314.80	(0.00)	314.80
155. Mask per square foot for drywall work	55.00 SF	0.30	0.24	3.34	20.08	(0.00)	20.08
156. Seal/prime then paint the surface area (2 coats)	55.00 SF	1.14	0.77	12.70	76.17	(0.00)	76.17
Interior Damage Totals:			**3.75**	**68.50**	**411.05**		**411.05**
Totals: Bedroom 2			**3.75**	**68.50**	**411.05**	**0.00**	**411.05**

Bedroom 1 **Height: 8'**

342.94	SF Walls	188.95	SF Ceiling
531.90	SF Walls & Ceiling	188.95	SF Floor
20.99	SY Flooring	45.17	LF Floor Perimeter
55.00	LF Ceil. Perimeter		

Missing Wall - Goes to Floor	**9' 10" X 6' 8"**	**Opens into CLOSET1**
Missing Wall - Goes to neither Floor/Ceiling	**6' X 3' 6"**	**Opens into Exterior**
Missing Wall - Goes to neither Floor/Ceiling	**3' X 3' 6"**	**Opens into Exterior**

DESCRIPTION	QTY	UNIT PRICE	TAX	O&P	RCV	DEPREC.	ACV
INTERIOR DAMAGE							
160. R&R 1/2" drywall - hung, taped, with smooth wall finish	65.00 SF	4.72	3.24	62.00	372.04	(0.00)	372.04
161. Mask per square foot for drywall work	65.00 SF	0.30	0.28	3.96	23.74	(0.00)	23.74
162. Seal/prime then paint the surface area (2 coats)	65.00 SF	1.14	0.91	15.00	90.01	(0.00)	90.01
Interior Damage Totals:			**4.43**	**80.96**	**485.79**		**485.79**
Totals: Bedroom 1			**4.43**	**80.96**	**485.79**	**0.00**	**485.79**

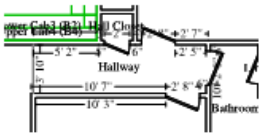
Area Interior Damage Total:	**8.18**	**149.46**	**896.84**		**896.84**
Totals: Bedrooms	**8.18**	**149.46**	**896.84**	**0.00**	**896.84**

Dining Room **Height: 8'**

206.56 SF Walls	148.70 SF Ceiling
355.26 SF Walls & Ceiling	148.70 SF Floor
16.52 SY Flooring	30.17 LF Floor Perimeter
35.58 LF Ceil. Perimeter	

Missing Wall - Goes to neither Floor/Ceiling	**6' X 3' 6"**	**Opens into Exterior**
Missing Wall - Goes to neither Floor/Ceiling	**6' X 3' 6"**	**Opens into Exterior**
Missing Wall - Goes to Floor	**5' 5" X 6' 8"**	**Opens into LIVING_ROOM**
Missing Wall	**13' 5" X 8'**	**Opens into KITCHEN**

DESCRIPTION	QTY	UNIT PRICE	TAX	O&P	RCV	DEPREC.	ACV
CRIPPLE WALL AND FOUNDATION							
209. R&R 1/2" - drywall per LF - up to 2' tall	13.42 LF	15.33	1.49	41.44	248.66	(0.00)	248.66
INTERIOR DAMAGE							
147. R&R 1/2" drywall - hung, taped, with smooth wall finish	40.00 SF	4.72	2.00	38.16	228.96	(0.00)	228.96
149. Mask per square foot for drywall work	40.00 SF	0.30	0.18	2.44	14.62	(0.00)	14.62
150. Seal/prime then paint the surface area (2 coats)	46.00 SF	1.14	0.64	10.60	63.68	(0.00)	63.68
205. R&R 1/2" drywall - hung, taped, floated, ready for paint	40.00 SF	3.57	2.00	28.96	173.76	(0.00)	173.76
CEILINGS							
181. R&R Two coat plaster over metal lath	6.00 SF	12.67	0.85	15.38	92.25	(0.00)	92.25
183. Clean the surface area	6.00 SF	0.35	0.01	0.42	2.53	(0.00)	2.53
184. Plaster - add for ceiling detailing/trim	10.00 LF	32.04	2.72	64.62	387.74	(0.00)	387.74
Cripple Wall and Foundation Totals:			**1.49**	**41.44**	**248.66**		**248.66**
Interior Damage Totals:			**4.82**	**80.16**	**481.02**		**481.02**
Ceilings Totals:			**3.58**	**80.42**	**482.52**		**482.52**
Totals: Dining Room			**9.89**	**202.02**	**1,212.20**	**0.00**	**1,212.20**



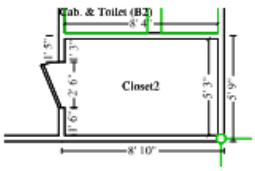
Hallway **Height: 8'**

199.22 SF Walls
251.29 SF Walls & Ceiling
5.79 SY Flooring
31.17 LF Ceil. Perimeter

52.07 SF Ceiling
52.07 SF Floor
23.83 LF Floor Perimeter

Missing Wall - Goes to Floor	**2' 8" X 6' 10"**	**Opens into BEDROOM_2**
Missing Wall	**3' 10" X 8'**	**Opens into LIVING_ROOM**
Missing Wall - Goes to Floor	**2' X 6' 10"**	**Opens into HALL_CLOSET**
Missing Wall - Goes to Floor	**2' 8" X 6' 10"**	**Opens into BATHROOM**

DESCRIPTION	QTY	UNIT PRICE	TAX	O&P	RCV	DEPREC.	ACV
INTERIOR DAMAGE							
157. R&R 1/2" drywall - hung, taped, with smooth wall finish	30.00 SF	4.72	1.50	28.62	171.72	(0.00)	171.72
158. Mask per square foot for drywall work	30.00 SF	0.30	0.13	1.82	10.95	(0.00)	10.95
159. Seal/prime then paint the surface area (2 coats)	30.00 SF	1.14	0.42	6.92	41.54	(0.00)	41.54
Interior Damage Totals:			**2.05**	**37.36**	**224.21**		**224.21**
Totals: Hallway			**2.05**	**37.36**	**224.21**	**0.00**	**224.21**



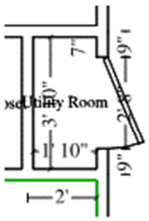
Closet2 **Height: 8'**

200.67 SF Walls
244.42 SF Walls & Ceiling
4.86 SY Flooring
27.17 LF Ceil. Perimeter

43.75 SF Ceiling
43.75 SF Floor
24.67 LF Floor Perimeter

Missing Wall - Goes to Floor	**2' 6" X 6' 8"**	**Opens into BEDROOM_2**

DESCRIPTION	QTY	UNIT PRICE	TAX	O&P	RCV	DEPREC.	ACV
INTERIOR DAMAGE							
178. R&R 1/2" drywall - hung, taped, with smooth wall finish	25.00 SF	4.72	1.25	23.86	143.11	(0.00)	143.11
179. Mask per square foot for drywall work	25.00 SF	0.30	0.11	1.52	9.13	(0.00)	9.13
180. Seal/prime then paint the surface area (2 coats)	25.00 SF	1.14	0.35	5.78	34.63	(0.00)	34.63
Interior Damage Totals:			**1.71**	**31.16**	**186.87**		**186.87**
Totals: Closet2			**1.71**	**31.16**	**186.87**	**0.00**	**186.87**

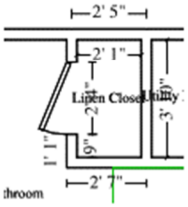


Utility Room **Height: 8'**

72.44 SF Walls	7.03 SF Ceiling
79.47 SF Walls & Ceiling	7.03 SF Floor
0.78 SY Flooring	8.67 LF Floor Perimeter
11.33 LF Ceil. Perimeter	

Missing Wall - Goes to Floor **2' 8" X 6' 10"** **Opens into Exterior**

DESCRIPTION	QTY	UNIT PRICE	TAX	O&P	RCV	DEPREC.	ACV
INTERIOR DAMAGE							
172. R&R 1/2" drywall - hung, taped, with smooth wall finish	10.00 SF	4.72	0.50	9.54	57.24	(0.00)	57.24
173. Mask per square foot for drywall work	10.00 SF	0.30	0.04	0.60	3.64	(0.00)	3.64
174. Seal/prime then paint the surface area (2 coats)	10.00 SF	1.14	0.14	2.30	13.84	(0.00)	13.84
Interior Damage Totals:			**0.68**	**12.44**	**74.72**		**74.72**
Totals: Utility Room			**0.68**	**12.44**	**74.72**	**0.00**	**74.72**



Linen Closet **Height: 8'**

78.72 SF Walls	7.99 SF Ceiling
86.71 SF Walls & Ceiling	7.99 SF Floor
0.89 SY Flooring	9.50 LF Floor Perimeter
11.83 LF Ceil. Perimeter	

Missing Wall - Goes to Floor **2' 4" X 6' 10"** **Opens into BATHROOM**

DESCRIPTION	QTY	UNIT PRICE	TAX	O&P	RCV	DEPREC.	ACV
INTERIOR DAMAGE							
169. R&R 1/2" drywall - hung, taped, with smooth wall finish	10.00 SF	4.72	0.50	9.54	57.24	(0.00)	57.24
170. Mask per square foot for drywall work	10.00 SF	0.30	0.04	0.60	3.64	(0.00)	3.64
171. Seal/prime then paint the surface area (2 coats)	10.00 SF	1.14	0.14	2.30	13.84	(0.00)	13.84
Interior Damage Totals:			**0.68**	**12.44**	**74.72**		**74.72**
Totals: Linen Closet			**0.68**	**12.44**	**74.72**	**0.00**	**74.72**

Bathroom **Height: 8'**

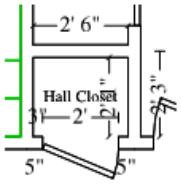
205.17 SF Walls	64.24 SF Ceiling
269.40 SF Walls & Ceiling	37.25 SF Floor
4.14 SY Flooring	31.67 LF Floor Perimeter
36.67 LF Ceil. Perimeter	

Missing Wall - Goes to Floor **2' 8" X 6' 10"** **Opens into HALLWAY**

Missing Wall - Goes to Floor **2' 4" X 6' 10"** **Opens into LINEN_CLOSET**

Missing Wall - Goes to neither Floor/Ceiling **3' X 3' 6"** **Opens into Exterior**

DESCRIPTION	QTY	UNIT PRICE	TAX	O&P	RCV	DEPREC.	ACV
INTERIOR DAMAGE							
175. R&R 1/2" drywall - hung, taped, with smooth wall finish	35.00 SF	4.72	1.75	33.40	200.35	(0.00)	200.35
176. Mask per square foot for drywall work	35.00 SF	0.30	0.15	2.14	12.79	(0.00)	12.79
177. Seal/prime then paint the surface area (2 coats)	35.00 SF	1.14	0.49	8.08	48.47	(0.00)	48.47
194. R&R Ceramic tile - Standard grade	175.00 SF	17.93	42.42	636.04	3,816.21	(0.00)	3,816.21
195. Clean ceramic tile	30.00 SF	0.52	0.03	3.12	18.75	(0.00)	18.75
196. R&R Ceramic tile base - Standard grade	20.00 LF	27.18	6.60	110.04	660.24	(0.00)	660.24
197. R&R 1/2" Cement board	175.00 SF	7.15	19.91	254.24	1,525.40	(0.00)	1,525.40
198. R&R Mortar bed for tile	175.00 SF	12.17	25.27	431.02	2,586.04	(0.00)	2,586.04
199. Regrout tile	175.00 SF	6.35	2.45	222.76	1,336.46	(0.00)	1,336.46
200. Seal grout on tile wall	30.00 SF	2.33	0.42	14.06	84.38	(0.00)	84.38
201. Tile/stone sealer	30.00 SF	1.36	0.87	8.34	50.01	(0.00)	50.01
Interior Damage Totals:			**100.36**	**1723.24**	**10,339.10**		**10,339.10**
Totals: Bathroom			**100.36**	**1,723.24**	**10,339.10**	**0.00**	**10,339.10**



Hall Closet **Height: 8'**

59.67 SF Walls	5.21 SF Ceiling
64.88 SF Walls & Ceiling	5.21 SF Floor
0.58 SY Flooring	7.17 LF Floor Perimeter
9.17 LF Ceil. Perimeter	

Missing Wall - Goes to Floor **2' X 6' 10"** **Opens into HALLWAY**

DESCRIPTION	QTY	UNIT PRICE	TAX	O&P	RCV	DEPREC.	ACV
INTERIOR DAMAGE							
166. R&R 1/2" drywall - hung, taped, with smooth wall finish	10.00 SF	4.72	0.50	9.54	57.24	(0.00)	57.24

CONTINUED - Hall Closet

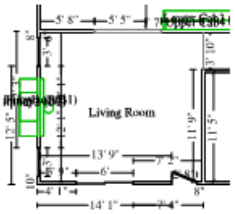
DESCRIPTION	QTY	UNIT PRICE	TAX	O&P	RCV	DEPREC.	ACV
167. Mask per square foot for drywall work	10.00 SF	0.30	0.04	0.60	3.64	(0.00)	3.64
168. Seal/prime then paint the surface area (2 coats)	10.00 SF	1.14	0.14	2.30	13.84	(0.00)	13.84
Interior Damage Totals:			**0.68**	**12.44**	**74.72**		**74.72**
Totals: Hall Closet			**0.68**	**12.44**	**74.72**	**0.00**	**74.72**

Closet1 **Height: 8'**

150.44 SF Walls	27.50 SF Ceiling
177.94 SF Walls & Ceiling	27.50 SF Floor
3.06 SY Flooring	17.17 LF Floor Perimeter
27.00 LF Ceil. Perimeter	

Missing Wall - Goes to Floor **9' 10" X 6' 8"** **Opens into BEDROOM_1**

DESCRIPTION	QTY	UNIT PRICE	TAX	O&P	RCV	DEPREC.	ACV
INTERIOR DAMAGE							
163. R&R 1/2" drywall - hung, taped, with smooth wall finish	20.00 SF	4.72	1.00	19.08	114.48	(0.00)	114.48
164. Mask per square foot for drywall work	20.00 SF	0.30	0.09	1.22	7.31	(0.00)	7.31
165. Seal/prime then paint the surface area (2 coats)	20.00 SF	1.14	0.28	4.62	27.70	(0.00)	27.70
Interior Damage Totals:			**1.37**	**24.92**	**149.49**		**149.49**
Totals: Closet1			**1.37**	**24.92**	**149.49**	**0.00**	**149.49**

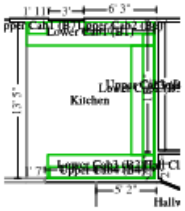


Living Room **Height: 8'**

359.78 SF Walls	264.26 SF Ceiling
624.03 SF Walls & Ceiling	262.26 SF Floor
29.14 SY Flooring	51.67 LF Floor Perimeter
61.33 LF Ceil. Perimeter	

Missing Wall	**3' 10" X 8'**	**Opens into HALLWAY**
Missing Wall - Goes to Floor	**1' 7" X 6' 8"**	**Opens into KITCHEN**
Missing Wall - Goes to Floor	**5' 5" X 6' 8"**	**Opens into DINING_ROOM**
Missing Wall - Goes to neither Floor/Ceiling	**3' X 3' 6"**	**Opens into Exterior**
Missing Wall - Goes to neither Floor/Ceiling	**3' X 3' 6"**	**Opens into Exterior**
Missing Wall - Goes to Floor	**2' 8" X 6' 10"**	**Opens into Exterior**
Missing Wall - Goes to neither Floor/Ceiling	**6' X 3' 6"**	**Opens into Exterior**

DESCRIPTION	QTY	UNIT PRICE	TAX	O&P	RCV	DEPREC.	ACV
INTERIOR DAMAGE							
151. R&R 1/2" drywall - hung, taped, with smooth wall finish	80.00 SF	4.72	3.99	76.32	457.91	(0.00)	457.91
152. Mask per square foot for drywall work	70.00 SF	0.30	0.31	4.26	25.57	(0.00)	25.57
153. Seal/prime then paint the surface area (2 coats)	70.00 SF	1.14	0.98	16.16	96.94	(0.00)	96.94
CHIMNEY							
214. R&R Fireplace - chimney chase cover - stainless steel	1.00 EA	595.06	29.72	124.96	749.74	(0.00)	749.74
Interior Damage Totals:			**5.28**	**96.74**	**580.42**		**580.42**
Chimney Totals:			**29.72**	**124.96**	**749.74**		**749.74**
Totals: Living Room			**35.00**	**221.70**	**1,330.16**	**0.00**	**1,330.16**



Kitchen **Height: 8'**

112.19 SF Walls	147.58 SF Ceiling
259.78 SF Walls & Ceiling	88.42 SF Floor
9.82 SY Flooring	33.83 LF Floor Perimeter
35.42 LF Ceil. Perimeter	

Missing Wall	**13' 5" X 8'**	**Opens into DINING_ROOM**
Missing Wall - Goes to Floor	**1' 7" X 6' 8"**	**Opens into LIVING_ROOM**

DESCRIPTION	QTY	UNIT PRICE	TAX	O&P	RCV	DEPREC.	ACV
INTERIOR DAMAGE							

CONTINUED - Kitchen

DESCRIPTION	QTY	UNIT PRICE	TAX	O&P	RCV	DEPREC.	ACV
185. R&R Ceramic tile - Standard grade	210.00 SF	17.93	50.90	763.24	4,579.44	(0.00)	4,579.44
187. Clean ceramic tile	75.00 SF	0.52	0.07	7.82	46.89	(0.00)	46.89
188. R&R Ceramic tile base - Standard grade	16.00 LF	27.18	5.28	88.02	528.18	(0.00)	528.18
189. R&R 1/2" Cement board	210.00 SF	7.15	23.89	305.08	1,830.47	(0.00)	1,830.47
190. R&R Mortar bed for tile	210.00 SF	12.17	30.32	517.20	3,103.22	(0.00)	3,103.22
191. Regrout tile	210.00 SF	6.35	2.94	267.28	1,603.72	(0.00)	1,603.72
192. Seal grout on tile wall	75.00 SF	2.33	1.05	35.18	210.98	(0.00)	210.98
193. Tile/stone sealer	75.00 SF	1.36	2.17	20.84	125.01	(0.00)	125.01
202. R&R 1/2" drywall - hung, taped, floated, ready for paint	40.00 SF	3.57	2.00	28.96	173.76	(0.00)	173.76
203. Mask per square foot for drywall work	40.00 SF	0.30	0.18	2.44	14.62	(0.00)	14.62
204. Seal/prime then paint the surface area (2 coats)	40.00 SF	1.14	0.56	9.24	55.40	(0.00)	55.40
Interior Damage Totals:			**119.36**	**2045.30**	**12,271.69**		**12,271.69**
Totals: Kitchen			**119.36**	**2,045.30**	**12,271.69**	**0.00**	**12,271.69**
Area Cripple Wall and Foundation Total:			**1.49**	**41.44**	**248.66**		**248.66**
Area Exterior Damage Total:			**25.24**	**445.78**	**2,674.72**		**2,674.72**
Area Interior Damage Total:			**245.17**	**4,225.66**	**25,353.80**		**25,353.80**
Area Ceilings Total:			**3.58**	**80.42**	**482.52**		**482.52**
Area Chimney Total:			**29.72**	**124.96**	**749.74**		**749.74**
Totals: Superstructure			**305.20**	**4,918.26**	**29,509.44**	**0.00**	**29,509.44**

Cracked Walls

DESCRIPTION	QTY	UNIT PRICE	TAX	O&P	RCV	DEPREC.	ACV
EXTERIOR DAMAGE							
206. R&R 1/2" drywall - hung, taped, with smooth wall finish	30.00 SF	4.72	1.50	28.62	171.72	(0.00)	171.72
207. Mask per square foot for drywall work	30.00 SF	0.30	0.13	1.82	10.95	(0.00)	10.95
208. Seal/prime then paint the surface area (2 coats)	30.00 SF	1.14	0.42	6.92	41.54	(0.00)	41.54
Exterior Damage Totals:			**2.05**	**37.36**	**224.21**		**224.21**
Totals: Cracked Walls			**2.05**	**37.36**	**224.21**	**0.00**	**224.21**

Labor Minimums Applied

DESCRIPTION	QTY	UNIT PRICE	TAX	O&P	RCV	DEPREC.	ACV
EXTERIOR DAMAGE							
135. Cleaning labor minimum	1.00 EA	4.80	0.00	0.96	5.76	(0.00)	5.76
137. Framing labor minimum	1.00 EA	106.01	0.00	21.20	127.21	(0.00)	127.21
CEILINGS							
182. Plaster labor minimum	1.00 EA	216.20	0.00	43.24	259.44	(0.00)	259.44
Exterior Damage Totals:			**0.00**	**22.16**	**132.97**		**132.97**
Ceilings Totals:			**0.00**	**43.24**	**259.44**		**259.44**
Totals: Labor Minimums Applied			**0.00**	**65.40**	**392.41**	**0.00**	**392.41**
Area Cripple Wall and Foundation Total:			**19.17**	**439.46**	**2,636.86**		**2,636.86**
Area Exterior Damage Total:			**27.29**	**505.30**	**3,031.90**		**3,031.90**
Area Interior Damage Total:			**245.17**	**4,225.66**	**25,353.80**		**25,353.80**
Area Ceilings Total:			**3.58**	**123.66**	**741.96**		**741.96**
Area Chimney Total:			**29.72**	**124.96**	**749.74**		**749.74**
Line Item Totals: CS1-UN-DS2			**324.93**	**5,419.04**	**32,514.26**	**0.00**	**32,514.26**

Grand Total Areas:

2,603.90 SF Walls	2,335.86 SF Ceiling	4,939.76 SF Walls and Ceiling
2,287.86 SF Floor	254.21 SY Flooring	505.33 LF Floor Perimeter
0.00 SF Long Wall	0.00 SF Short Wall	528.67 LF Ceil. Perimeter
2,287.86 Floor Area	2,479.58 Total Area	2,578.58 Interior Wall Area
1,467.46 Exterior Wall Area	266.67 Exterior Perimeter of Walls	
1,528.96 Surface Area	15.29 Number of Squares	175.76 Total Perimeter Length
14.50 Total Ridge Length	95.90 Total Hip Length	

Coverage	Item Total	%	ACV Total	%
Cripple Wall and Foundation	2,636.86	8.11%	2,636.86	8.11%
Exterior Damage	3,031.90	9.32%	3,031.90	9.32%
Interior Damage	25,353.80	77.98%	25,353.80	77.98%
Windows and Doors	0.00	0.00%	0.00	0.00%
Ceilings	741.96	2.28%	741.96	2.28%
Floors	0.00	0.00%	0.00	0.00%
Roof	0.00	0.00%	0.00	0.00%
Miscellaneous	0.00	0.00%	0.00	0.00%
Chimney	749.74	2.31%	749.74	2.31%
Stairs and Porch	0.00	0.00%	0.00	0.00%
MEP	0.00	0.00%	0.00	0.00%
Total	32,514.26	100.00%	32,514.26	100.00%

Summary for Cripple Wall and Foundation

Line Item Total	2,178.23
Material Sales Tax	19.17
Subtotal	2,197.40
Overhead	219.73
Profit	219.73
Replacement Cost Value	**$2,636.86**
Net Claim	**$2,636.86**

Bill Smith
Manager

Summary for Exterior Damage

Line Item Total	2,499.31
Material Sales Tax	27.29
Subtotal	2,526.60
Overhead	252.65
Profit	252.65
Replacement Cost Value	**$3,031.90**
Net Claim	**$3,031.90**

Bill Smith
Manager

Summary for Interior Damage

Line Item Total	20,882.97
Material Sales Tax	245.17
Subtotal	21,128.14
Overhead	2,112.83
Profit	2,112.83
Replacement Cost Value	**$25,353.80**
Net Claim	**$25,353.80**

Bill Smith
Manager

Summary for Ceilings

Line Item Total	614.72
Material Sales Tax	3.58
Subtotal	618.30
Overhead	61.83
Profit	61.83
Replacement Cost Value	**$741.96**
Net Claim	**$741.96**

Bill Smith
Manager

Summary for Chimney

Line Item Total	595.06
Material Sales Tax	29.72
Subtotal	624.78
Overhead	62.48
Profit	62.48
Replacement Cost Value	**$749.74**
Net Claim	**$749.74**

Bill Smith
Manager

Recap of Taxes, Overhead and Profit

	Overhead (10%)	Profit (10%)	Material Sales Tax (8.75%)	Storage Rental Tax (8.75%)
Line Items	2,709.52	2,709.52	324.93	0.00
Total	**2,709.52**	**2,709.52**	**324.93**	**0.00**

Recap by Room

Estimate: CS1-UN-DS2

Area: Cripple Wall		**1,972.50**	**7.37%**
Coverage: Cripple Wall and Foundation	100.00% =	1,972.50	
Area Subtotal: Cripple Wall		**1,972.50**	**7.37%**
Coverage: Cripple Wall and Foundation	100.00% =	1,972.50	
Area: Superstructure		**2,203.70**	**8.23%**
Coverage: Exterior Damage	100.00% =	2,203.70	
Area: Bedrooms			
Bedroom 2		**338.80**	**1.27%**
Coverage: Interior Damage	100.00% =	338.80	
Bedroom 1		**400.40**	**1.50%**
Coverage: Interior Damage	100.00% =	400.40	
Area Subtotal: Bedrooms		**739.20**	**2.76%**
Coverage: Interior Damage	100.00% =	739.20	
Dining Room		**1,000.29**	**3.74%**
Coverage: Cripple Wall and Foundation	20.57% =	205.73	
Coverage: Interior Damage	39.59% =	396.04	
Coverage: Ceilings	39.84% =	398.52	
Hallway		**184.80**	**0.69%**
Coverage: Interior Damage	100.00% =	184.80	
Closet2		**154.00**	**0.58%**
Coverage: Interior Damage	100.00% =	154.00	
Utility Room		**61.60**	**0.23%**
Coverage: Interior Damage	100.00% =	61.60	
Linen Closet		**61.60**	**0.23%**
Coverage: Interior Damage	100.00% =	61.60	
Bathroom		**8,515.50**	**31.81%**
Coverage: Interior Damage	100.00% =	8,515.50	
Hall Closet		**61.60**	**0.23%**
Coverage: Interior Damage	100.00% =	61.60	
Closet1		**123.20**	**0.46%**
Coverage: Interior Damage	100.00% =	123.20	
Living Room		**1,073.46**	**4.01%**
Coverage: Interior Damage	44.57% =	478.40	
Coverage: Chimney	55.43% =	595.06	
Kitchen		**10,107.03**	**37.75%**
Coverage: Interior Damage	100.00% =	10,107.03	
Area Subtotal: Superstructure		**24,285.98**	**90.72%**

Coverage: Cripple Wall and Foundation	0.85% =	205.73	
Coverage: Exterior Damage	9.07% =	2,203.70	
Coverage: Interior Damage	85.99% =	20,882.97	
Coverage: Ceilings	1.64% =	398.52	
Coverage: Chimney	2.45% =	595.06	
Cracked Walls		**184.80**	**0.69%**
Coverage: Exterior Damage	100.00% =	184.80	
Labor Minimums Applied		**327.01**	**1.22%**
Coverage: Exterior Damage	33.89% =	110.81	
Coverage: Ceilings	66.11% =	216.20	
Subtotal of Areas		**26,770.29**	**100.00%**
Coverage: Cripple Wall and Foundation	8.14% =	2,178.23	
Coverage: Exterior Damage	9.34% =	2,499.31	
Coverage: Interior Damage	78.01% =	20,882.97	
Coverage: Ceilings	2.30% =	614.72	
Coverage: Chimney	2.22% =	595.06	
Total		**26,770.29**	**100.00%**

Recap by Category

O&P Items			Total	%
CLEANING			**109.50**	**0.34%**
Coverage: Cripple Wall and Foundation	@	21.92% =	24.00	
Coverage: Exterior Damage	@	26.30% =	28.80	
Coverage: Interior Damage	@	49.86% =	54.60	
Coverage: Ceilings	@	1.92% =	2.10	
GENERAL DEMOLITION			**2,294.16**	**7.06%**
Coverage: Cripple Wall and Foundation	@	2.97% =	68.22	
Coverage: Exterior Damage	@	4.45% =	102.00	
Coverage: Interior Damage	@	91.24% =	2,093.24	
Coverage: Ceilings	@	0.41% =	9.42	
Coverage: Chimney	@	0.93% =	21.28	
DRYWALL			**2,289.11**	**7.04%**
Coverage: Cripple Wall and Foundation	@	7.49% =	171.51	
Coverage: Exterior Damage	@	5.95% =	136.20	
Coverage: Interior Damage	@	86.56% =	1,981.40	
FIREPLACES			**573.78**	**1.76%**
Coverage: Chimney	@	100.00% =	573.78	
FRAMING & ROUGH CARPENTRY			**283.61**	**0.87%**
Coverage: Exterior Damage	@	100.00% =	283.61	
INTERIOR LATH & PLASTER			**603.20**	**1.86%**
Coverage: Ceilings	@	100.00% =	603.20	
PAINTING			**646.84**	**1.99%**
Coverage: Cripple Wall and Foundation	@	10.70% =	69.20	
Coverage: Exterior Damage	@	15.99% =	103.40	
Coverage: Interior Damage	@	73.32% =	474.24	
STUCCO & EXTERIOR PLASTER			**3,690.60**	**11.35%**
Coverage: Cripple Wall and Foundation	@	50.00% =	1,845.30	
Coverage: Exterior Damage	@	50.00% =	1,845.30	
TILE			**16,279.49**	**50.07%**
Coverage: Interior Damage	@	100.00% =	16,279.49	
O&P Items Subtotal			**26,770.29**	**82.33%**
Material Sales Tax			**324.93**	**1.00%**
Coverage: Cripple Wall and Foundation	@	5.90% =	19.17	
Coverage: Exterior Damage	@	8.40% =	27.29	
Coverage: Interior Damage	@	75.45% =	245.17	
Coverage: Ceilings	@	1.10% =	3.58	
Coverage: Chimney	@	9.15% =	29.72	
Overhead			**2,709.52**	**8.33%**
Coverage: Cripple Wall and Foundation	@	8.11% =	219.73	
Coverage: Exterior Damage	@	9.32% =	252.65	
Coverage: Interior Damage	@	77.98% =	2,112.83	
Coverage: Ceilings	@	2.28% =	61.83	
Coverage: Chimney	@	2.31% =	62.48	
Profit			**2,709.52**	**8.33%**
Coverage: Cripple Wall and Foundation	@	8.11% =	219.73	

Coverage: Exterior Damage	@	9.32% =	252.65	
Coverage: Interior Damage	@	77.98% =	2,112.83	
Coverage: Ceilings	@	2.28% =	61.83	
Coverage: Chimney	@	2.31% =	62.48	
Total			**32,514.26**	**100.00%**

APPENDIX B INITIAL SURVEY QUESTIONS FOR CLAIMS ADJUSTORS

Table B.1 Initial Survey Questions

Number	Question
1a	For Damage State 4, what is is the replacement cost in $/sf and source of the value?
1b	What portion of the replacement cost was for demolition and removal of the existing home ($/sf)?
1c	What portion of the replacement cost was for the garage in Case Study 3 ($/sf)?
2a	For Damage State 3, did you replace the entire structure the rather than repair/upgrade the damage?
2b	If you answered yes, why did you replace the entire structure?
3a	For Damage State 1, 2, or 3, did you upgrade rather than repair the damage?
3b	If you answered yes, which damage state(s) were upgraded and which elements?
3c	Why did you upgrade or not upgrade?
4a	For Damage State 1, 2, or 3, did you locally replace rather than repair the damage?
4b	If you answered yes, which damage state(s) had local replacement and which elements?
4c	Why did you locally replace instead of repair?
5a	For Damage State 3, did you jack and replumb the cripple wall or replace it entirely?
5b	At what level of residual displacement do you think it is no longer economically practical to jack the cripple wall to plumb and rebuilding is needed?
5c	Up to what level of residual displacement do you leave the cripple wall in its tilted condition?
5d	For Case Study Building 1, did you replace the horizontal sheathing under the stucco with plywood?
5e	What rules or approach did you use for triggered collateral extent to obtain a consistent appearance in general?
6	If there is local damage to an interior wall finishes, at what point (if any) do you repair/repaint the entire wall or room?
7	What rules or approach did you use in deciding when to replace the building paper?
8	What percentage if any did you assume for escalation?
	What amount if any did you assume for the following items as a percentage of the direct construction costs?
9a	Construction contingency
9b	Utilities (power and water) for construction
9c	Design fees
9d	Plan check and permitting fees and shear wall special inspection fees
9e	Lead paint and asbestos abatement
9f	Occupied structure
9g	Coverage C costs allocated for personal property damage

Number	Question
9h	Coverage D costs allocated for additional living expenses
10	What additional information would help you refine your estimate?
11	Are there assumptions with which you disagree?
12	Any other comments or suggestions?

APPENDIX C RESPONSES TO INITIAL SURVEY QUESTIONS FOR CLAIMS ADJUSTORS

Table C.1 Anonymous Adjustor 1 – Initial Survey Response.

Number	Question	Response for Case Study 1	Response for Case Study 2
1a	For Damage State 4, what is is the replacement cost in $/sf and source of the value?	$184/sf - xactimate residential valuation tool	$192/ sf xactimate residential tool
1b	What portion of the replacement cost was for demolition and removal of the existing home ($/sf)?	$7.15/SF	$7.15/SF
1c	What portion of the replacement cost was for the garage in Case Study 3 ($/sf)?		
2a	For Damage State 3, did you replace the entire structure the rather than repair/upgrade the damage?	Yes	Yes
2b	If you answered yes, why did you replace the entire structure?	The estimates for both Damage Scenarios 3 are a bit out of my knowledge area. Based on the descriptions I believe they should be a total loss, however I would typically default to an expert in the area – contractor and/or engineer for their expertise before making that determination. For repairs that require greater techinical knowledge and/or signifigant structural repairs I will almost always refer to a trusted expert and write an estimate based on their recommedations.	The estimates for both Damage Scenarios 3 are a bit out of my knowledge area. Based on the descriptions I believe they should be a total loss, however I would typically default to an expert in the area – contractor and/or engineer for their expertise before making that determination. For repairs that require greater techinical knowledge and/or signifigant structural repairs I will almost always refer to a trusted expert and write an estimate based on their recommedations.
3a	For Damage State 1, 2, or 3, did you upgrade rather than repair the damage?	No	No
3b	If you answered yes, which damage state(s) were upgraded and which elements?		
3c	Why did you upgrade or not upgrade?	I am not sure what upgrades to utilize or how to estimate for them.	I am not sure what upgrades to utilize or how to estimate for them.
4a	For Damage State 1, 2, or 3, did you locally replace rather than repair the damage?	For Damage State 1: I repaired the damages. For Damage State 2: I locally replaced	For Damage State 1: I repaired the damages. For Damage State 2: I locally replaced

Table C.1 Anonymous Adjustor 1 – Initial Survey Response (continued).

Number	Question	Response for Case Study 1	Response for Case Study 2
4b	If you answered yes, which damage state(s) had local replacement and which elements?	I locally replaced the stucco and the drywall for Scenario 2.	I repaired the siding as needed and locally replaced the plaster for Scenario 2.
4c	Why did you locally replace instead of repair?	The cost to repair was higher than that of replacement. Further, the damages were more severe in DS2 and therefore in order to make a proper repair to bring the home to preloss locally replacing damaged materials was needed.	Based on repair vs. replace cost comparison
5a	For Damage State 3, did you jack and replumb the cripple wall or replace it entirely?	n/a	N/A
5b	At what level of residual displacement do you think it is no longer economically practical to jack the cripple wall to plumb and rebuilding is needed?	I do not have the experience to make that determinination	I do not have the experience to make that determinination
5c	Up to what level of residual displacement do you leave the cripple wall in its tilted condition?		
5d	For Case Study Building 1, did you replace the horizontal sheathing under the stucco with plywood?		
5e	What rules or approach did you use for triggered collateral extent to obtain a consistent appearance in general?		
6	If there is local damage to an interior wall finishes, at what point (if any) do you repair/repaint the entire wall or room?	I use a cost comparison. I will create an estimate to see how much a proper repair would be to the affected portions of the wall vs. total replacement of the drywall. Then I chose repair vs. replace based on the option that is more cost effective. We typically seal & paint new drywall and then one coat of paint on undamaged drywall to create a uniform color	

Table C.1 Anonymous Adjustor 1 – Initial Survey Response (continued).

Number	Question	Response for Case Study 1	Response for Case Study 2
		appearance. So if a room has drywall repairs being made the entire room will at least receive one coat of paint.	
7	What rules or approach did you use in deciding when to replace the building paper?	If it is no longer able to provide the fuction its intended to	If it is no longer able to provide the fuction its intended to
8	What percentage if any did you assume for escalation?	I have no experience in dealing with cost escalation.	I have no experience in dealing with cost escalation.
	What amount if any did you assume for the following items as a percentage of the direct construction costs?		
9a	Construction contingency	Unknown	Unknown
9b	Utilities (power and water) for construction	Unknown	Unknown
9c	Design fees	None	None
9d	Plan check and permitting fees and shear wall special inspection fees	Unknown	Unknown
9e	Lead paint and asbestos abatement	$15K+	$15K+
9f	Occupied structure	Unknown	Unknown
9g	Coverage C costs allocated for personal property damage	None	None
9h	Coverage D costs allocated for additional living expenses	2-3 months of ALE expenses: hotel, furnished apt, etc. Approx 8K	2-3 months of ALE expenses: hotel, furnished apt, etc. Approx 8K
10	What additional information would help you refine your estimate?	Photos of actual damage or rooms that you want an estimate written for.	Photos of actual damage or rooms that you want an estimate written for.
11	Are there assumptions with which you disagree?		
12	Any other comments or suggestions?	As an adjuster I typically write estimates for superficial damages - drywall, flooring, cabinetry etc. If I have an estimate that requires structural/framing repairs I will typically call a local contractor	

Table C.1 Anonymous Adjustor 1 – Initial Survey Response (continued).

Number	Question	Response for Case Study 1	Response for Case Study 2
		and an engineer to assist with my scope of repair. Also noted - Pricing for the TIL CTTLB line item is very high. It should be closer to $8.50 per sq ft not $24.74 as is showing up with your price list. I have adjusted the price on my estimates to reflect the more accurate price of $8.50	

See instructions for definitions of repair, upgrade, locally replace, replacement of the entire structure, and escalation.

Table C.2 Anonymous Adjustor 2 – Initial Survey Response (continued).

Number	Question	Response for Case Study 3
1a	For Damage State 4, what is is the replacement cost in $/sf and source of the value?	Total Loss Report
1b	What portion of the replacement cost was for demolition and removal of the existing home ($/sf)?	6.39
1c	What portion of the replacement cost was for the garage in Case Study 3 ($/sf)?	??
2a	For Damage State 3, did you replace the entire structure the rather than repair/upgrade the damage?	No
2b	If you answered yes, why did you replace the entire structure?	
3a	For Damage State 1, 2, or 3, did you upgrade rather than repair the damage?	No
3b	If you answered yes, which damage state(s) were upgraded and which elements?	
3c	Why did you upgrade or not upgrade?	No upgrades needed
4a	For Damage State 1, 2, or 3, did you locally replace rather than repair the damage?	No for Damage State 1; Yes for damage state 2 and 3
4b	If you answered yes, which damage state(s) had local replacement and which elements?	Damage State 2 = Siding because it seemed more cost effective to tear off all the siding and replace vs. repair. Damage State 3 = same as State 2 with the siding. Interior drywall also seemed more cost effective to tear out than try to repair.
4c	Why did you locally replace instead of repair?	It seemed more cost effect to replace vs. repair
5a	For Damage State 3, did you jack and replumb the cripple wall or replace it entirely?	Jack and replaced cripple wall
5b	At what level of residual displacement do you think it is no longer economically practical to jack the cripple wall to plumb and rebuilding is needed?	When the displacement is too severe that the house would need to be moved back over the existing foundation.
5c	Up to what level of residual displacement do you leave the cripple wall in its tilted condition?	Up to 1/2"? Or when the engineer confirms that it can remain in its current condition.
5d	For Case Study Building 1, did you replace the horizontal sheathing under the stucco with plywood?	
5e	What rules or approach did you use for triggered collateral extent to obtain a consistent appearance in general?	Paint all walls, not just damaged sections.

Table C.2 Anonymous Adjustor 2 – Initial Survey Response (continued).

Number	Question	Response for Case Study 3
6	If there is local damage to an interior wall finishes, at what point (if any) do you repair/repaint the entire wall or room?	Damage State 1 and 2 appeared to be repairable. Damage State 3 seems to be the point where the damage is too severe to attempt repair. It is more cost effect to just replace at this point.
7	What rules or approach did you use in deciding when to replace the building paper?	When the siding comes off, the building paper is replaced.
8	What percentage if any did you assume for escalation?	I don't understand the question.
	What amount if any did you assume for the following items as a percentage of the direct construction costs?	
9a	Construction contingency	
9b	Utilities (power and water) for construction	Depends on the state of damage
9c	Design fees	As incurred
9d	Plan check and permitting fees and shear wall special inspection fees	As incurred
9e	Lead paint and asbestos abatement	As incurred
9f	Occupied structure	
9g	Coverage C costs allocated for personal property damage	Content manipulation in estimate
9h	Coverage D costs allocated for additional living expenses	Depends on the state of damage: Damage State 1 - 2 weeks, Damage State 2 = 2 months, Damage State 4 = 4 months
10	What additional information would help you refine your estimate?	
11	Are there assumptions with which you disagree?	
12	Any other comments or suggestions?	

See instructions for definitions of repair, upgrade, locally replace, replacement of the entire structure, and escalation.

Table C.3 Anonymous Adjustor 3 – Initial Survey Response.

Number	Question	Response for Case Study 1	Response for Case Study 2	Response for Case Study 3
1a	For Damage State 4, what is is the replacement cost in $/sf and source of the value?	N/A	N/A	N/A
1b	What portion of the replacement cost was for demolition and removal of the existing home ($/sf)?	N/A	N/A	N/A
1c	What portion of the replacement cost was for the garage in Case Study 3 ($/sf)?			N/A
2a	For Damage State 3, did you replace the entire structure the rather than repair/upgrade the damage?	N/A	N/A	No
2b	If you answered yes, why did you replace the entire structure?	N/A	N/A	N/A
3a	For Damage State 1, 2, or 3, did you upgrade rather than repair the damage?	N/A	N/A	No
3b	If you answered yes, which damage state(s) were upgraded and which elements?	N/A	N/A	N/A
3c	Why did you upgrade or not upgrade?	N/A	N/A	Repaired
4a	For Damage State 1, 2, or 3, did you locally replace rather than repair the damage?	N/A	N/A	Yes
4b	If you answered yes, which damage state(s) had local replacement and which elements?	N/A	N/A	locally replaced chimney, cripple wall, framing, drywall, tile, door openings
4c	Why did you locally replace instead of repair?	N/A	N/A	per the damage scenario
5a	For Damage State 3, did you jack and replumb the cripple wall or replace it entirely?	N/A	N/A	replace
5b	At what level of residual displacement do you think it is no longer economically practical to jack the cripple wall to plumb and rebuilding is needed?	N/A	N/A	1.5"
5c	Up to what level of residual displacement do you leave the cripple wall in its tilted condition?	N/A	N/A	1'5"
5d	For Case Study Building 1, did you replace the horizontal sheathing under the stucco with plywood?	N/A		
5e	What rules or approach did you use for triggered collateral extent to obtain a consistent appearance in general?	N/A	N/A	Followed damage description
6	If there is local damage to an interior wall finishes, at what point (if any) do you repair/repaint the entire wall or room?	N/A	N/A	Yes, painted the room

Table C.3 Anonymous Adjustor 3 – Initial Survey Response (continued).

Number	Question	Response for Case Study 1	Response for Case Study 2	Response for Case Study 3
7	What rules or approach did you use in deciding when to replace the building paper?	N/A	N/A	When paper is torn
8	What percentage if any did you assume for escalation?	N/A	N/A	N/A
	What amount if any did you assume for the following items as a percentage of the direct construction costs?			
9a	Construction contingency	N/A	N/A	N/A
9b	Utilities (power and water) for construction	N/A	N/A	N/A
9c	Design fees	N/A	N/A	N/A
9d	Plan check and permitting fees and shear wall special inspection fees	N/A	N/A	N/A
9e	Lead paint and asbestos abatement	N/A	N/A	N/A
9f	Occupied structure	N/A	N/A	N/A
9g	Coverage C costs allocated for personal property damage	N/A	N/A	N/A
9h	Coverage D costs allocated for additional living expenses	N/A	N/A	N/A
10	What additional information would help you refine your estimate?	N/A	N/A	Specific damages to interior finishes
11	Are there assumptions with which you disagree?	N/A	N/A	No
12	Any other comments or suggestions?	N/A	N/A	No

See instructions for definitions of repair, upgrade, locally replace, replacement of the entire structure, and escalation.

Table C.4 Anonymous Adjustor 4 – Initial Survey Response.

Number	Question	Response for Case Study 1	Response for Case Study 2
1a	For Damage State 4, what is is the replacement cost in $/sf and source of the value?	$191 Valuation Tool	$189 Valuation Tool
1b	What portion of the replacement cost was for demolition and removal of the existing home ($/sf)?	$5.96	$5.96
1c	What portion of the replacement cost was for the garage in Case Study 3 ($/sf)?		
2a	For Damage State 3, did you replace the entire structure the rather than repair/upgrade the damage?	No	No
2b	If you answered yes, why did you replace the entire structure?		
3a	For Damage State 1, 2, or 3, did you upgrade rather than repair the damage?	No	No
3b	If you answered yes, which damage state(s) were upgraded and which elements?		
3c	Why did you upgrade or not upgrade?		
4a	For Damage State 1, 2, or 3, did you locally replace rather than repair the damage?	No	No
4b	If you answered yes, which damage state(s) had local replacement and which elements?		
4c	Why did you locally replace instead of repair?		
5a	For Damage State 3, did you jack and replumb the cripple wall or replace it entirely?	Jack up and replumb	Jack up and replumb
5b	At what level of residual displacement do you think it is no longer economically practical to jack the cripple wall to plumb and rebuilding is needed?	Cost exceed 75%	Cost exceeds 75%
5c	Up to what level of residual displacement do you leave the cripple wall in its tilted condition?	Repair if there is residual displacement	Repair if there is residual displacement
5d	For Case Study Building 1, did you replace the horizontal sheathing under the stucco with plywood?	Yes	
5e	What rules or approach did you use for triggered collateral extent to obtain a consistent appearance in general?	Reasonably uniform appearance of repairs	Reasonably uniform appearance of repairs
6	If there is local damage to an interior wall finishes, at what point (if any) do you repair/repaint the entire wall or room?	Paint to outside corner	Paint to an outside corner
7	What rules or approach did you use in deciding when to replace the building paper?		
8	What percentage if any did you assume for escalation?	N/A	N/A

Table C.4 Anonymous Adjustor 4 – Initial Survey Response (continued).

Number	Question	Response for Case Study 1	Response for Case Study 2
	What amount if any did you assume for the following items as a percentage of the direct construction costs?		
9a	Construction contingency	N/A	N/A
9b	Utilities (power and water) for construction	Pends incurred cost	Pends incurred cost
9c	Design fees	Pends incurred cost	Pends incurred cost
9d	Plan check and permitting fees and shear wall special inspection fees	Pends incurred cost	Pends incurred cost
9e	Lead paint and asbestos abatement	Pends testing	Pends testing
9f	Occupied structure	Pends incurred cost	Pends incurred cost
9g	Coverage C costs allocated for personal property damage	Pends incurred cost	Pends incurred cost
9h	Coverage D costs allocated for additional living expenses	Pends incurred cost	Pends incurred cost
10	What additional information would help you refine your estimate?	More detailed intruction Damage State 3	More detailed intruction Damage State 3
11	Are there assumptions with which you disagree?	No	No
12	Any other comments or suggestions?		

See instructions for definitions of repair, upgrade, locally replace, replacement of the entire structure, and escalation

Table C.5 Anonymous Adjustor 5 – Initial Survey Response.

Number	Question	Response for Case Study 3
1a	For Damage State 4, what is is the replacement cost in $/sf and source of the value?	$250/sf Local Contractor and home quality and location
1b	What portion of the replacement cost was for demolition and removal of the existing home ($/sf)?	
1c	What portion of the replacement cost was for the garage in Case Study 3 ($/sf)?	
2a	For Damage State 3, did you replace the entire structure the rather than repair/upgrade the damage?	No
2b	If you answered yes, why did you replace the entire structure?	
3a	For Damage State 1, 2, or 3, did you upgrade rather than repair the damage?	No
3b	If you answered yes, which damage state(s) were upgraded and which elements?	
3c	Why did you upgrade or not upgrade?	
4a	For Damage State 1, 2, or 3, did you locally replace rather than repair the damage?	Yes
4b	If you answered yes, which damage state(s) had local replacement and which elements?	Cripple wall
4c	Why did you locally replace instead of repair?	Too difficult to repair and not cause more damage
5a	For Damage State 3, did you jack and replumb the cripple wall or replace it entirely?	Replace it
5b	At what level of residual displacement do you think it is no longer economically practical to jack the cripple wall to plumb and rebuilding is needed?	If the entire home was off plumb, just the first floor is border line and could be considered
5c	Up to what level of residual displacement do you leave the cripple wall in its tilted condition?	Under 0.5"
5d	For Case Study Building 1, did you replace the horizontal sheathing under the stucco with plywood?	
5e	What rules or approach did you use for triggered collateral extent to obtain a consistent appearance in general?	Line of site
6	If there is local damage to an interior wall finishes, at what point (if any) do you repair/repaint the entire wall or room?	50%
7	What rules or approach did you use in deciding when to replace the building paper?	When torn or not

Table C.5 Anonymous Adjustor 5 – Initial Survey Response (continued).

Number	Question	Response for Case Study 3
8	What percentage if any did you assume for escalation?	I don't understand the question
	What amount if any did you assume for the following items as a percentage of the direct construction costs?	
9a	Construction contingency	
9b	Utilities (power and water) for construction	
9c	Design fees	
9d	Plan check and permitting fees and shear wall special inspection fees	
9e	Lead paint and asbestos abatement	
9f	Occupied structure	
9g	Coverage C costs allocated for personal property damage	
9h	Coverage D costs allocated for additional living expenses	
10	What additional information would help you refine your estimate?	
11	Are there assumptions with which you disagree?	
12	Any other comments or suggestions?	

See instructions for definitions of repair, upgrade, locally replace, replacement of the entire structure, and escalation.

Table C.6 Anonymous Adjustor 6 – Initial Survey Response.

Number	Question	Response for Case Study 1	Response for Case Study 2	Response for Case Study 3
1a	For Damage State 4, what is is the replacement cost in $/sf and source of the value?	18.08	21.39	
1b	What portion of the replacement cost was for demolition and removal of the existing home ($/sf)?	0.1954	0.489	
1c	What portion of the replacement cost was for the garage in Case Study 3 ($/sf)?			
2a	For Damage State 3, did you replace the entire structure the rather than repair/upgrade the damage?			Repair
2b	If you answered yes, why did you replace the entire structure?			Only 1" displacement
3a	For Damage State 1, 2, or 3, did you upgrade rather than repair the damage?	Repair	Repair	Repair
3b	If you answered yes, which damage state(s) were upgraded and which elements?			
3c	Why did you upgrade or not upgrade?			
4a	For Damage State 1, 2, or 3, did you locally replace rather than repair the damage?	Repair	Local replace	Entire replacement
4b	If you answered yes, which damage state(s) had local replacement and which elements?		Effected area	Entire replacement
4c	Why did you locally replace instead of repair?		Not realistic to patch	Not realistic to patch
5a	For Damage State 3, did you jack and replumb the cripple wall or replace it entirely?			Replumb
5b	At what level of residual displacement do you think it is no longer economically practical to jack the cripple wall to plumb and rebuilding is needed?			2"+
5c	Up to what level of residual displacement do you leave the cripple wall in its tilted condition?			Engineer recommendation
5d	For Case Study Building 1, did you replace the horizontal sheathing under the stucco with plywood?	no		
5e	What rules or approach did you use for triggered collateral extent to obtain a consistent appearance in general?	Same elevation	Same elevation	Same elevation
6	If there is local damage to an interior wall finishes, at what point (if any) do you repair/repaint the entire wall or room?	Despends on paint (gloss vs. flat), local repairs effect adjacent walls.		
7	What rules or approach did you use in deciding when to replace the building paper?	Stucco replament will trigger building paper replacement		

Table C.6 Anonymous Adjustor 6 – Initial Survey Response (continued).

Number	Question	Response for Case Study 1	Response for Case Study 2	Response for Case Study 3
8	What percentage if any did you assume for escalation?			
	What amount if any did you assume for the following items as a percentage of the direct construction costs?			
9a	Construction contingency			
9b	Utilities (power and water) for construction			
9c	Design fees	0	0	$1,200 average for area
9d	Plan check and permitting fees and shear wall special inspection fees	800	800	400 per trade. Framing, plumbing ect
9e	Lead paint and asbestos abatement	Approximately $1,100 per room		
9f	Occupied structure	Pack out of contents $3000	3000	3000
9g	Coverage C costs allocated for personal property damage	Asbesto contamination $10,000		
9h	Coverage D costs allocated for additional living expenses	$4,000 per month x 2	$4,000 x 4	$4,000x 12 month
10	What additional information would help you refine your estimate?	Better photos / discription		
11	Are there assumptions with which you disagree?			
12	Any other comments or suggestions?	A lot of the repairs are subjected. Destructive investigation needed by engineers. Cribbing of walls can damage flooring that can double estimate		

See instructions for definitions of repair, upgrade, locally replace, replacement of the entire structure, and escalation.

Table C.7 Anonymous Adjustor 7 – Initial Survey Response.

Number	Question	Response for Case Study 3
1a	For Damage State 4, what is is the replacement cost in $/sf and source of the value?	$193.47 (360-Value)
1b	What portion of the replacement cost was for demolition and removal of the existing home ($/sf)?	$5.66
1c	What portion of the replacement cost was for the garage in Case Study 3 ($/sf)?	$0.07
2a	For Damage State 3, did you replace the entire structure the rather than repair/upgrade the damage?	No
2b	If you answered yes, why did you replace the entire structure?	
3a	For Damage State 1, 2, or 3, did you upgrade rather than repair the damage?	No
3b	If you answered yes, which damage state(s) were upgraded and which elements?	
3c	Why did you upgrade or not upgrade?	
4a	For Damage State 1, 2, or 3, did you locally replace rather than repair the damage?	Yes
4b	If you answered yes, which damage state(s) had local replacement and which elements?	Drywall, Tile, Chimney, Framing, Insulation, Windows, Doors, Siding, Housewrap, Water Heater
4c	Why did you locally replace instead of repair?	Cost Effective, Unrepairable
5a	For Damage State 3, did you jack and replumb the cripple wall or replace it entirely?	Replaced
5b	At what level of residual displacement do you think it is no longer economically practical to jack the cripple wall to plumb and rebuilding is needed?	Broken glass, damaged wall studs, significant re nailing of framing of bracing
5c	Up to what level of residual displacement do you leave the cripple wall in its tilted condition?	Engineer's call
5d	For Case Study Building 1, did you replace the horizontal sheathing under the stucco with plywood?	
5e	What rules or approach did you use for triggered collateral extent to obtain a consistent appearance in general?	Continuous walls with no natural break, line of sight, age of materials/finish, refinish possible?
6	If there is local damage to an interior wall finishes, at what point (if any) do you repair/repaint the entire wall or room?	Age of paint? 2 or more walls w/o break in line of sight
7	What rules or approach did you use in deciding when to replace the building paper?	Damaged? Likely to be damaged during removal of siding?

Table C.7 Anonymous Adjustor 7 – Initial Survey Response (continued).

Number	Question	Response for Case Study 3
8	What percentage if any did you assume for escalation?	0
	What amount if any did you assume for the following items as a percentage of the direct construction costs?	
9a	Construction contingency	10-15%
9b	Utilities (power and water) for construction	0
9c	Design fees	5%
9d	Plan check and permitting fees and shear wall special inspection fees	2-3%
9e	Lead paint and asbestos abatement	0% however, should be tested and supplemented based on licensed abatement company estimate
9f	Occupied structure	100
9g	Coverage C costs allocated for personal property damage	0
9h	Coverage D costs allocated for additional living expenses	None accounted for, however, would allow is CS3 & 4 as home unliveable
10	What additional information would help you refine your estimate?	Room by room description of damages to include finished surfaces, for example type of showers, vanities, counters etc. interior walls out of plum?
11	Are there assumptions with which you disagree?	No indication of non-load bearing wall damage, however, damaaged interior doors
12	Any other comments or suggestions?	Estimate is based on RCV, which normally is written for LKQ, is there an expectation to write estimate based on CEA coverage limits or upgrades/changes due to code? Less back and forth would be better. Often had to flip back 30+ pages to find material or damage descritions. Some details not mentioned such as wood burning vs. gas fireplace

See instructions for definitions of repair, upgrade, locally replace, replacement of the entire structure, and escalation.

Table C.8 Anonymous Adjustor 8 – Initial Survey Response.

Number	Question	Response for Case Study 3
1a	For Damage State 4, what is is the replacement cost in $/sf and source of the value?	$144.66 using Xactimate Valuation
1b	What portion of the replacement cost was for demolition and removal of the existing home ($/sf)?	0
1c	What portion of the replacement cost was for the garage in Case Study 3 ($/sf)?	0
2a	For Damage State 3, did you replace the entire structure the rather than repair/upgrade the damage?	No
2b	If you answered yes, why did you replace the entire structure?	
3a	For Damage State 1, 2, or 3, did you upgrade rather than repair the damage?	No
3b	If you answered yes, which damage state(s) were upgraded and which elements?	
3c	Why did you upgrade or not upgrade?	No instruction to upgrade
4a	For Damage State 1, 2, or 3, did you locally replace rather than repair the damage?	
4b	If you answered yes, which damage state(s) had local replacement and which elements?	
4c	Why did you locally replace instead of repair?	
5a	For Damage State 3, did you jack and replumb the cripple wall or replace it entirely?	Replace
5b	At what level of residual displacement do you think it is no longer economically practical to jack the cripple wall to plumb and rebuilding is needed?	2 inch
5c	Up to what level of residual displacement do you leave the cripple wall in its tilted condition?	none
5d	For Case Study Building 1, did you replace the horizontal sheathing under the stucco with plywood?	
5e	What rules or approach did you use for triggered collateral extent to obtain a consistent appearance in general?	Line of sight
6	If there is local damage to an interior wall finishes, at what point (if any) do you repair/repaint the entire wall or room?	Matching the walls with the same paint. The ceiling usually stands on its own.
7	What rules or approach did you use in deciding when to replace the building paper?	When instructions advised to
8	What percentage if any did you assume for escalation?	If drywall cracks are fresh and over 1/16 wide

Table C.8 Anonymous Adjustor 8 – Initial Survey Response (continued).

Number	Question	Response for Case Study 3
	What amount if any did you assume for the following items as a percentage of the direct construction costs?	
9a	Construction contingency	0
9b	Utilities (power and water) for construction	0
9c	Design fees	0
9d	Plan check and permitting fees and shear wall special inspection fees	0
9e	Lead paint and asbestos abatement	0
9f	Occupied structure	0
9g	Coverage C costs allocated for personal property damage	0
9h	Coverage D costs allocated for additional living expenses	0
10	What additional information would help you refine your estimate?	What personal property was damaged? I would have better notes if I had done the inspection personally. It's difficult to write an accurate estimate using someone else's notes.
11	Are there assumptions with which you disagree?	The one's listed in Question 9. They are way too ambiguous.
12	Any other comments or suggestions?	Describe all of the damages in each scenario instead of cutting corners and advising to refer back to a previous case study. It was very cumbersome to stop on Case Study 3 and go read Case Study 1. It would just make it a little easier to follow the damages if they were written in their entirety.

See instructions for definitions of repair, upgrade, locally replace, replacement of the entire structure, and escalation.

Table C.9 Anonymous Adjustor 9 – Initial Survey Response.

Number	Question	Response for Case Study 1	Response for Case Study 2
1a	For Damage State 4, what is is the replacement cost in $/sf and source of the value?	196.61	
1b	What portion of the replacement cost was for demolition and removal of the existing home ($/sf)?		
1c	What portion of the replacement cost was for the garage in Case Study 3 ($/sf)?		
2a	For Damage State 3, did you replace the entire structure the rather than repair/upgrade the damage?		
2b	If you answered yes, why did you replace the entire structure?		
3a	For Damage State 1, 2, or 3, did you upgrade rather than repair the damage?	Repair	Repair
3b	If you answered yes, which damage state(s) were upgraded and which elements?		
3c	Why did you upgrade or not upgrade?	Repaired based on information provided.	Repaired based on information provided.
4a	For Damage State 1, 2, or 3, did you locally replace rather than repair the damage?	Replaced damaged areas only	
4b	If you answered yes, which damage state(s) had local replacement and which elements?		
4c	Why did you locally replace instead of repair?		
5a	For Damage State 3, did you jack and replumb the cripple wall or replace it entirely?	Jack the wall and plumb	
5b	At what level of residual displacement do you think it is no longer economically practical to jack the cripple wall to plumb and rebuilding is needed?	would require expert opnion to assist with determining, engineer	
5c	Up to what level of residual displacement do you leave the cripple wall in its tilted condition?		
5d	For Case Study Building 1, did you replace the horizontal sheathing under the stucco with plywood?	yes where It was damaged	
5e	What rules or approach did you use for triggered collateral extent to obtain a consistent appearance in general?		
6	If there is local damage to an interior wall finishes, at what point (if any) do you repair/repaint the entire wall or room?	repair, allow texture to maintain uniform appearance.	
7	What rules or approach did you use in deciding when to replace the building paper?	if damaged would replace.	

Table C.9 Anonymous Adjustor 9 – Initial Survey Response (continued).

Number	Question	Response for Case Study 1	Response for Case Study 2
8	What percentage if any did you assume for escalation?		
	What amount if any did you assume for the following items as a percentage of the direct construction costs?		
9a	Construction contingency	10% for overhead & 10% for Profit	10% for overhead & 10% for Profit
9b	Utilities (power and water) for construction	Incurred, Varies per city	
9c	Design fees	Incurred	
9d	Plan check and permitting fees and shear wall special inspection fees	incurred	
9e	Lead paint and asbestos abatement	$390.00 & $504.00 Normally this is on incurred basis.	$390.00 & $504.00 Normally this is on incurred basis.
9f	Occupied structure		
9g	Coverage C costs allocated for personal property damage	Unknown, I asumed property was vacant due to damage	Unknown, I asumed property was vacant due to damage
9h	Coverage D costs allocated for additional living expenses		
10	What additional information would help you refine your estimate?	Plan check, permits on incurred basis. Unable to estimate as unsure the cost.	
11	Are there assumptions with which you disagree?	Very difficult to estimate without seeing damage. I was unable to determine what else was needed inside the home.	Very difficult to estimate without seeing damage. I was unable to determine what else was needed inside the home.
12	Any other comments or suggestions?		

See instructions for definitions of repair, upgrade, locally replace, replacement of the entire structure, and escalation.

Table C.10 Anonymous Adjustor 10 – Initial Survey Response.

Number	Question	Response for Case Study 1 (CS1-R-DS3)
1a	For Damage State 4, what is is the replacement cost in $/sf and source of the value?	
1b	What portion of the replacement cost was for demolition and removal of the existing home ($/sf)?	
1c	What portion of the replacement cost was for the garage in Case Study 3 ($/sf)?	
2a	For Damage State 3, did you replace the entire structure the rather than repair/upgrade the damage?	No, repaired
2b	If you answered yes, why did you replace the entire structure?	
3a	For Damage State 1, 2, or 3, did you upgrade rather than repair the damage?	No, repaired home
3b	If you answered yes, which damage state(s) were upgraded and which elements?	
3c	Why did you upgrade or not upgrade?	
4a	For Damage State 1, 2, or 3, did you locally replace rather than repair the damage?	No
4b	If you answered yes, which damage state(s) had local replacement and which elements?	
4c	Why did you locally replace instead of repair?	
5a	For Damage State 3, did you jack and replumb the cripple wall or replace it entirely?	Jack and replumb
5b	At what level of residual displacement do you think it is no longer economically practical to jack the cripple wall to plumb and rebuilding is needed?	Hard question, would have really had an engineer review and determine best method of repair.
5c	Up to what level of residual displacement do you leave the cripple wall in its tilted condition?	You don't, you need to correct it.
5d	For Case Study Building 1, did you replace the horizontal sheathing under the stucco with plywood?	
5e	What rules or approach did you use for triggered collateral extent to obtain a consistent appearance in general?	Line of sight.
6	If there is local damage to an interior wall finishes, at what point (if any) do you repair/repaint the entire wall or room?	Based on photos given, damages, to me, without an actual inspection appeared to be severe enough and more cost effective to just gut the interior wall materials and replace, keep what could be kept and reinstalling items as warranted.
7	What rules or approach did you use in deciding when to replace the building paper?	Building paper is not a term adjusters use. If you referring to insulation wrap (INS HWRAP - in XACT), then replace when siding material is being replaced;

Table C.10 Anonymous Adjustor 10 – Initial Survey Response (continued).

Number	Question	Response for Case Study 1 (CS1-R-DS3)
8	What percentage if any did you assume for escalation?	Not sure of your terminology.
	What amount if any did you assume for the following items as a percentage of the direct construction costs?	
9a	Construction contingency	Do not allow for contingencies, only for actual damages.
9b	Utilities (power and water) for construction	Unknown how power is hooked up in scenario, mast on roof? Undergroud with meter on side of home? Makes a difference; water for this scenario, did not allow for the time being as jack were used to just support openings while framing being worked on the cripple wall area.
9c	Design fees	None, have only acknowledged fees, however always leave as "open" as location is unique in these costs, paid on incurred invoices.
9d	Plan check and permitting fees and shear wall special inspection fees	None, have only acknowledged fees, however always leave as "open" as each buildling dept jurisdiction greatly varies in costs, so paid on incurred amounts only.
9e	Lead paint and asbestos abatement	At this time, having tested and test results will dictate what is to be done, no allowance to abate due to jurisdictions vary in costs. Did allow to test and will then engage in cost is positive for the materials.
9f	Occupied structure	During couse of repairs, no
9g	Coverage C costs allocated for personal property damage	No idea as to what the actual damages were/are so unable to determine any of this coverage. We utilitize contents adjusters for that coverage, so I am not versed in this area.
9h	Coverage D costs allocated for additional living expenses	At this time the duration of repairs is unknown so unable to make any determination of costs at this time.
10	What additional information would help you refine your estimate?	Actually seeing and inspecting damages or having relevant photos of the actual damages it is a challenge. I understand this is a case study and exercise, but challenging at best to have us make assumptions. Use of the "exterior" function (for perimeter) wall exterior is more helpful in some calucations and would recommend using it. Understand that as General Adjuster, I take 100's of photos an pages of notes for my inspection, so to me a lot more information is needed for this exercise, the main on being to actually see these damages in person.
11	Are there assumptions with which you disagree?	

Table C.10 Anonymous Adjustor 10 – Initial Survey Response (continued).

Number	Question	Response for Case Study 1 (CS1-R-DS3)
12	Any other comments or suggestions?	Having worked in the field for some time (28 yrs), giving scenarios without us actually visually inspecting is a challenge. Definitions you may be using are engineering terms, but not ones we use in adjusting. Adjusters do not breakout each and every component like cripple walls, ceilings, walls, etc in estimates. We may notate in the scope what is work is related to, but do not breakout the components like you did - so, not sure if that is just for this exercise. Use adjuster terms, asking about "collateral extent to obtain a consistent appearance in general" to most adjusters will give you a deer in the highlights look as a response - use the word "matching" and we understand. When these studies are put together, get with adjusters who are seasoned and experienced in the field (I am not talking about Public Adjusters either) that may help in using our terminology. On a technical note, some general calculations are off, example, in CS1-UN-DS1, Exterior damage, Stucco crack repairs at 50% of each wall has cracking and then cite 85LF, however the actual number is 70LF (picky I know, but just a notation) and the LF is not 85. This is was noticed in all scenarios. Trim was mentioned as needing to be removed and reset, or at least hinted at, however we need type of material? (MDF vs. hardwood) - makes a difference. Generally when I physically inspect a home I have numerous pages of notes on building materials, quality, measurements, etc to accurately scope what needs to be done; Just as a notation, what you call "trimmer stud" is also known as a "jack studs" in other areas, so just keep in mind that in the event of an seismic event, 100's or 1000's of adjusters will be flooding CA and terminology will be different. Scope notes state 5 windows are cracked, however only 4 are listed for the rooms mentioned. Are the wood windows stained or painted, assuming stained due to age of home. unknown plumbing drain line size; unknown ductwork size; As a note, cost used to jack up home was a cost I recently had in Alaska from their recent earthquake, so this costs was determined by very recent experience.

See instructions for definitions of repair, upgrade, locally replace, replacement of the entire structure, and escalation.

Table C.11 Anonymous Adjustor 10 – Initial Survey Response.

Number	Question	Response for Case Study 1 (CS1-UN-DS1)
1a	For Damage State 4, what is is the replacement cost in $/sf and source of the value?	
1b	What portion of the replacement cost was for demolition and removal of the existing home ($/sf)?	
1c	What portion of the replacement cost was for the garage in Case Study 3 ($/sf)?	
2a	For Damage State 3, did you replace the entire structure the rather than repair/upgrade the damage?	
2b	If you answered yes, why did you replace the entire structure?	
3a	For Damage State 1, 2, or 3, did you upgrade rather than repair the damage?	No
3b	If you answered yes, which damage state(s) were upgraded and which elements?	
3c	Why did you upgrade or not upgrade?	Simple repair
4a	For Damage State 1, 2, or 3, did you locally replace rather than repair the damage?	Term is odd in adjusting, we just us the term "repair" or "replace". But only a repair was done.
4b	If you answered yes, which damage state(s) had local replacement and which elements?	Question was not a yes or no, it was an "either" and "or".
4c	Why did you locally replace instead of repair?	N/A, it was repaired.
5a	For Damage State 3, did you jack and replumb the cripple wall or replace it entirely?	
5b	At what level of residual displacement do you think it is no longer economically practical to jack the cripple wall to plumb and rebuilding is needed?	
5c	Up to what level of residual displacement do you leave the cripple wall in its tilted condition?	You don't, you need to correct it.
5d	For Case Study Building 1, did you replace the horizontal sheathing under the stucco with plywood?	No
5e	What rules or approach did you use for triggered collateral extent to obtain a consistent appearance in general?	Line of sight.
6	If there is local damage to an interior wall finishes, at what point (if any) do you repair/repaint the entire wall or room?	Any repairs to drywall will trigger, for consistent line of sight, repainting all walls.
7	What rules or approach did you use in deciding when to replace the building paper?	Building paper? If you referring to insulation wrap (INS HWRAP - in XACT) then replace when siding material is being replaced;

Table C.11 Anonymous Adjustor 10 – Initial Survey Response (continued).

Number	Question	Response for Case Study 1 (CS1-UN-DS1)
8	What percentage if any did you assume for escalation?	Not sure of your terminology.
	What amount if any did you assume for the following items as a percentage of the direct construction costs?	
9a	Construction contingency	Do not allow for contingencies.
9b	Utilities (power and water) for construction	None
9c	Design fees	None, have only acknowledged fees, however always leave as "open" as location is unique in these costs, paid on incurred invoices.
9d	Plan check and permitting fees and shear wall special inspection fees	None, have only acknowledged fees, however always leave as "open" as each buildling dept jurisdiction greatly varies in costs, so paid on incurred amounts only.
9e	Lead paint and asbestos abatement	At this time, having tested and test results will dictate what is to be done, no allowance to abate.
9f	Occupied structure	N/A
9g	Coverage C costs allocated for personal property damage	N/A
9h	Coverage D costs allocated for additional living expenses	N/A
10	What additional information would help you refine your estimate?	Actually seeing and inspecting damages or having relevant photos of the actual damages it is a challenge. I understand this is a case study and exercise, but challenging at best to have us make assumptions.
11	Are there assumptions with which you disagree?	
12	Any other comments or suggestions?	Having worked in the field for some time, giving scenarios without us actually visually inspecting is a challenge. Example, you mention in the bathroom there is 10% wall damage to tile - is that to all walls, or a typical shower/tub area that has tile? Definitions you may be using are possibly engineering terms, but not ones we use in adjusting. Adjusters do not breakout each and every component like cripple walls, ceilings, walls, etc - so, not sure if that is just for this exercise. Use adjuster terms, asking about "collateral extent to obtain a consistent appearance in general" to most adjusters will give you a deer in the highlights look as a response. When these studies are put together, get with adjusters who are seasoned and experienced in the field (I am not talking about Public Adjusters either) that may help in

Table C.11 Anonymous Adjustor 10 – Initial Survey Response (continued).

Number	Question	Response for Case Study 1 (CS1-UN-DS1)
		using our terminology. On a technical note, some general calculations are off, example, in CS1-UN-DS2, Exterior damage, Stucco crack repairs at 50% of each wall has cracking and cite 85LF, however the actual number is 70LF (picky I know, but just a notation) and the LF is not 85. Trim is mentioned as needing to be removed and reset, or at least hinted at, however - what trim? Windows? Doors? Type of material? (MDF vs. hardwood) - makes a difference.

See instructions for definitions of repair, upgrade, locally replace, replacement of the entire structure, and escalation.

Table C.12 Anonymous Adjustor 10 – Initial Survey Response.

Number	Question	Response for Case Study 1 (CS1-UN-DS2)
1a	For Damage State 4, what is is the replacement cost in $/sf and source of the value?	
1b	What portion of the replacement cost was for demolition and removal of the existing home ($/sf)?	
1c	What portion of the replacement cost was for the garage in Case Study 3 ($/sf)?	
2a	For Damage State 3, did you replace the entire structure the rather than repair/upgrade the damage?	
2b	If you answered yes, why did you replace the entire structure?	
3a	For Damage State 1, 2, or 3, did you upgrade rather than repair the damage?	No
3b	If you answered yes, which damage state(s) were upgraded and which elements?	
3c	Why did you upgrade or not upgrade?	Simple repair
4a	For Damage State 1, 2, or 3, did you locally replace rather than repair the damage?	Term is odd in adjusting, we just us the term "repair" or "replace". But only a repair was done.
4b	If you answered yes, which damage state(s) had local replacement and which elements?	Question was not a yes or no, it was an "either" and "or".
4c	Why did you locally replace instead of repair?	N/A, it was repaired.
5a	For Damage State 3, did you jack and replumb the cripple wall or replace it entirely?	
5b	At what level of residual displacement do you think it is no longer economically practical to jack the cripple wall to plumb and rebuilding is needed?	
5c	Up to what level of residual displacement do you leave the cripple wall in its tilted condition?	You don’t, you need to correct it.
5d	For Case Study Building 1, did you replace the horizontal sheathing under the stucco with plywood?	No
5e	What rules or approach did you use for triggered collateral extent to obtain a consistent appearance in general?	Line of sight.
6	If there is local damage to an interior wall finishes, at what point (if any) do you repair/repaint the entire wall or room?	Any repairs to drywall will trigger, for consistent line of sight, repainting all walls.
7	What rules or approach did you use in deciding when to replace the building paper?	Building paper? If you referring to insulation wrap (INS HWRAP - in XACT) then replace when siding material is being replaced;

Table C.12 Anonymous Adjustor 10 – Initial Survey Response (continued).

Number	Question	Response for Case Study 1 (CS1-UN-DS2)
8	What percentage if any did you assume for escalation?	Not sure of your terminology.
	What amount if any did you assume for the following items as a percentage of the direct construction costs?	
9a	Construction contingency	Do not allow for contingencies.
9b	Utilities (power and water) for construction	None
9c	Design fees	None, have only acknowledged fees, however always leave as "open" as location is unique in these costs, paid on incurred invoices.
9d	Plan check and permitting fees and shear wall special inspection fees	None, have only acknowledged fees, however always leave as "open" as each buildling dept jurisdiction greatly varies in costs, so paid on incurred amounts only.
9e	Lead paint and asbestos abatement	At this time, having tested and test results will dictate what is to be done, no allowance to abate.
9f	Occupied structure	N/A
9g	Coverage C costs allocated for personal property damage	N/A
9h	Coverage D costs allocated for additional living expenses	N/A
10	What additional information would help you refine your estimate?	Actually seeing and inspecting damages or having relevant photos of the actual damages it is a challenge. I understand this is a case study and exercise, but challenging at best to have us make assumptions.
11	Are there assumptions with which you disagree?	
12	Any other comments or suggestions?	Having worked in the field for some time, giving scenarios without us actually visually inspecting is a challenge. Example, you mention in the bathroom there is 10% wall damage to tile - is that to all walls, or a typical shower/tub area that has tile? Definitions you may be using are possibly engineering terms, but not ones we use in adjusting. Adjusters do not breakout each and every component like cripple walls, ceilings, walls, etc - so, not sure if that is just for this exercise. Use adjuster terms, asking about "collateral extent to obtain a consistent appearance in general" to most adjusters will give you a deer in the highlights look as a response. When these studies are put together, get with adjusters who are seasoned and experienced in the field (I am not talking about Public Adjusters either) that may help in

Table C.12 Anonymous Adjustor 10 – Initial Survey Response (continued).

Number	Question	Response for Case Study 1 (CS1-UN-DS2)
		using our terminology. On a technical note, some general calculations are off, example, in CS1-UN-DS2, Exterior damage, Stucco crack repairs at 50% of each wall has cracking and cite 85LF, however the actual number is 70LF (picky I know, but just a notation) and the LF is not 85. Trim is mentioned as needing to be removed and reset, or at least hinted at, however - what trim? Windows? Doors? Type of material? (MDF vs. hardwood) - makes a difference.

See instructions for definitions of repair, upgrade, locally replace, replacement of the entire structure, and escalation.

Table C.13 Anonymous Adjustor 10 – Initial Survey Response.

Number	Question	Response for Case Study 1 (CS1-UN-DS3)
1a	For Damage State 4, what is is the replacement cost in $/sf and source of the value?	
1b	What portion of the replacement cost was for demolition and removal of the existing home ($/sf)?	
1c	What portion of the replacement cost was for the garage in Case Study 3 ($/sf)?	
2a	For Damage State 3, did you replace the entire structure the rather than repair/upgrade the damage?	No, repaired
2b	If you answered yes, why did you replace the entire structure?	
3a	For Damage State 1, 2, or 3, did you upgrade rather than repair the damage?	No, repaired home
3b	If you answered yes, which damage state(s) were upgraded and which elements?	
3c	Why did you upgrade or not upgrade?	
4a	For Damage State 1, 2, or 3, did you locally replace rather than repair the damage?	No
4b	If you answered yes, which damage state(s) had local replacement and which elements?	
4c	Why did you locally replace instead of repair?	
5a	For Damage State 3, did you jack and replumb the cripple wall or replace it entirely?	Jack and replumb
5b	At what level of residual displacement do you think it is no longer economically practical to jack the cripple wall to plumb and rebuilding is needed?	Hard question, would have really had an engineer review and determine best method of repair.
5c	Up to what level of residual displacement do you leave the cripple wall in its tilted condition?	You don't, you need to correct it.
5d	For Case Study Building 1, did you replace the horizontal sheathing under the stucco with plywood?	
5e	What rules or approach did you use for triggered collateral extent to obtain a consistent appearance in general?	Line of sight.
6	If there is local damage to an interior wall finishes, at what point (if any) do you repair/repaint the entire wall or room?	Based on photos given, damages, to me, without an actual inspection appeared to be severe enough and more cost effective to just gut the interior wall materials and replace, keep what could be kept and reinstalling items as warranted.

Table C.13 Anonymous Adjustor 10 – Initial Survey Response (continued).

Number	Question	Response for Case Study 1 (CS1-UN-DS3)
7	What rules or approach did you use in deciding when to replace the building paper?	Building paper is not a term adjusters use. If you referring to insulation wrap (INS HWRAP - in XACT) then replace when siding material is being replaced;
8	What percentage if any did you assume for escalation?	Not sure of your terminology.
	What amount if any did you assume for the following items as a percentage of the direct construction costs?	
9a	Construction contingency	Do not allow for contingencies, only for actual damages.
9b	Utilities (power and water) for construction	Unknown how power is hooked up in scenario, mast on roof? Undergroud with meter on side of home? Makes a difference; water for this scenario, did not allow for the time being as jack were used to just support openings while framing being worked on the cripple wall area.
9c	Design fees	None, have only acknowledged fees, however always leave as "open" as location is unique in these costs, paid on incurred invoices.
9d	Plan check and permitting fees and shear wall special inspection fees	None, have only acknowledged fees, however always leave as "open" as each buildling dept jurisdiction greatly varies in costs, so paid on incurred amounts only.
9e	Lead paint and asbestos abatement	At this time, having tested and test results will dictate what is to be done, no allowance to abate due to jurisdictions vary in costs. Did allow to test and will then engage in cost is positive for the materials.
9f	Occupied structure	During couse of repairs, no
9g	Coverage C costs allocated for personal property damage	No idea as to what the actual damages were/are so unable to determine any of this coverage. We utilitize contents adjusters for that coverage, so I am not versed in this area.
9h	Coverage D costs allocated for additional living expenses	At this time the duration of repairs is unknown so unable to make any determination of costs at this time.

Table C.13 Anonymous Adjustor 10 – Initial Survey Response (continued).

Number	Question	Response for Case Study 1 (CS1-UN-DS3)
10	What additional information would help you refine your estimate?	Actually seeing and inspecting damages or having relevant photos of the actual damages it is a challenge. I understand this is a case study and exercise, but challenging at best to have us make assumptions. Use of the "exterior" function (for perimeter) wall exterior is more helpful in some calucations and would recommend using it. Understand that as General Adjuster, I take 100s of photos an pages of notes for my inspection, so to me a lot more information is needed for this exercise, the main on being to actually see these damages in person.
11	Are there assumptions with which you disagree?	
12	Any other comments or suggestions?	Having worked in the field for some time (28 yrs), giving scenarios without us actually visually inspecting is a challenge. Definitions you may be using are engineering terms, but not ones we use in adjusting. Adjusters do not breakout each and every component like cripple walls, ceilings, walls, etc in estimates. We may notate in the scope what is work is related to, but do not breakout the components like you did - so, not sure if that is just for this exercise. Use adjuster terms, asking about "collateral extent to obtain a consistent appearance in general" to most adjusters will give you a deer in the highlights look as a response - use the word "matching" and we understand. When these studies are put together, get with adjusters who are seasoned and experienced in the field (I am not talking about Public Adjusters either) that may help in using our terminology. On a technical note, some general calculations are off, example, in CS1-UN-DS1, Exterior damage, Stucco crack repairs at 50% of each wall has cracking and then cite 85LF, however the actual number is 70LF (picky I know, but just a notation) and the LF is not 85. This is was noticed in all scenarios. Trim was mentioned as needing to be removed and reset, or at least hinted at, however we need type of material? (MDF vs. hardwood) - makes a difference. Generally when I physically inspect a home I have numerous pages of notes on building materials, quality, measurements, etc to accurately scope what needs to be done; Just as a notation, what you call "trimmer stud" is also known as a "jack studs" in other areas, so just keep in mind that in the event of an seismic event, 100s or 1000s of adjusters will

Table C.13 Anonymous Adjustor 10 – Initial Survey Response (continued).

Number	Question	Response for Case Study 1 (CS1-UN-DS3)
		be flooding CA and terminology will be different. Scope notes state 5 windows are cracked, however only 4 are listed for the rooms mentioned. Are the wood windows stained or painted, assuming stained due to age of home. unknown plumbing drain line size; unknown ductwork size;

See instructions for definitions of repair, upgrade, locally replace, replacement of the entire structure, and escalation.

Table C.14 Anonymous Adjustor 10 – Initial Survey Response.

Number	Question	Response for Case Study 1 (CS1-UN-DS4)
1a	For Damage State 4, what is is the replacement cost in $/sf and source of the value?	$188.80
1b	What portion of the replacement cost was for demolition and removal of the existing home ($/sf)?	$7.63
1c	What portion of the replacement cost was for the garage in Case Study 3 ($/sf)?	
2a	For Damage State 3, did you replace the entire structure the rather than repair/upgrade the damage?	
2b	If you answered yes, why did you replace the entire structure?	
3a	For Damage State 1, 2, or 3, did you upgrade rather than repair the damage?	
3b	If you answered yes, which damage state(s) were upgraded and which elements?	
3c	Why did you upgrade or not upgrade?	
4a	For Damage State 1, 2, or 3, did you locally replace rather than repair the damage?	
4b	If you answered yes, which damage state(s) had local replacement and which elements?	
4c	Why did you locally replace instead of repair?	
5a	For Damage State 3, did you jack and replumb the cripple wall or replace it entirely?	
5b	At what level of residual displacement do you think it is no longer economically practical to jack the cripple wall to plumb and rebuilding is needed?	
5c	Up to what level of residual displacement do you leave the cripple wall in its tilted condition?	
5d	For Case Study Building 1, did you replace the horizontal sheathing under the stucco with plywood?	
5e	What rules or approach did you use for triggered collateral extent to obtain a consistent appearance in general?	
6	If there is local damage to an interior wall finishes, at what point (if any) do you repair/repaint the entire wall or room?	
7	What rules or approach did you use in deciding when to replace the building paper?	

Table C.14 Anonymous Adjustor 10 – Initial Survey Response (continued).

Number	Question	Response for Case Study 1 (CS1-UN-DS4)
8	What percentage if any did you assume for escalation?	
	What amount if any did you assume for the following items as a percentage of the direct construction costs?	
9a	Construction contingency	Do not allow for contingencies, only owe for actual damages/costs.
9b	Utilities (power and water) for construction	Temp power/water may be needed, but cannot allow in Xact Value.
9c	Design fees	None, have only acknowledged fees, however always leave as "open" as location is unique in these costs, paid on incurred invoices.
9d	Plan check and permitting fees and shear wall special inspection fees	None, have only acknowledged fees, however always leave as "open" as each buildling dept jurisdiction greatly varies in costs, so paid on incurred amounts only.
9e	Lead paint and asbestos abatement	At this time, having tested and test results will dictate what is to be done, no allowance to abate.
9f	Occupied structure	N/A
9g	Coverage C costs allocated for personal property damage	N/A
9h	Coverage D costs allocated for additional living expenses	N/A
10	What additional information would help you refine your estimate?	Actually seeing and inspecting damages or having relevant photos of the actual damages it is a challenge. I understand this is a case study and exercise, but challenging at best to have us make assumptions.
11	Are there assumptions with which you disagree?	Using Xact Value for Demoliton is not accurate; I write demolition scopes in Xactimate, for what was in place at the time of the loss. Using a square foot method for cost is generally not accurate in my experience. While notated to not write and estimate for this case, I find the $/sqft method inaccurate.
12	Any other comments or suggestions?	Having worked in the field for some time (28 yrs), giving scenarios without us actually visually inspecting is a challenge. Using XactValue to determine an estimate is generally not accurate. Understand this is based on my experience in CA, design costs, permitting, Title 24 and all of the other fees are excessive and all over the place in terms of costs. There is no

Table C.14 Anonymous Adjustor 10 – Initial Survey Response (continued).

Number	Question	Response for Case Study 1 (CS1-UN-DS4)
		accurate way to predict those costs. I have a member right now, from a recent wildfire, where design fees alone for his 1800sqft home were $100,000 (not a type O), this does not include, permits or any Title 24 costs. I have long given up on attempting to estimate these costs in CA. This particular member is at $187,000 in those costs prior any worker steping onto his propery with any equipment and this loss is not unique for CA.

See instructions for definitions of repair, upgrade, locally replace, replacement of the entire structure, and escalation.

Table C.15 Anonymous Adjustor 10 – Initial Survey Response.

Number	Question	Response for Case Study 2 (CS2-R-DS2-CW)
1a	For Damage State 4, what is is the replacement cost in $/sf and source of the value?	
1b	What portion of the replacement cost was for demolition and removal of the existing home ($/sf)?	
1c	What portion of the replacement cost was for the garage in Case Study 3 ($/sf)?	
2a	For Damage State 3, did you replace the entire structure the rather than repair/upgrade the damage?	Repair
2b	If you answered yes, why did you replace the entire structure?	
3a	For Damage State 1, 2, or 3, did you upgrade rather than repair the damage?	No, repaired
3b	If you answered yes, which damage state(s) were upgraded and which elements?	
3c	Why did you upgrade or not upgrade?	
4a	For Damage State 1, 2, or 3, did you locally replace rather than repair the damage?	No, repaired
4b	If you answered yes, which damage state(s) had local replacement and which elements?	
4c	Why did you locally replace instead of repair?	
5a	For Damage State 3, did you jack and replumb the cripple wall or replace it entirely?	
5b	At what level of residual displacement do you think it is no longer economically practical to jack the cripple wall to plumb and rebuilding is needed?	
5c	Up to what level of residual displacement do you leave the cripple wall in its tilted condition?	
5d	For Case Study Building 1, did you replace the horizontal sheathing under the stucco with plywood?	
5e	What rules or approach did you use for triggered collateral extent to obtain a consistent appearance in general?	
6	If there is local damage to an interior wall finishes, at what point (if any) do you repair/repaint the entire wall or room?	
7	What rules or approach did you use in deciding when to replace the building paper?	
8	What percentage if any did you assume for escalation?	Not sure of your terminology.

Table C.15 Anonymous Adjustor 10 – Initial Survey Response. (continued).

Number	Question	Response for Case Study 2 (CS2-R-DS2-CW)
	What amount if any did you assume for the following items as a percentage of the direct construction costs?	
9a	Construction contingency	Do not allow for contingencies, only for actual damages.
9b	Utilities (power and water) for construction	Unknown how power is hooked up in scenario, mast on roof? Undergroud with meter on side of home? Makes a difference; water for this scenario, did not allow for the time being as jack were used to just support openings while framing being worked on the cripple wall area.
9c	Design fees	None, have only acknowledged fees, however always leave as "open" as location is unique in these costs, paid on incurred invoices.
9d	Plan check and permitting fees and shear wall special inspection fees	None, have only acknowledged fees, however always leave as "open" as each buildling dept jurisdiction greatly varies in costs, so paid on incurred amounts only.
9e	Lead paint and asbestos abatement	At this time, having tested and test results will dictate what is to be done, no allowance to abate due to jurisdictions vary in costs. Did allow to test and will then engage in cost is positive for the materials.
9f	Occupied structure	During couse of repairs, no
9g	Coverage C costs allocated for personal property damage	No idea as to what the actual damages were/are so unable to determine any of this coverage. We utilitize contents adjusters for that coverage, so I am not versed in this area.
9h	Coverage D costs allocated for additional living expenses	At this time the duration of repairs is unknown so unable to make any determination of costs at this time.
10	What additional information would help you refine your estimate?	Actually seeing and inspecting damages or having relevant photos of the actual damages it is a challenge. I understand this is a case study and exercise, but challenging at best to have us make assumptions. Use of the "exterior" function (for perimeter) wall exterior is more helpful in some calucations and would recommend using it. Understand that as General Adjuster, I take 100s of photos an pages of notes for my inspection, so to me a lot more information is needed for this exercise, the main on being to actually see these damages in person. As a note, this file name was not notated in your documentation. There was no "CW" on page 44 where the directions for this particular study was noted;

Table C.15 Anonymous Adjustor 10 – Initial Survey Response. (continued).

Number	Question	Response for Case Study 2 (CS2-R-DS2-CW)
11	Are there assumptions with which you disagree?	
12	Any other comments or suggestions?	Having worked in the field for some time (28 yrs), giving scenarios without us actually visually inspecting is a challenge. Definitions you may be using are engineering terms, but not ones we use in adjusting. Adjusters do not breakout each and every component like cripple walls, ceilings, walls, etc in estimates. We may notate in the scope what is work is related to, but do not breakout the components like you did - so, not sure if that is just for this exercise. Use adjuster terms, asking about "collateral extent to obtain a consistent appearance in general" to most adjusters will give you a deer in the highlights look as a response - use the word "matching" and we understand. When these studies are put together, get with adjusters who are seasoned and experienced in the field (I am not talking about Public Adjusters either) that may help in using our terminology. On a technical note, some general calculations are off, example, in CS1-UN-DS1, Exterior damage, Stucco crack repairs at 50% of each wall has cracking and then cite 85LF, however the actual number is 70LF (picky I know, but just a notation) and the LF is not 85. This is was noticed in all scenarios. Trim was mentioned as needing to be removed and reset, or at least hinted at, however we need type of material? (MDF vs. hardwood) - makes a difference. Generally when I physically inspect a home I have numerous pages of notes on building materials, quality, measurements, etc to accurately scope what needs to be done; Just as a notation, what you call "trimmer stud" is also known as a "jack studs" in other areas, so just keep in mind that in the event of an seismic event, 100s or 1000s of adjusters will be flooding CA and terminology will be different. Scope notes state 5 windows are cracked, however only 4 are listed for the rooms mentioned. Are the wood windows stained or painted, assuming stained due to age of home. unknown plumbing drain line size; unknown ductwork size; As a note, cost used to jack up home was a cost I recently had in Alaska from their recent earthquake, so this costs was determined by very recent experience.

See instructions for definitions of repair, upgrade, locally replace, replacement of the entire structure, and escalation.

Table C.16 Anonymous Adjustor 10 – Initial Survey Response.

Number	Question	Response for Case Study 2 (CS2-R-DS3)
1a	For Damage State 4, what is is the replacement cost in $/sf and source of the value?	
1b	What portion of the replacement cost was for demolition and removal of the existing home ($/sf)?	
1c	What portion of the replacement cost was for the garage in Case Study 3 ($/sf)?	
2a	For Damage State 3, did you replace the entire structure the rather than repair/upgrade the damage?	No, repaired
2b	If you answered yes, why did you replace the entire structure?	
3a	For Damage State 1, 2, or 3, did you upgrade rather than repair the damage?	No, repaired home
3b	If you answered yes, which damage state(s) were upgraded and which elements?	
3c	Why did you upgrade or not upgrade?	
4a	For Damage State 1, 2, or 3, did you locally replace rather than repair the damage?	No
4b	If you answered yes, which damage state(s) had local replacement and which elements?	
4c	Why did you locally replace instead of repair?	
5a	For Damage State 3, did you jack and replumb the cripple wall or replace it entirely?	Jack and replumb
5b	At what level of residual displacement do you think it is no longer economically practical to jack the cripple wall to plumb and rebuilding is needed?	Hard question, would have really had an engineer review and determine best method of repair.
5c	Up to what level of residual displacement do you leave the cripple wall in its tilted condition?	You don't, you need to correct it.
5d	For Case Study Building 1, did you replace the horizontal sheathing under the stucco with plywood?	
5e	What rules or approach did you use for triggered collateral extent to obtain a consistent appearance in general?	Line of sight.
6	If there is local damage to an interior wall finishes, at what point (if any) do you repair/repaint the entire wall or room?	Based on photos given, damages, to me, without an actual inspection appeared to be severe enough and more cost effective to just gut the interior wall materials and replace, keep what could be kept and reinstalling items as warranted.
7	What rules or approach did you use in deciding when to replace the building paper?	Building paper is not a term adjusters use. If you referring to insulation wrap (INS HWRAP - in XACT) then replace when siding material is being replaced;

Table C.16 Anonymous Adjustor 10 – Initial Survey Response (continued).

Number	Question	Response for Case Study 2 (CS2-R-DS3)
8	What percentage if any did you assume for escalation?	Not sure of your terminology.
	What amount if any did you assume for the following items as a percentage of the direct construction costs?	
9a	Construction contingency	Do not allow for contingencies, only for actual damages.
9b	Utilities (power and water) for construction	Unknown how power is hooked up in scenario, mast on roof? Undergroud with meter on side of home? Makes a difference; water for this scenario, did not allow for the time being as jack were used to just support openings while framing being worked on the cripple wall area.
9c	Design fees	None, have only acknowledged fees, however always leave as "open" as location is unique in these costs, paid on incurred invoices.
9d	Plan check and permitting fees and shear wall special inspection fees	None, have only acknowledged fees, however always leave as "open" as each buildling dept jurisdiction greatly varies in costs, so paid on incurred amounts only.
9e	Lead paint and asbestos abatement	At this time, having tested and test results will dictate what is to be done, no allowance to abate due to jurisdictions vary in costs. Did allow to test and will then engage in cost is positive for the materials.
9f	Occupied structure	During couse of repairs, no
9g	Coverage C costs allocated for personal property damage	No idea as to what the actual damages were/are so unable to determine any of this coverage. We utilitize contents adjusters for that coverage, so I am not versed in this area.
9h	Coverage D costs allocated for additional living expenses	At this time the duration of repairs is unknown so unable to make any determination of costs at this time.
10	What additional information would help you refine your estimate?	Actually seeing and inspecting damages or having relevant photos of the actual damages it is a challenge. I understand this is a case study and exercise, but challenging at best to have us make assumptions. Use of the "exterior" function (for perimeter) wall exterior is more helpful in some calculations and would recommend using it. Understand that as General Adjuster, I take 100s of photos an pages of notes for my inspection, so to me a lot more information is needed for this exercise, the main on being to actually see these damages in person.
11	Are there assumptions with which you disagree?	
12	Any other comments or suggestions?	Having worked in the field for some time (28 yrs), giving scenarios without us actually

Table C.16 Anonymous Adjustor 10 – Initial Survey Response (continued).

Number	Question	Response for Case Study 2 (CS2-R-DS3)
		visually inspecting is a challenge. Definitions you may be using are engineering terms, but not ones we use in adjusting. Adjusters do not breakout each and every component like cripple walls, ceilings, walls, etc in estimates. We may notate in the scope what is work is related to, but do not breakout the components like you did - so, not sure if that is just for this exercise. Use adjuster terms, asking about "collateral extent to obtain a consistent appearance in general" to most adjusters will give you a deer in the highlights look as a response - use the word "matching" and we understand. When these studies are put together, get with adjusters who are seasoned and experienced in the field (I am not talking about Public Adjusters either) that may help in using our terminology. On a technical note, some general calculations are off, example, in CS1-UN-DS1, Exterior damage, Stucco crack repairs at 50% of each wall has cracking and then cite 85LF, however the actual number is 70LF (picky I know, but just a notation) and the LF is not 85. This is was noticed in all scenarios. Trim was mentioned as needing to be removed and reset, or at least hinted at, however we need type of material? (MDF vs. hardwood) - makes a difference. Generally when I physically inspect a home I have numerous pages of notes on building materials, quality, measurements, etc to accurately scope what needs to be done; Just as a notation, what you call "trimmer stud" is also known as a "jack studs" in other areas, so just keep in mind that in the event of an seismic event, 100s or 1000s of adjusters will be flooding CA and terminology will be different. Scope notes state 5 windows are cracked, however only 4 are listed for the rooms mentioned. Are the wood windows stained or painted, assuming stained due to age of home. unknown plumbing drain line size; unknown ductwork size; As a note, cost used to jack up home was a cost I recently had in Alaska from their recent earthquake, so this costs was determined by very recent experience.

See instructions for definitions of repair, upgrade, locally replace, replacement of the entire structure, and escalation.

Table C.17 Anonymous Adjustor 10 – Initial Survey Response.

Number	Question	Response for Case Study 2 (CS2-UN-DS1)
1a	For Damage State 4, what is is the replacement cost in $/sf and source of the value?	N/A
1b	What portion of the replacement cost was for demolition and removal of the existing home ($/sf)?	N/A
1c	What portion of the replacement cost was for the garage in Case Study 3 ($/sf)?	N/A
2a	For Damage State 3, did you replace the entire structure the rather than repair/upgrade the damage?	N/A
2b	If you answered yes, why did you replace the entire structure?	N/A
3a	For Damage State 1, 2, or 3, did you upgrade rather than repair the damage?	Repair
3b	If you answered yes, which damage state(s) were upgraded and which elements?	
3c	Why did you upgrade or not upgrade?	Simple repair
4a	For Damage State 1, 2, or 3, did you locally replace rather than repair the damage?	Repair
4b	If you answered yes, which damage state(s) had local replacement and which elements?	N/A
4c	Why did you locally replace instead of repair?	N/A
5a	For Damage State 3, did you jack and replumb the cripple wall or replace it entirely?	N/A
5b	At what level of residual displacement do you think it is no longer economically practical to jack the cripple wall to plumb and rebuilding is needed?	N/A
5c	Up to what level of residual displacement do you leave the cripple wall in its tilted condition?	N/A
5d	For Case Study Building 1, did you replace the horizontal sheathing under the stucco with plywood?	
5e	What rules or approach did you use for triggered collateral extent to obtain a consistent appearance in general?	Line of sight.
6	If there is local damage to an interior wall finishes, at what point (if any) do you repair/repaint the entire wall or room?	Any repairs to drywall will trigger, for consistent line of sight, repainting all walls.
7	What rules or approach did you use in deciding when to replace the building paper?	Building paper? If you referring to insulation wrap (INS HWRAP - in XACT) then replace when siding material is being replaced;

Table C.17 Anonymous Adjustor 10 – Initial Survey Response (continued).

Number	Question	Response for Case Study 2 (CS2-UN-DS1)
8	What percentage if any did you assume for escalation?	Not sure of your terminology.
	What amount if any did you assume for the following items as a percentage of the direct construction costs?	
9a	Construction contingency	Do not allow for contingencies.
9b	Utilities (power and water) for construction	None
9c	Design fees	None, have only acknowledged fees, however always leave as "open" as location is unique in these costs, paid on incurred invoices.
9d	Plan check and permitting fees and shear wall special inspection fees	None, have only acknowledged fees, however always leave as "open" as each buildling dept jurisdiction greatly varies in costs, so paid on incurred amounts only.
9e	Lead paint and asbestos abatement	At this time, having tested and test results will dictate what is to be done, no allowance to abate.
9f	Occupied structure	N/A
9g	Coverage C costs allocated for personal property damage	N/A
9h	Coverage D costs allocated for additional living expenses	N/A
10	What additional information would help you refine your estimate?	Actually seeing and inspecting damages or having relevant photos of the actual damages it is a challenge. I understand this is a case study and exercise, but challenging at best to have us make assumptions. Use of the "exterior" function (for perimeter) wall exterior is more helpful in some calucations and would recommend using it. Understand that as General Adjuster, I take 100s of photos an pages of notes for my inspection, so to me a lot more information is needed for this exercise, the main on being to actually see these damages in person.
11	Are there assumptions with which you disagree?	Based on verbiage of the case, did not use CEA policy for plaster vs. drywall
12	Any other comments or suggestions?	Having worked in the field for some time (28 yrs), giving scenarios without us actually visually inspecting is a challenge. Definitions you may be using are engineering terms, but not ones we use in adjusting. Adjusters do not breakout each and every component like cripple walls, ceilings, walls, etc in estimates. We may notate in the scope what is work is related to,

Table C.17 Anonymous Adjustor 10 – Initial Survey Response (continued).

Number	Question	Response for Case Study 2 (CS2-UN-DS1)
		but do not breakout the components like you did - so, not sure if that is just for this exercise. Use adjuster terms, asking about "collateral extent to obtain a consistent appearance in general" to most adjusters will give you a deer in the highlights look as a response - use the word "matching" and we understand. When these studies are put together, get with adjusters who are seasoned and experienced in the field (I am not talking about Public Adjusters either) that may help in using our terminology. On a technical note, some general calculations are off, example, in CS1-UN-DS1, Exterior damage, Stucco crack repairs at 50% of each wall has cracking and then cite 85LF, however the actual number is 70LF (picky I know, but just a notation) and the LF is not 85. This is was noticed in all scenarios. Trim was mentioned as needing to be removed and reset, or at least hinted at, however we need type of material? (MDF vs. hardwood) - makes a difference. Generally when I physically inspect a home I have numerous pages of notes on building materials, quality, measurements, etc to accurately scope what needs to be done; Just as a notation, what you call "trimmer stud" is also known as a "jack studs" in other areas, so just keep in mind that in the event of an seismic event, 100s or 1000s of adjusters will be flooding CA and terminology will be different. Scope notes state 5 windows are cracked, however only 4 are listed for the rooms mentioned. Are the wood windows stained or painted, assuming stained due to age of home. unknown plumbing drain line size; unknown ductwork size; in reviwing all of this, was the scope to follow CEA policy? Unclear if that was the case.

See instructions for definitions of repair, upgrade, locally replace, replacement of the entire structure, and escalation.

Table C.18 Anonymous Adjustor 10 – Initial Survey Response.

Number	Question	Response for Case Study 2 (CS2-UN-DS2)
1a	For Damage State 4, what is is the replacement cost in $/sf and source of the value?	N/A
1b	What portion of the replacement cost was for demolition and removal of the existing home ($/sf)?	N/A
1c	What portion of the replacement cost was for the garage in Case Study 3 ($/sf)?	N/A
2a	For Damage State 3, did you replace the entire structure the rather than repair/upgrade the damage?	N/A
2b	If you answered yes, why did you replace the entire structure?	N/A
3a	For Damage State 1, 2, or 3, did you upgrade rather than repair the damage?	Repair
3b	If you answered yes, which damage state(s) were upgraded and which elements?	
3c	Why did you upgrade or not upgrade?	Simple repair
4a	For Damage State 1, 2, or 3, did you locally replace rather than repair the damage?	Repair
4b	If you answered yes, which damage state(s) had local replacement and which elements?	N/A
4c	Why did you locally replace instead of repair?	N/A
5a	For Damage State 3, did you jack and replumb the cripple wall or replace it entirely?	N/A
5b	At what level of residual displacement do you think it is no longer economically practical to jack the cripple wall to plumb and rebuilding is needed?	N/A
5c	Up to what level of residual displacement do you leave the cripple wall in its tilted condition?	N/A
5d	For Case Study Building 1, did you replace the horizontal sheathing under the stucco with plywood?	
5e	What rules or approach did you use for triggered collateral extent to obtain a consistent appearance in general?	Line of sight.
6	If there is local damage to an interior wall finishes, at what point (if any) do you repair/repaint the entire wall or room?	Any repairs to drywall will trigger, for consistent line of sight, repainting all walls.
7	What rules or approach did you use in deciding when to replace the building paper?	Building paper? If you referring to insulation wrap (INS HWRAP - in XACT) then replace when siding material is being replaced;

Table C.18 Anonymous Adjustor 10 – Initial Survey Response (continued).

Number	Question	Response for Case Study 2 (CS2-UN-DS2)
8	What percentage if any did you assume for escalation?	Not sure of your terminology.
	What amount if any did you assume for the following items as a percentage of the direct construction costs?	
9a	Construction contingency	Do not allow for contingencies.
9b	Utilities (power and water) for construction	None
9c	Design fees	None, have only acknowledged fees, however always leave as "open" as location is unique in these costs, paid on incurred invoices.
9d	Plan check and permitting fees and shear wall special inspection fees	None, have only acknowledged fees, however always leave as "open" as each buildling dept jurisdiction greatly varies in costs, so paid on incurred amounts only.
9e	Lead paint and asbestos abatement	At this time, having tested and test results will dictate what is to be done, no allowance to abate.
9f	Occupied structure	N/A
9g	Coverage C costs allocated for personal property damage	N/A
9h	Coverage D costs allocated for additional living expenses	N/A
10	What additional information would help you refine your estimate?	Actually seeing and inspecting damages or having relevant photos of the actual damages it is a challenge. I understand this is a case study and exercise, but challenging at best to have us make assumptions. Use of the "exterior" function (for perimeter) wall exterior is more helpful in some calucations and would recommend using it. Understand that as General Adjuster, I take 100s of photos an pages of notes for my inspection, so to me a lot more information is needed for this exercise, the main on being to actually see these damages in person.
11	Are there assumptions with which you disagree?	Based on verbiage of the case, did not use CEA policy for plaster vs. drywall
12	Any other comments or suggestions?	Having worked in the field for some time (28 yrs), giving scenarios without us actually visually inspecting is a challenge. Definitions you may be using are engineering terms, but not ones we use in adjusting. Adjusters do not breakout each and every component like cripple walls, ceilings, walls, etc in estimates. We may notate in the scope what is work is related to,

Table C.18 Anonymous Adjustor 10 – Initial Survey Response (continued).

Number	Question	Response for Case Study 2 (CS2-UN-DS2)
		but do not breakout the components like you did - so, not sure if that is just for this exercise. Use adjuster terms, asking about "collateral extent to obtain a consistent appearance in general" to most adjusters will give you a deer in the highlights look as a response - use the word "matching" and we understand. When these studies are put together, get with adjusters who are seasoned and experienced in the field (I am not talking about Public Adjusters either) that may help in using our terminology. On a technical note, some general calculations are off, example, in CS1-UN-DS1, Exterior damage, Stucco crack repairs at 50% of each wall has cracking and then cite 85LF, however the actual number is 70LF (picky I know, but just a notation) and the LF is not 85. This is was noticed in all scenarios. Trim was mentioned as needing to be removed and reset, or at least hinted at, however we need type of material? (MDF vs. hardwood) - makes a difference. Generally when I physically inspect a home I have numerous pages of notes on building materials, quality, measurements, etc to accurately scope what needs to be done; Just as a notation, what you call "trimmer stud" is also known as a "jack studs" in other areas, so just keep in mind that in the event of an seismic event, 100s or 1000s of adjusters will be flooding CA and terminology will be different. Scope notes state 5 windows are cracked, however only 4 are listed for the rooms mentioned. Are the wood windows stained or painted, assuming stained due to age of home. unknown plumbing drain line size; unknown ductwork size; in reviwing all of this, was the scope to follow CEA policy? Unclear if that was the case. Tile for kitchen & kitchen flooring as not mentioned as damaged as noted in CS1 #2 scenario.

See instructions for definitions of repair, upgrade, locally replace, replacement of the entire structure, and escalation.

Table C.19 Anonymous Adjustor 10 – Initial Survey Response.

Number	Question	Response for Case Study 2 (CS2-UN-DS3)
1a	For Damage State 4, what is is the replacement cost in $/sf and source of the value?	
1b	What portion of the replacement cost was for demolition and removal of the existing home ($/sf)?	
1c	What portion of the replacement cost was for the garage in Case Study 3 ($/sf)?	
2a	For Damage State 3, did you replace the entire structure the rather than repair/upgrade the damage?	No, repaired
2b	If you answered yes, why did you replace the entire structure?	
3a	For Damage State 1, 2, or 3, did you upgrade rather than repair the damage?	No, repaired home
3b	If you answered yes, which damage state(s) were upgraded and which elements?	
3c	Why did you upgrade or not upgrade?	
4a	For Damage State 1, 2, or 3, did you locally replace rather than repair the damage?	No
4b	If you answered yes, which damage state(s) had local replacement and which elements?	
4c	Why did you locally replace instead of repair?	
5a	For Damage State 3, did you jack and replumb the cripple wall or replace it entirely?	Jack and replumb
5b	At what level of residual displacement do you think it is no longer economically practical to jack the cripple wall to plumb and rebuilding is needed?	Hard question, would have really had an engineer review and determine best method of repair.
5c	Up to what level of residual displacement do you leave the cripple wall in its tilted condition?	You don’t, you need to correct it.
5d	For Case Study Building 1, did you replace the horizontal sheathing under the stucco with plywood?	
5e	What rules or approach did you use for triggered collateral extent to obtain a consistent appearance in general?	Line of sight.

Table C.19 Anonymous Adjustor 10 – Initial Survey Response (continued).

Number	Question	Response for Case Study 2 (CS2-UN-DS3)
6	If there is local damage to an interior wall finishes, at what point (if any) do you repair/repaint the entire wall or room?	Based on photos given, damages, to me, without an actual inspection appeared to be severe enough and more cost effective to just gut the interior wall materials and replace, keep what could be kept and reinstalling items as warranted.
7	What rules or approach did you use in deciding when to replace the building paper?	Building paper is not a term adjusters use. If you referring to insulation wrap (INS HWRAP - in XACT) then replace when siding material is being replaced;
8	What percentage if any did you assume for escalation?	Not sure of your terminology.
	What amount if any did you assume for the following items as a percentage of the direct construction costs?	
9a	Construction contingency	Do not allow for contingencies, only for actual damages.
9b	Utilities (power and water) for construction	Unknown how power is hooked up in scenario, mast on roof? Undergroud with meter on side of home? Makes a difference; water for this scenario, did not allow for the time being as jack were used to just support openings while framing being worked on the cripple wall area.
9c	Design fees	None, have only acknowledged fees, however always leave as "open" as location is unique in these costs, paid on incurred invoices.
9d	Plan check and permitting fees and shear wall special inspection fees	None, have only acknowledged fees, however always leave as "open" as each buildling dept jurisdiction greatly varies in costs, so paid on incurred amounts only.
9e	Lead paint and asbestos abatement	At this time, having tested and test results will dictate what is to be done, no allowance to abate due to jurisdictions vary in costs. Did allow to test and will then engage in cost is positive for the materials.
9f	Occupied structure	During couse of repairs, no
9g	Coverage C costs allocated for personal property damage	No idea as to what the actual damages were/are so unable to determine any of this coverage. We utilitize contents adjusters for that coverage, so I am not versed in this area.
9h	Coverage D costs allocated for additional living expenses	At this time the duration of repairs is unknown so unable to make any determination of costs at this time.
10	What additional information would help you refine your estimate?	Actually seeing and inspecting damages or having relevant photos of the actual damages it

Table C.19 Anonymous Adjustor 10 – Initial Survey Response (continued).

Number	Question	Response for Case Study 2 (CS2-UN-DS3)
		is a challenge. I understand this is a case study and exercise, but challenging at best to have us make assumptions. Use of the "exterior" function (for perimeter) wall exterior is more helpful in some calucations and would recommend using it. Understand that as General Adjuster, I take 100s of photos an pages of notes for my inspection, so to me a lot more information is needed for this exercise, the main on being to actually see these damages in person.
11	Are there assumptions with which you disagree?	
12	Any other comments or suggestions?	Having worked in the field for some time (28 yrs), giving scenarios without us actually visually inspecting is a challenge. Definitions you may be using are engineering terms, but not ones we use in adjusting. Adjusters do not breakout each and every component like cripple walls, ceilings, walls, etc in estimates. We may notate in the scope what is work is related to, but do not breakout the components like you did - so, not sure if that is just for this exercise. Use adjuster terms, asking about "collateral extent to obtain a consistent appearance in general" to most adjusters will give you a deer in the highlights look as a response - use the word "matching" and we understand. When these studies are put together, get with adjusters who are seasoned and experienced in the field (I am not talking about Public Adjusters either) that may help in using our terminology. On a technical note, some general calculations are off, example, in CS1-UN-DS1, Exterior damage, Stucco crack repairs at 50% of each wall has cracking and then cite 85LF, however the actual number is 70LF (picky I know, but just a notation) and the LF is not 85. This is was noticed in all scenarios. Trim was mentioned as needing to be removed and reset, or at least hinted at, however we need type of material? (MDF vs. hardwood) - makes a difference. Generally when I physically inspect a home I have numerous pages of notes on building materials, quality, measurements, etc to accurately scope what needs to be done; Just as a notation, what you call "trimmer stud" is also known as a "jack studs" in other areas, so just keep in mind that in the event of an seismic event, 100s or 1000s of adjusters will be flooding CA and terminology will be different. Scope notes state 5 windows are cracked, however only 4 are listed for the rooms

Table C.19 Anonymous Adjustor 10 – Initial Survey Response (continued).

Number	Question	Response for Case Study 2 (CS2-UN-DS3)
		mentioned. Are the wood windows stained or painted, assuming stained due to age of home. unknown plumbing drain line size; unknown ductwork size;

See instructions for definitions of repair, upgrade, locally replace, replacement of the entire structure, and escalation.

Table C.20 Anonymous Adjustor 10 – Initial Survey Response.

Number	Question	Response for Case Study 2 (CS2-UN-DS4)
1a	For Damage State 4, what is is the replacement cost in $/sf and source of the value?	$178.96
1b	What portion of the replacement cost was for demolition and removal of the existing home ($/sf)?	$7.63
1c	What portion of the replacement cost was for the garage in Case Study 3 ($/sf)?	
2a	For Damage State 3, did you replace the entire structure the rather than repair/upgrade the damage?	
2b	If you answered yes, why did you replace the entire structure?	
3a	For Damage State 1, 2, or 3, did you upgrade rather than repair the damage?	
3b	If you answered yes, which damage state(s) were upgraded and which elements?	
3c	Why did you upgrade or not upgrade?	
4a	For Damage State 1, 2, or 3, did you locally replace rather than repair the damage?	
4b	If you answered yes, which damage state(s) had local replacement and which elements?	
4c	Why did you locally replace instead of repair?	
5a	For Damage State 3, did you jack and replumb the cripple wall or replace it entirely?	
5b	At what level of residual displacement do you think it is no longer economically practical to jack the cripple wall to plumb and rebuilding is needed?	
5c	Up to what level of residual displacement do you leave the cripple wall in its tilted condition?	
5d	For Case Study Building 1, did you replace the horizontal sheathing under the stucco with plywood?	
5e	What rules or approach did you use for triggered collateral extent to obtain a consistent appearance in general?	
6	If there is local damage to an interior wall finishes, at what point (if any) do you repair/repaint the entire wall or room?	
7	What rules or approach did you use in deciding when to replace the building paper?	
8	What percentage if any did you assume for escalation?	

Table C.20 Anonymous Adjustor 10 – Initial Survey Response (continued).

Number	Question	Response for Case Study 2 (CS2-UN-DS4)
	What amount if any did you assume for the following items as a percentage of the direct construction costs?	
9a	Construction contingency	Do not allow for contingencies, only owe for actual damages/costs.
9b	Utilities (power and water) for construction	Temp power/water may be needed, but cannot allow in Xact Value.
9c	Design fees	None, have only acknowledged fees, however always leave as "open" as location is unique in these costs, paid on incurred invoices.
9d	Plan check and permitting fees and shear wall special inspection fees	None, have only acknowledged fees, however always leave as "open" as each buildling dept jurisdiction greatly varies in costs, so paid on incurred amounts only.
9e	Lead paint and asbestos abatement	At this time, having tested and test results will dictate what is to be done, no allowance to abate.
9f	Occupied structure	N/A
9g	Coverage C costs allocated for personal property damage	N/A
9h	Coverage D costs allocated for additional living expenses	N/A
10	What additional information would help you refine your estimate?	Actually seeing and inspecting damages or having relevant photos of the actual damages it is a challenge. I understand this is a case study and exercise, but challenging at best to have us make assumptions.
11	Are there assumptions with which you disagree?	Using Xact Value for Demoliton is not accurate; I write demolition scopes in Xactimate, for what was in place at the time of the loss. Using a square foot method for cost is generally not accurate in my experience. While notated to not write and estimate for this case, I find the $/sqft method inaccurate.
12	Any other comments or suggestions?	Having worked in the field for some time (28 yrs), giving scenarios without us actually visually inspecting is a challenge. Using XactValue to determine an estimate is generally not accurate. Understand this is based on my experience in CA, design costs, permitting, Title 24 and all of the other fees are excessive and all over the place in terms of costs. There is no accurate way to predict those costs. I have a member right now, from a recent wildfire, where design fees alone for his 1800sqft home were $100,000 (not a type O), this does not include, permits or any Title 24 costs. I have long given

Table C.20 Anonymous Adjustor 10 – Initial Survey Response (continued).

Number	Question	Response for Case Study 2 (CS2-UN-DS4)
		up on attempting to estimate these costs in CA. This particular member is at $187,000 in those costs prior any worker steping onto his propery with any equipment and this loss is not unique for CA.

See instructions for definitions of repair, upgrade, locally replace, replacement of the entire structure, and escalation.

APPENDIX D FINAL SURVEY QUESTIONS FOR CLAIMS ADJUSTORS

Table D.1 Final Survey Questions.

Number	Question
1a	For Damage State 4, what is is the replacement cost in $/sf and source of the value?
1b	What portion of the replacement cost was for demolition and removal of the existing home ($/sf)?
1c	What portion of the replacement cost was for the garage in Case Study 3 ($/sf)?
2a	For Damage State 3, did you replace the entire structure the rather than repair/upgrade the damage?
2b	If you answered yes, why did you replace the entire structure?
3a	For Damage State 1, 2, or 3, did you upgrade rather than repair the damage?
3b	If you answered yes, which damage state(s) were upgraded and which elements?
3c	Why did you upgrade or not upgrade?
4a	For Damage State 1, 2, or 3, did you locally replace rather than repair the damage?
4b	If you answered yes, which damage state(s) had local replacement and which elements?
4c	Why did you locally replace instead of repair?
5a	For Case Study Building 1, did you replace the horizontal sheathing under the stucco with plywood?
5b	What rules or approach did you use for triggered collateral extenthow far to extend repair or replacement of damaged elements to obtain a consistent appearance?
6	If there is local damage to an interior wall finish, at what point (if any) do you repair/repaint the entire wall or room?
7	What additional information would help you refine your estimate?
8	Are there assumptions with which you disagree?
9	Any other comments or suggestions?

APPENDIX E RESPONSE TO FINAL SURVEY QUESTIONS FOR CLAIMS ADJUSTORS

Table E.1 Anonymous Adjustor 1 – Final Survey Response.

Number	Question	Response for Case Study 1	Response for Case Study 2
1a	For Damage State 4, what is is the replacement cost in $/sf and source of the value?	$184/sf - xactimate residential valuation tool	$192/ sf xactimate residential tool
1b	What portion of the replacement cost was for demolition and removal of the existing home ($/sf)?	$7.15/SF	$7.15/SF
1c	What portion of the replacement cost was for the garage in Case Study 3 ($/sf)?		
2a	For Damage State 3, did you replace the entire structure the rather than repair/upgrade the damage?	No	N/A
2b	If you answered yes, why did you replace the entire structure?		
3a	For Damage State 1, 2, or 3, did you upgrade rather than repair the damage?	No	No
3b	If you answered yes, which damage state(s) were upgraded and which elements?		
3c	Why did you upgrade or not upgrade?	We don't owe for upgrades we owe to restore the home to the condition it was preloss	We don't owe for upgrades we owe to restore the home to the condition it was preloss
4a	For Damage State 1, 2, or 3, did you locally replace rather than repair the damage?	Locally replaced when able	Locally replaced when able
4b	If you answered yes, which damage state(s) had local replacement and which elements?	For Damage state 1: I repaired the damages. For Damage stated 2: I locally replaced. I locally replaced the stucco and the drywall for scenario 2.	For Damage state 1: I repaired the damages. For Damage stated 2: I locally replaced. I repaired the siding as needed and locally replaced the plaster for scenario 2.
4c	Why did you locally replace instead of repair?	The cost to repair was higher than that of replacement. Further, the damages were more severe in DS2 and therefore in order to make a proper repair to bring the home to preloss locally replacing damaged materials was needed.	Depending on cost

Table E.1 Anonymous Adjustor 1 – Final Survey Response (continued).

Number	Question	Response for Case Study 1	Response for Case Study 2
5a	For Case Study Building 1, did you replace the horizontal sheathing under the stucco with plywood?	Yes	
5b	What rules or approach did you use for triggered collateral extenthow far to extend repair or replacement of damaged elements to obtain a consistent appearance?	I allowed for the stated amount of stucco replacement needed. If it was only partial stucco replacement I then allowed for a color coat to rest of exterior walls to match the new to existing.	
6	If there is local damage to an interior wall finish, at what point (if any) do you repair/repaint the entire wall or room?	When the cost to repair is more than the cost to replace	
7	What additional information would help you refine your estimate?	I would need photos of the specific room to be estimated, photos of the actual damage being estimated for and a report from an engineer w/ recommended repairs	
8	Are there assumptions with which you disagree?	Yes, to assume that the cement backer board of a tile wall would be salvagable is highly unlikely. Also, if the tile on the walls are damaged I would assume the tile on the floor would be damaged too.	
9	Any other comments or suggestions?	It is very hard as an adjuster to work on what if scenarios since we are taught to estimate known visible damages. I tried my best to give an accurate estimate based on the information provided with each scenario.	

See instructions for definitions of repair, upgrade, locally replace, and replacement of the entire structure.

Table E.2 Anonymous Adjustor 3 – Final Survey Response.

Number	Question	Response for Case Study 1	Response for Case Study 2	Response for Case Study 3
1a	For Damage State 4, what is is the replacement cost in $/sf and source of the value?	N/A	N/A	$275/sf
1b	What portion of the replacement cost was for demolition and removal of the existing home ($/sf)?	N/A	N/A	18.92/sf
1c	What portion of the replacement cost was for the garage in Case Study 3 ($/sf)?			$275/sf
2a	For Damage State 3, did you replace the entire structure the rather than repair/upgrade the damage?	N/A	N/A	No
2b	If you answered yes, why did you replace the entire structure?	N/A	N/A	N/A
3a	For Damage State 1, 2, or 3, did you upgrade rather than repair the damage?	N/A	N/A	No
3b	If you answered yes, which damage state(s) were upgraded and which elements?	N/A	N/A	N/A
3c	Why did you upgrade or not upgrade?	N/A	N/A	I repaired due to policy paying for Like Kind and Quality. If code upgrades apply we will address at a later date once documentation for code upgrade is submitted and supported.
4a	For Damage State 1, 2, or 3, did you locally replace rather than repair the damage?	N/A	N/A	Yes
4b	If you answered yes, which damage state(s) had local replacement and which elements?	n/A	N/A	Interior wall mateirals, tile, siding except for damage state 3
4c	Why did you locally replace instead of repair?	N/A	N/A	By the severity of the damage desribed in the damage state. If the damage was not as sever, repair was the likely option.
5a	For Case Study Building 1, did you replace the horizontal sheathing under the stucco with plywood?	N/A		

Table E.2 Anonymous Adjustor 3 – Final Survey Response (continued).

Number	Question	Response for Case Study 1	Response for Case Study 2	Response for Case Study 3
5b	What rules or approach did you use for triggered collateral extenthow far to extend repair or replacement of damaged elements to obtain a consistent appearance?	N/A	N/A	depends on the material, if the materials could be found for uniform appearance. Usually issues are presented by a contractor if materials could not be found or are discontinued. We will need to address those mateirals when it is presented. If we cannot acheive a uniform apperance, we will replace the material for uniform apperance.
6	If there is local damage to an interior wall finish, at what point (if any) do you repair/repaint the entire wall or room?	N/A	N/A	Repaint the etnire room
7	What additional information would help you refine your estimate?	N/A	N/A	Pictures of room finishes
8	Are there assumptions with which you disagree?	N/A	N/A	No
9	Any other comments or suggestions?	N/A	N/A	None

See instructions for definitions of repair, upgrade, locally replace, and replacement of the entire structure.

Table E.3 Anonymous Adjustor 4 – Final Survey Response

Number	Question	Response for Case Study 1	Response for Case Study 2
1a	For Damage State 4, what is is the replacement cost in $/sf and source of the value?	$244 Valuation tool	$235 Valuation Tool
1b	What portion of the replacement cost was for demolition and removal of the existing home ($/sf)?	$22	$17
1c	What portion of the replacement cost was for the garage in Case Study 3 ($/sf)?		
2a	For Damage State 3, did you replace the entire structure the rather than repair/upgrade the damage?	No	No
2b	If you answered yes, why did you replace the entire structure?		
3a	For Damage State 1, 2, or 3, did you upgrade rather than repair the damage?	No	No
3b	If you answered yes, which damage state(s) were upgraded and which elements?		
3c	Why did you upgrade or not upgrade?		
4a	For Damage State 1, 2, or 3, did you locally replace rather than repair the damage?	No	No
4b	If you answered yes, which damage state(s) had local replacement and which elements?		
4c	Why did you locally replace instead of repair?		
5a	For Damage State 3, did you jack and replumb the cripple wall or replace it entirely?	No	No
5b	At what level of residual displacement do you think it is no longer economically practical to jack the cripple wall to plumb and rebuilding is needed?	Likely get engineer report	Likely get engineer report
5c	Up to what level of residual displacement do you leave the cripple wall in its tilted condition?	Repair if tilted	Repair if tilted
5d	For Case Study Building 1, did you replace the horizontal sheathing under the stucco with plywood?	No	No
5e	What rules or approach did you use for triggered collateral extent to obtain a consistent appearance in general?	Repair to an outside corner	Repair to an outside corner
6	If there is local damage to an interior wall finishes, at what point (if any) do you repair/repaint the entire wall or room?	Paint to an outside corner	Paint to an outside corner
7	What additional information would help you refine your estimate?	Photos and site inspection	Photos and site inspection
8	Are there assumptions with which you disagree?	No	No

Table E.3 Anonymous Adjustor 4 – Final Survey Response (continued).

Number	Question	Response for Case Study 1	Response for Case Study 2
9	Any other comments or suggestions?		

See instructions for definitions of repair, upgrade, locally replace, and replacement of the entire structure.

Table E.4 Anonymous Adjustor 6 – Final Survey Response.

Number	Question	Response for Case Study 1	Response for Case Study 2	Response for Case Study 3
1a	For Damage State 4, what is is the replacement cost in $/sf and source of the value?			Average $375
1b	What portion of the replacement cost was for demolition and removal of the existing home ($/sf)?	0.2	1.62	1.84
1c	What portion of the replacement cost was for the garage in Case Study 3 ($/sf)?			
2a	For Damage State 3, did you replace the entire structure the rather than repair/upgrade the damage?			Repair. Would consult engineer recommendations in real world
2b	If you answered yes, why did you replace the entire structure?			
3a	For Damage State 1, 2, or 3, did you upgrade rather than repair the damage?	Policy owes for like kind and quality. Upgrades are limited to $25,000 sub limit		
3b	If you answered yes, which damage state(s) were upgraded and which elements?	No upgrades	No upgrades	No upgrades
3c	Why did you upgrade or not upgrade?			
4a	For Damage State 1, 2, or 3, did you locally replace rather than repair the damage?	Repair	Replace	Replace
4b	If you answered yes, which damage state(s) had local replacement and which elements?	Replace tile	Replace drywall & tile	Replace drywall, stucco, tile
4c	Why did you locally replace instead of repair?	Utilized most cost effective solution.		
5a	For Case Study Building 1, did you replace the horizontal sheathing under the stucco with plywood?	No		
5b	What rules or approach did you use for triggered collateral extenthow far to extend repair or replacement of damaged elements to obtain a consistent appearance?	Repair entire elevation on a case by case basis.		
6	If there is local damage to an interior wall finish, at what point (if any) do you repair/repaint the entire wall or room?	More 70% of the room will trigger full repaint.		
7	What additional information would help you refine your estimate?	Engineer reports and recommendations. A lot of the decision to repair v replace are made on a case by case bases.		

Table E.4 Anonymous Adjustor 6 – Final Survey Response (continued).

Number	Question	Response for Case Study 1	Response for Case Study 2	Response for Case Study 3
		There is no set rules.		
8	Are there assumptions with which you disagree?	I believe damage state 3 would require full replacement of all drywall and exterior finishes. Jacking and plumbing causes extensive damage to the structure.		
9	Any other comments or suggestions?	I recommend better lay out of the damages. Room by room break down of the damages would be a more efficent way of writing estimate.		

See instructions for definitions of repair, upgrade, locally replace, and replacement of the entire structure.

Table E.5 Anonymous Adjustor 8 – Final Survey Response.

Number	Question	Response for Case Study 3
1a	For Damage State 4, what is is the replacement cost in $/sf and source of the value?	$144.66 using Xactimate Valuation
1b	What portion of the replacement cost was for demolition and removal of the existing home ($/sf)?	0
1c	What portion of the replacement cost was for the garage in Case Study 3 ($/sf)?	None- there were no scope notes indicating the garage was damaged
2a	For Damage State 3, did you replace the entire structure the rather than repair/upgrade the damage?	No
2b	If you answered yes, why did you replace the entire structure?	
3a	For Damage State 1, 2, or 3, did you upgrade rather than repair the damage?	No
3b	If you answered yes, which damage state(s) were upgraded and which elements?	
3c	Why did you upgrade or not upgrade?	No clear instruction to upgrade
4a	For Damage State 1, 2, or 3, did you locally replace rather than repair the damage?	This question is vague. If I replace a small area of drywall wouldn't that still be a repair? I looked in the definitions and could not find anything that described "locally replaced". What does that mean?
4b	If you answered yes, which damage state(s) had local replacement and which elements?	
4c	Why did you locally replace instead of repair?	
5a	For Case Study Building 1, did you replace the horizontal sheathing under the stucco with plywood?	
5b	What rules or approach did you use for triggered collateral extenthow far to extend repair or replacement of damaged elements to obtain a consistent appearance?	
6	If there is local damage to an interior wall finish, at what point (if any) do you repair/repaint the entire wall or room?	What is the difference between local damage to a wall and just plain damage? I would seal the repair/replaced drywall then paint the entire room one coat.
7	What additional information would help you refine your estimate?	Again, better scope notes. Was there damage to the garage? What size baseboard? Where was the damage on the roof, was it near the chimney or a several feet away? Personally I would have very detailed field notes.
8	Are there assumptions with which you disagree?	Yes. I have been handling fire losses in Ventura and Engineers and architects have a huge range. There is no one size fits all in those catagories.

Table E.5 Anonymous Adjustor 8 – Final Survey Response (continued).

Number	Question	Response for Case Study 3
9	Any other comments or suggestions?	I really do want to thank you for allowing me to be part of this study. So, Thank you very much!

See instructions for definitions of repair, upgrade, locally replace, and replacement of the entire structure.

Table E.6 Anonymous Adjustor 11 – Final Survey Response.

Number	Question	Response for Case Study 2	Response for Case Study 3
1a	For Damage State 4, what is is the replacement cost in $/sf and source of the value?	$192.75	184.4
1b	What portion of the replacement cost was for demolition and removal of the existing home ($/sf)?	9158.8	15753.54
1c	What portion of the replacement cost was for the garage in Case Study 3 ($/sf)?		76.88
2a	For Damage State 3, did you replace the entire structure the rather than repair/upgrade the damage?	No	
2b	If you answered yes, why did you replace the entire structure?		
3a	For Damage State 1, 2, or 3, did you upgrade rather than repair the damage?	Yes	
3b	If you answered yes, which damage state(s) were upgraded and which elements?	Only where playwood was added to walls to replace plaster with sheetrock	
3c	Why did you upgrade or not upgrade?	Upgrade was considered based on overall damages. If it were more cost-effective to replace rather than repair, that avenue was taken.	
4a	For Damage State 1, 2, or 3, did you locally replace rather than repair the damage?	No	
4b	If you answered yes, which damage state(s) had local replacement and which elements?		
4c	Why did you locally replace instead of repair?		
5a	For Case Study Building 1, did you replace the horizontal sheathing under the stucco with plywood?		
5b	What rules or approach did you use for triggered collateral extenthow far to extend repair or replacement of damaged elements to obtain a consistent appearance?	Line of sight or natural break in a room such as a doorway that can close.	
6	If there is local damage to an interior wall finish, at what point (if any) do you repair/repaint the entire wall or room?	If we are painting one wall in a room, we would paint all walls in that room to match. Usually not the ceiling though. If there were no natural breaks, we would paint all walls to maintain uniform appearance	

Table E.6 Anonymous Adjustor 11 – Final Survey Response (continued).

Number	Question	Response for Case Study 2	Response for Case Study 3
7	What additional information would help you refine your estimate?	Having the scope of damages laid out by room rather than a generalzation of material/damage. When adjusters scope a loss, they typically prepare their scope room by room as they tour the damages. This would have saved time from having to read though all project details over and over to make certain that all rooms were addressed for damages being mentioned.	
8	Are there assumptions with which you disagree?	No	
9	Any other comments or suggestions?		

See instructions for definitions of repair, upgrade, locally replace, and replacement of the entire structure.

APPENDIX F DAMAGE WORKSHOP PROJECT PARTICIPANTS

The following individuals participated in the February 20, 2019, damage workshop.

California Earthquake Authority

- Janiele Maffei
- Shawna Ackerman
- Mitch Ziemer

PEER-CEA Project Team

- Bret Lizundia, Rutherford + Chekene, Damage Workshop Coordinator
- Kylin Vail, Rutherford + Chekene
- Yousef Bozorgnia, UC Berkeley
- Kelly Cobeen, Wiss Janney Elstner
- Grace Kang, UC Berkeley
- Sharyl Rabinovici, UC Berkeley
- Evan Reis, Reis Consulting
- Brandon Schiller, UC San Diego
- Dave Welch, Stanford University

Xactimate and Claims Advisor

- Christopher McDermott, Crawford & Company

Insurance Claims Adjustors

- Heather Bartle, Farmers
- Jon Dickinson, CSAA
- Edgar Gudino, Farmers
- Brock Harl, Nationwide
- Tom Hodgson, Farmers
- Jim Lenell, USAA
- Henry Lu, CSAA
- Cesar Martinez, CSAA
- Ben Owens, AAA Missouri
- David Villalobos, MAPFRE

Insurance Catastrophe Modelers

- Kent David, Corelogic
- Laura Eads, RMS
- Chuck Menu, RMS
- Tao Lai, Air-Worldwide
- Mehmet Unal, Corelogic
- Todd Rein, RMS
- Nilesh Shome, RMS
- Patxi Uriz, RMS

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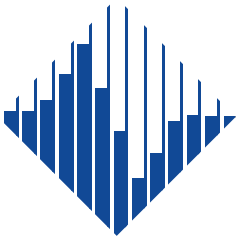

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