IMPLEMENTATION MANUAL

USRC BUILDING RATING SYSTEM

FOR

EARTHQUAKE HAZARDS

September 15, 2015

Updated January 07, 2019

Acknowledgements

This manual has been developed by the USRC Technical Advisory Committee with input and review by the USRC Founding Members and the USRC Stakeholder Advisory Committee.

There are a total of 64 Founding Members and all are listed on the USRC web site www.usrc.org. In June 2014 the 1st Organizational meeting of the Founding Members was held to develop the organizational structure and operational procedures of the USRC. The Founding Members met 11 times prior to the official launch of the USRC. At the Founding Members second meeting they authorized the formation of two major USRC committees, the Technical Advisory Committee (TAC) and the Stakeholders Advisory Committee (SAC). The TAC met 14 times prior to the official launch of the organization. It consisted of 42 representatives from the Founding Member organizations. The SAC consisted of 45 members from the user community and met a total of five times providing valuable information to the Founding Members and TAC as they developed the technical and organizational issues prior to launch of the USRC.

A list of all subcommittee members that contributed to the development of the USRC and this Implementation Manual are provided in Appendix F. The contribution of all is gratefully acknowledged.

The Earthquake Performance Rating System was initially conceived by a volunteer committee of the Structural Engineers Association of Northern California (SEAONC) and remains the property of SEAONC. SEAONC granted the USRC permission to use its work and property in the development of a USRC Rating System. SEAONC did not meaningfully participate in any USRC committees and does not necessarily endorse or approve anything in this manual that makes use of SEAONC's work or property.

Contents

1 Introduction

The mission of the United States Resiliency Council (USRC) is to establish and implement meaningful rating systems that describe the performance of buildings during earthquakes and other natural hazard events, to educate the general public to understand these risks, credential professional engineers to perform ratings, and review ratings for conformance to national consensus-based technical methodologies.

Ratings will benefit building owners, lenders, tenants and government jurisdictions by increasing the value of well-designed properties and providing a means to quantify risk. Policy makers will use USRC ratings to compare and prioritize relative risks and to form a basis for developing long-term community resilience policy. The USRC vision is that it will play a similar role in educating the community about building performance in earthquakes and other natural hazards that the US Green Building Council (USGBC®) plays educating the community about the importance of sustainable design.

Current methods to define and evaluate building performance are often inconsistent and lack both standardization and verification. The USRC has adopted a certification program for professional engineers that will require specific knowledge of structural engineering and the performance of buildings subject to natural and man-made hazards. The USRC will develop training materials and offer courses and workshops to enhance the technical skills of certified rating professionals. USRC certification as a Certified Rating Professional (CRP) will lead to a high level of technical competence and consistency in delivering USRC Ratings. Completed rating reports prepared by CRP's will be audited periodically through a technical review process. The USRC will conduct these audits using Certified Rating Reviewers (CRR), thus preserving the credibility of the overall rating system.

This implementation manual provides standardized and consistent procedures, methodologies and translation procedures for obtaining a USRC Rating for performance of buildings subject to earthquake hazards. Implementation procedures for obtaining ratings for other hazards will be established as methodologies are developed and adopted for these hazards. The manual and its appendices describe:

1. The requirements for professional or structural engineers who will be certified by the USRC to develop USRC Ratings
2. The types of Ratings available from the USRC
3. The process by which an owner will apply to receive a Rating
4. The review procedures the USRC will use to determine the validity of a Rating.

All rating system users should understand the process for producing a USRC Rating (Section 2), the essential features of the rating system (Section 3), and the documentation required to accompany a rating (Section 4). Each of these topics is discussed further in Appendices A through E.

This manual is not meant to be exhaustive. Additional information can be found by visiting the USRC website at www.usrc.org and the USRC web portal at www.usrc-portal.org. if users of this manual have specific questions regarding the process for obtaining a USRC Rating, USRC contact information can be obtained from the USRC website.

2 The Rating Process

Producing a Rating involves the following basic steps as outlined below and in the flowchart of Figure 1.

1. The building owner determines the type of USRC Rating desired: Transaction Rating or Verified Rating (Section Sec 2.1). Transaction Ratings are primarily used for financial and real estate transactions and Verified Ratings are for public display in the entrance of a building and for use in marketing materials.
2. The building owner selects and contracts with a USRC Certified Rating Professional (CRP) (Section 2.2 and www.usrc-portal.org) to complete a seismic evaluation of the building.
3. The CRP performs a seismic evaluation of the subject building using one of the USRC approved methodologies (Section 3.2 and Appendices D & E). The evaluation is an engineering product produced by the CRP, independent of the USRC, and the opinions produced by the CRP are solely the responsibility of the CRP.
4. The CRP translates the findings of the evaluation into a three-part Rating using the USRC approved translation methodologies (Section 3.6 and Appendices D & E.)
5. The proposed rating, based on the CRP's evaluation, is submitted by the CRP or the building owner to the USRC web portal (www.usrc-portal.org) along with appropriate documentation (Section 4), application fees and the request for either a Transaction Rating or a Verified Rating.
6. The USRC reviews the submission for completeness and will either issue a Transaction Rating certificate or organize a technical or elevated review for the issuance of a Verified Rating certificate (Section 4.3 and Appendix A).

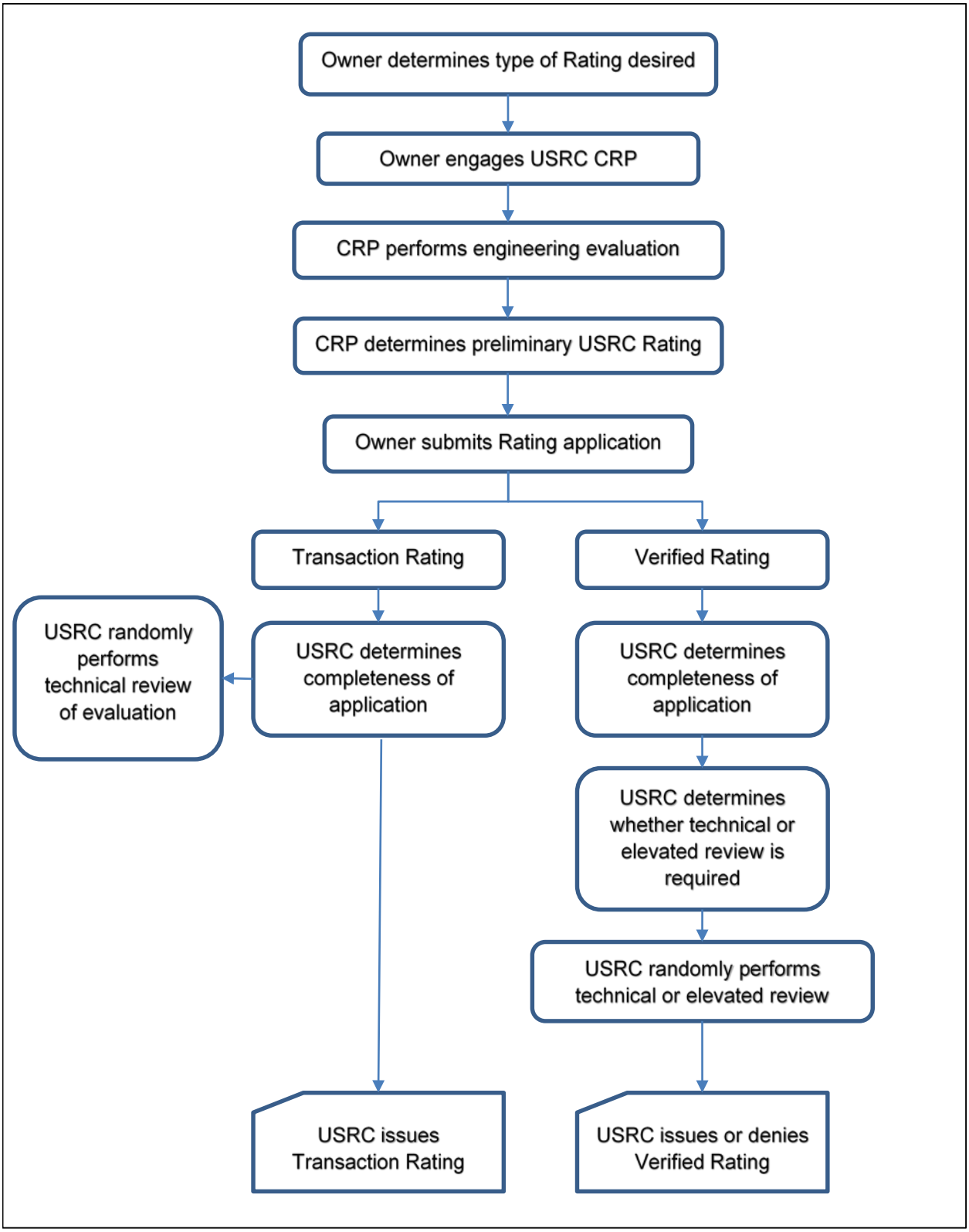


Figure 1 - USRC Rating Process Flowchart

2.1 Rating Types – Transaction and Verified

Transaction Rating

Transaction Ratings are primarily used for financial and real estate transactions and are not permitted for public display or to be used in marketing materials. They are limited to three stars in each of the three rating dimensions.

Transaction Ratings are subject to a random process of technical review for the purpose of Quality Control and confirming that the CRP has applied the applicable procedures as they were intended. Not every Transaction Rating is reviewed by the USRC.

A Transaction Rating shall remain confidential and is intended for the purpose of satisfying due-diligence efforts of the Rating owner. A Transaction Rating is not transferable, and expires five years after it is granted, or sooner as described in Section 3.5. The USRC makes no warranty regarding the reliance of information contained in the Rating or the underlying engineering evaluation by third parties.

Verified Rating

Verified Ratings are for public display in the entrance of a building and for use in marketing materials subject to the terms and conditions for use of USRC trademarks (Appendix A).

Every Verified Rating is subjected to either a technical or elevated review as described in Section 2.6.

A Verified Rating is not transferable, and must be re-registered with the USRC every five years, or sooner as described in Section 3.5. The USRC makes no warranty regarding the reliance of information contained in the Rating or the underlying engineering evaluation by third parties.

2.2 USRC Certified Rating Professionals (CRP)

The rating system is to be applied by USRC Certified Rating Professionals (CRP) with appropriate experience in the design and evaluation of building structures subject to earthquakes or other natural hazards rated by the USRC. The USRC Certification Committee is responsible for evaluating the qualifications of potential CRP candidates and granting or denying certification. The USRC endeavors to maintain a high level of expertise, consistency, and credibility through the certification of CRPs; therefore Rating applications submitted by owners will only be considered if they have been developed by CRPs. The qualifications and application procedure to become a CRP are provided in Appendix B.

2.3 Engineering Evaluation

The USRC Rating is a translation between an engineering evaluation and descriptions of building performance that communicate information about a building to stakeholders. The Rating is not the evaluation itself. Engineering evaluations of a building are performed by licensed professional or structural engineers, engaged by a building owner who are USRC CRPs. Only CRPs may submit a rating, based upon an engineering evaluation. The USRC makes no warranty of any opinions developed by the CRP engaged by the owner to prepare an evaluation. The USRC will not

indemnify the CRP for any opinions contained in the evaluation. The use of an engineering evaluation by the CRP, Owner or third parties, other than solely for the purpose of obtaining a USRC Rating, is outside the consideration of the USRC.

To be considered for a USRC Rating, an engineering evaluation must conform to one of the accepted underlying methodologies described in Section 3.2 and summarized in Appendices D and E. Additional evaluation methodologies may be accepted by the USRC in the future.

When deriving a USRC Rating, the CRP should use appropriate engineering judgment when performing an engineering evaluation of the building and interpreting the underlying technical methodology employed. The CRP should use judgement only when applying the evaluation methodology and should clearly state where and why judgement was used. Judgement should be avoided in the translation of the evaluation results into a USRC Rating

2.4 Rating Application Submission

Once the CRP has completed an engineering evaluation that is intended to be used as supporting documentation for a USRC Rating, using one of the underlying methodologies described in Section 3.2, the engineer will use the translation procedures described in Section 3.6 to develop the USRC Rating in each of the three performance dimensions. The CRP shall submit the engineering evaluation, proposed rating, and any other supporting documentation to the USRC through the USRC web portal (www.usrc-portal.org). The Verified Rating developed by the engineer is preliminary and must be approved by the USRC before it is considered a valid USRC Rating.

Fees may be paid either by the CRP or an owner's representative and are based on the type of Rating requested and the size of the building. Fees are listed on the USRC web portal and are independent of any fees paid by the owner directly to a CRP for the development of the engineering evaluation.

2.5 Technical Review

The USRC provides quality control in the form of a technical or elevated review of the submitted rating types. In general, each USRC CRP is responsible for the quality of the Rating, just as he or she is responsible for the quality of the underlying seismic evaluation upon which the rating is based. The specific details of a technical and elevated review for USRC adopted earthquake hazard evaluation methodologies are given in Appendix C.

Technical and elevated reviews (Section 2.6) are performed by USRC Certified Rating Reviewers (CRR); licensed design professionals with at least ten years of experience in the evaluation of buildings subject to earthquakes and other natural hazards.

If a serious discrepancy is found as a part of a technical review it will be referred to the USRC Rating Review Committee (RRC) for disposition. The RRC will decide the seriousness of the discrepancy and will have the authority to review prior ratings and/or require technical review of future ratings from that CRP at the CRP's expense.

If egregious manipulation of the USRC Rating System is deemed to have occurred, the RRC may at its discretion, refer the CRP to the USRC Discipline Committee for loss of Certification, subject to USRC policies on disciplinary action and appeals as described in Appendix B.

Transaction Rating

Transaction Ratings are subject to a random process of technical review for the purpose of confirming that the CRP has applied the applicable procedures as they were intended. Not every Transaction Rating is reviewed by the USRC. There is no additional charge to the owner for a review of the transaction rating and the results of the random review will not be provided to the owner unless the RRC believes a serious discrepancy has occurred.

Verified Rating

The USRC requires a technical review for every Verified Rating prior to the issuance of the Rating Certificate. The cost to the owner for a verified rating includes the cost of the technical review.

2.6 Elevated Review

Elevated reviews will be required for certain building evaluations as described below. The CRR may elect to discuss discrepancies found as part of an elevated review directly with the CRP who developed the building evaluation. Serious discrepancies found as a part of an elevated review will be referred to the USRC RRC for disposition in a similar manner as for technical reviews.

Transaction Rating

Elevated reviews are not required to receive a Transaction Rating.

Verified Rating

The USRC requires an elevated, or more detailed, review for Verified Ratings, as detailed in Appendix E, for buildings that meet the following conditions:

- Buildings with a Rating of 4 or 5 stars in any dimension
- Buildings defined by ASCE 7-10 as Risk Category Type III and IV
- Vulnerable building types that have a three star or greater rating
  - Unreinforced masonry
  - Reinforced concrete buildings designed pre-1985 UBC
  - Soft / Weak Story Buildings as defined by ASCE 41[1] standard
  - Steel Moment Frame Buildings designed pre-2000, unless the pre-Northridge connection issue has been addressed
  - Other known non-ductile framed systems
- Other unusual systems defined as any building that is not one of the common building types defined in ASCE 41 or would not qualify to be evaluated using the Tier 1 procedure in ASCE 41.

[1] References herein to ASCE 41 refer to the most current edition published by the American Society of Civil Engineers.

Buildings that have a three star or greater Safety rating with significant geologic site hazards as determined from USGS or CDMG maps, or site-specific geotechnical investigations at the level of ground shaking for which the rating is applicable.

- Liquefaction
- Slope Failure
- Surface Fault Rupture

The CRP may request exemption from an elevated review if a previous peer review has been performed on the evaluation, as described in Appendix C.

2.7 Granting of a USRC Rating

Transaction Ratings will be granted by the USRC as soon as practical (the goal is within 1-3 business days) once a complete application, supporting documents and required fees have been submitted to the USRC. Technical reviews of a Transaction Rating are not required prior to the issuance of a Transaction Rating. The CRP and the owner applicant will receive notification of the issuance of a Transaction Rating and a certificate.

Verified Ratings will not be issued until the evaluation has received a Technical and/or Elevated Review. The duration of the review will depend on the complexity of the building and the evaluation. If the USRC agrees with the rating proposed by the submitter, the owner applicant will receive notification of the issuance of a Verified Rating, a certificate, and placard posting information. If the USRC does not agree with the rating proposed by the submitter after some interaction with the CRP, the Rating request will be denied, subject to appeal as described in Appendix B.

2.8 Confirmation of the Rating and the CRP by the USRC

The certification of a CRP and the validity of a Rating can be checked by contacting the USRC. For both Transaction and Verified Ratings the USRC can confirm the name of the certified rating professional that performed a rating, and can confirm whether a Rating was granted by the USRC for the specific building. The USRC cannot provide the actual evaluation, Rating or a copy of the Rating certificates to other parties unless authorized by the owner.

2.9 Limitations and Disclaimer

LIMITATIONS: A USRC Rating is a qualitative summary of results from a separate evaluation, performed by a qualified engineer who is certified by, but not employed by the USRC, of a building's anticipated performance in a natural hazard. Ratings are intended to communicate building performance in consistent terms that are understandable by the general public. Accordingly, this Rating is not intended to be relied upon for any purpose requiring a specific quantitative measure from the Evaluation.

The evaluation underlying this Rating uses technical methodologies which require the exercise of engineering judgement within standards of care customarily exercised by qualified professionals practicing under similar circumstances. This Rating is valid only for the type and level of hazard that was evaluated and is also subject to all other limitations stated in the Evaluation Report on which it is based. Additional specific limitations are stated in the USRC Rating definitions.

The performance of this building in an event may differ from the description associated with its assigned Rating, due to the qualitative nature of the Rating, the uncertainties inherent in the underlying evaluation, as-built conditions of the building that may not be visible and/or in conformance with the design documents, and the variability of events to which the building is exposed.

Continued validity of this specific Rating could be affected at any time with or without the knowledge of the building owner or the USRC. The following is a non-exhaustive list of occurrences that could require the Rating to be re-evaluated:

- Any major alteration, including any alteration that affects the building mass, structural system, or nonstructural components
- Building damage (e.g. earthquake, fire, corrosion, dry rot) or significant deferred maintenance that may result in poorer performance than the design documents would otherwise indicate.
- Construction practice and quality that may not have conformed with generally accepted standards of practice.
- Advances in science or engineering, including but not limited to lessons learned in events

DISCLAIMER: The USRC Rating itself is not an engineering work product and does not represent an engineering opinion. The USRC is not responsible for engineering work products by the engineer who performed the evaluation. USRC expressly disclaims any and all liability relating to claims involving building performance under any circumstances.

3 Features of the USRC Building Rating System

The USRC Rating System builds on established engineering methodologies and standards. The CRP employing the methods should be experienced with their origin, intended use and limitations.

This section explains certain essential features of the USRC Rating System. Further explanation and discussion is provided in Appendices C through E.

This Implementation Manual is specifically for use in developing USRC Ratings for buildings subject to earthquake hazards. Implementation procedures for hazards other than earthquakes are under development by the USRC.

3.1 Rating Definitions

The USRC Building Rating System provides star ratings over three separate dimensions corresponding to the following selected consequences: SAFETY, DAMAGE expressed as Repair Cost, and RECOVERY expressed as Time To Regain Basic Functions. Descriptions of what each dimension covers and explanations of each star rating threshold are provided below.

For earthquake hazards, the ratings below are based on the building's expected performance, using USRC adopted technical methodologies, in earthquake events similar to those used in building codes and standards for design of new structures. The hazard levels for events other than earthquakes are under development by the USRC. Risks from these hazards are not currently identified or rated by the USRC, but may be present for the building under evaluation.

Safety

The SAFETY rating dimension addresses thresholds for the building in terms of the potential for people in the building to get out after an earthquake event and avoid bodily injuries or loss of life during the event. A safety rating is required in all building evaluations.

Safety Rating	
*****	**Injuries and blocking of exit paths unlikely** Expected performance results in conditions that are unlikely to cause injuries or to keep people from exiting the building.
****	**Serious injuries unlikely** Expected performance results in conditions that are unlikely to cause serious injuries.
***	**Loss of life unlikely** Expected performance results in conditions that are unlikely to cause loss of life.
**	**Loss of life possible in isolated locations** Expected performance results in conditions associated with partial collapse or falling objects that have potential to cause loss of life at locations within or around the building.
*	**Loss of life likely in the building** Expected performance results in conditions associated with building collapse, which has a high potential to cause loss of life within or around the building.

Damage

The DAMAGE rating dimension reflects an estimate of the cost to repair the building after an event, such that it can continue to be used as it was at the time the rating was last issued.

DAMAGE is defined as a percentage of the building's overall replacement cost, a common insurance concept measuring how much it would cost to construct a new building approximately the same as it was prior to the event. DAMAGE includes the cost of damage to all structural, architectural, mechanical, electrical and plumbing components of a building but does not include the cost of damage to the contents. Contents values may vary depending on how the building was being used at the time of the event. Separately, content damage can be estimated and reported once the contents are defined. DAMAGE is furthermore determined without consideration of overall market conditions in effect following the event, such as post-event increases in local construction costs, and it does not include factors such as business interruption associated with loss of use or occupancy restrictions, design fees, permit fees, historic preservation, or mandatory upgrades triggered by building code regulations.

Damage Rating	
*****	**Minimal Damage** Repair Cost likely less than 5% of building replacement cost
****	**Moderate Damage** Repair Cost likely less than 10% of building replacement cost.
***	**Significant Damage** Repair Cost likely less than 20% of building replacement cost.
**	**Substantial damage** Repair Cost likely less than 40% of building replacement cost.
*	**Severe Damage** Repair Cost likely greater than 40% of building replacement cost.
NE	**Not Evaluated** Repair Cost has not been evaluated.

Recovery

The RECOVERY dimension is an estimate of the time until a property owner or tenant is able to enter and use the building for its basic intended functions.

A RECOVERY rating represents a minimum timeframe to carry out needed repair and to remove major safety hazards and obstacles to occupancy and use. This rating does not address several other factors that can delay the time to regain function, including but not limited to: the condition of external infrastructure (e.g. utilities, transportation) that provide access and services to the building; damage or the post-event state of building contents; or the condition of adjacent buildings.

The complexity and time needed to restore a building to usable condition can increase quickly in relation to the degree of damage. Delays in design, financing, and construction may include time until arrival of special-order equipment or materials, increased prices, a lack of available local design professionals or contractors in a community where many buildings have been damaged, and longer than usual permitting and inspection wait times. Separately, these factors can be estimated and reported, but the actual total time impact of these factors is highly uncertain.

Recovery Rating	
*****	**Immediately to days** Expected performance will likely result in people being able to quickly re-enter and resume basic functionality of the building from immediately to a few days, excluding external factors.
****	**Within days to weeks** Expected performance may result in delay of basic functionality for days to weeks, excluding external factors.
***	**Within weeks to months** Expected performance may result in delay of basic functionality for weeks to months, excluding external factors.
**	**Within months to a year** Expected performance may result in delay of basic functionality for months to a year.
*	**More than one year** Expected performance may result in delay of basic functionality for at least one year or more.
NE	Not Evaluated Time to regain basic function has not been evaluated.

3.2 Underlying Evaluation Methodologies

The USRC Rating System is not itself an evaluation methodology. Rather, the rating system is a set of definitions, procedures and certification requirements by which the results of separate, or underlying, evaluations performed by qualified engineers may be translated into consistent terms.

For earthquake hazards, the USRC has accepted for use the following underlying evaluation methodologies described in Appendices D and E:

- ASCE 41 based methodology, as applied by the Structural Engineers Association of Northern California Earthquake Performance Rating System,
- FEMA P-58 based methodology, developed by the Federal Emergency Management Agency

A translation matrix has been developed to convert evaluations using either of these methodologies into a Rating (Section 3.6).

3.3 Seismic Hazard Level

For a USRC Verified and Transaction Rating the rating across all three dimensions – Safety, Damage and Recovery - corresponds to the average performance of a building under consideration given a single earthquake causing ground shaking at the site of the building consistent with the Design Basis Event (2/3 MCE_R) as defined in the latest ASCE 7 provisions.

For both ratings, Damage (repair cost) as a function of the building replacement cost when subject to ground shaking with 10% probability of being exceeded in 50 years, which is traditionally used for PML or Seismic Risk Assessment studies, shall be prominently reported on the Rating Certificate for those who wish to use that value.

For sites in the Western US, the 10%/50 year event may be larger than Design Basis Event. For sites in the Central and Eastern US, the 10%/50 year event may be smaller than Design Basis Event.

3.4 Rating Scope

Ratings consider the performance of structural and nonstructural building components, including most equipment. Ratings do not consider the performance of utilities and infrastructure external to the building, building contents or the performance of adjacent buildings.

3.5 Time Limit on a Rating

A Transaction Rating is valid for five years from the time it is issued or the effective date of any occurrence noted below that could affect the Rating, whichever is sooner.

A Verified Rating must be re-registered every five years by the owner. Prior to the renewal date, a registration update must be submitted, including a description of any alterations that have occurred in the building since issuance of the Rating or the prior renewal. A registration update does not necessarily require a new evaluation or Rating unless there is the occurrence of an event noted below that could affect the previously issued Rating.

Continued validity of either Rating could be affected at any time with or without the knowledge of the building owner or the USRC. The following is a non-exhaustive list of occurrences that could require re-rating:

- Any major alteration of the building, including any alteration that affects the building mass, structural system, or nonstructural components
- Building damage (e.g. earthquake, fire, corrosion) or significant deferred maintenance
- Advances in science or engineering, including but not limited to lessons learned in natural hazards occurring subsequent to the issuance of the rating.

3.6 Translating the underlying evaluation

The production of a USRC Rating requires the results of the engineering evaluation, using an accepted underlying technical methodology, to be translated into the three dimensions and five star levels that represent a USRC Rating. While the ideas embodied in the dimensions and definitions may be used informally to describe earthquake performance, formal Ratings shall be derived only with an approved USRC-approved translation procedure for the underlying evaluation methodology. The translation is only valid if the evaluation is performed according to the procedures and limitations described in the underlying methodology.

The dimensions and definitions used by the USRC may differ in specific wording from those contained in the original underlying evaluation methodology, however the user is to apply a direct translation from the USRC Rating System. The translation from each methodology to a USRC Rating is found in the description of each approved methodology: Appendix D for the use of ASCE 41 based procedures and Appendix E for the use of FEMA P58 based procedures. If other underlying evaluation methodologies are developed and approved by the USRC, translation processes will be developed for those methodologies as well.

4 The Rating Request Submission

The requirements for a rating submittal include an executive summary and a submittal as detailed in Sections 4.1 and 4.2. The CRP and the owner will receive a rating certificate as discussed in Section 4.3 and shown in Appendix A.

4.1 Executive Summary of the Rating Application

When submitting a Rating application to the USRC Portal website (www.usrc-portal.org), the CRP shall use the submittal described in Section 4.2. The format of the executive summary is intended as a cover sheet and is available to be downloaded from the USRC Portal (www.usrc-portal.org).

An executive summary includes the following:

- A unique building identifier (e.g. address, building name). Once the project has been submitted, a unique USRC rating ID # will be assigned to the project for tracking and identification purposes.
- Basic building data, year built, year(s) remodeled, original design code.
- The three-part rating requested by the CRP, showing each rating dimension and the star rating requested for each dimension. It is acceptable to Not Evaluate “NE” the Damage

and Recovery dimensions, but a star rating must be provided for at least the Safety dimension. It is not acceptable to request a single star rating for all three dimensions together.

- The USRC CRP's current professional license seal, which should show the engineer's name and license number.
- The USRC CRP's signature and seal.
- The effective date of the rating.
- The underlying methodology used to derive each dimension's rating. Different methods may be used to derive the rating for each dimension as described herein.
- Identify rating type being requested, either a Transaction Rating or a Verified Rating.

4.2 Submittal

The submittal represents the minimum amount of information that a CRP will deliver to the USRC via the USRC Portal website (www.usrc-portal.org) for both a Verified and Transaction Rating. The submittal will include all of the following:

- An executive summary submittal as described in Section 4.1
- A list of all documents submitted for review including related drawings, evaluation reports, summaries and other supporting documentation
- A description and documentation of any site visits performed
- Building design information, including the original design code and edition, a history of any significant structural alterations, and past and current use and occupancy
- Description of the seismic force-resisting system, the gravity force-resisting system, and the foundation
- Submittal of geotechnical reports and site seismicity parameters including time histories if they were used in the FEMA P-58 evaluation
- Submittal of the input parameters to an FEMA P-58 evaluation including the drifts and floor accelerations if they were used in the evaluation
- Liquefaction and/or landslide/slope stability reports, if any were performed
- Key deficiencies identified by the evaluation
- The translation to the Rating. This is a report showing how the Rating was derived from the underlying evaluation methodology. This will normally take the form of a copy of the applicable procedures from the Evaluation Methodology utilized.
- The underlying evaluation report. The format and content of the underlying evaluation report will vary with each methodology. In general, the report must be sufficient to show how its results were produced and where the judgment of the evaluating engineer, if any, was applied. A summary of the underlying evaluation showing the results that will be used as inputs to the Rating translation procedure.

4.3 USRC Rating Certificates

The USRC will issue formal rating certificates separately for Transaction and Verified Ratings. Drafts of these certificates are provided in Appendix A and include the following information:

- Building and Owner identification
- Rating and its definitions
- Registration renewal date by owner – every 5 years for Verified Rating

- Expiration date of 5 years for Transaction Rating
- Disclaimer
- Level of technical review

5 Supporting Material

Almufti, I., and Willford, M. (2013). REDi™ *Rating System, Resilience-based Earthquake Design Initiative for the Next Generation of Buildings*, Version 1.0, October, Arup

ASCE (2013). *Seismic Evaluation and Rehabilitation of Existing Buildings* (*ASCE/SEI 41-13*), American Society of Civil Engineers, Reston, VA

ASCE (2010). *Minimum design loads for buildings and other structures,* (*ASCE/SEI 7-10*), American Society of Civil Engineers, Reston, VA

SEAOC (2012). "ASCE 41-13: Seismic Evaluation and Retrofit of Existing Buildings." *Proceedings of the SEAOC 2012 Convention Proceedings), Structural Engineers Association of California, Sacramento, CA*

ASTM (1999). *E2026-99 Standard Guide for the Estimation of Building Damageability in Earthquakes*, American Society for Testing and Materials

ATC (2011). "FEMA P-807: Proceedings for a Workshop on a Rating System for the Earthquake Performance of Buildings," *Workshop Proceedings*, May 2011, prepared for the Federal Emergency Management Agency, Applied Technology Council, Redwood City, CA

Bonowitz, D. (2011). "Resilience Criteria for Seismic Evaluation of Existing Buildings," *August 5, 2011 Report to SEAONC*, Structural Engineers Association of Northern California

FEMA (2002). *Rapid Visual Screening of Buildings for Potential Seismic Hazards: A Handbook, Second Edition*, *FEMA 154 Report,* prepared by the Applied Technology Council for the Federal Emergency Management Agency, Washington, DC

FEMA (2012) *Seismic Performance Assessment of Buildings, Methodology and Implementation, FEMA P-58 Report,* prepared by the Applied Technology Council for the Federal Emergency Management Agency, Washington, DC

FEMA (2015). *Rapid Visual Screening of Buildings for Potential Seismic Hazards: A Handbook, Third Edition, FEMA 154 Report*, prepared by the Applied Technology Council for the Federal Emergency Management Agency, Washington, DC

ICC (2012). *International Existing Building Code*, International Code Council, Washington, DC

SEAONC Existing Buildings Committee, Building Ratings Subcommittee (2009). "Report Cards for Buildings: A Proposed Rating System for Earthquake Performance," *ATC&SEI Conference on Improving the Seismic Performance of Existing Buildings and Other Structures*, San Francisco, pp. 9-11.

SEAONC Existing Buildings Committee, Building Ratings Subcommittee (2011). "SEAONC Rating System for the Expected Earthquake Performance of Buildings," *SEAOC 2011 Convention Proceedings*, Structural Engineers Association of California, Sacramento, CA

SEAONC Existing Buildings Committee, Building Ratings Subcommittee (2012) "Earthquake Performance Rating System: Translating ASCE 31-03," *SEAOC 2012 Convention Proceedings*, Structural Engineers Association of California, Sacramento, CA

SEAONC (2015), Earthquake Performance Rating System Users Guide, www.seaonc.org

SEAONC (2017) Earthquake Performance Rating System ASCE 41-13 Translation Procedure, www.seaonc.org

APPENDICES

APPENDIX A
RATING CERTIFICATES

1 Introduction

The following images represent sample versions of both the Transaction Rating and Verified Rating certificates that will be issued to owners who receive ratings from the USRC. Unauthorized use, distribution, or duplication of the certificates, logos or other USRC trademarked material is prohibited. Display or use of the Transaction Rating certificate is subject to the terms and conditions contained within the certificate and in this document. The Verified Rating certificate may be publicly displayed or used for marketing and promotional materials, subject to the terms and conditions contained within the certificate and in this document.

2 Terms and Conditions

USRC trademarks and logos are the exclusive property of USRC. Use of the USRC Logo is authorized by the U.S. Resiliency Council on a case-by case basis through written request and thorough review of intent for usage. The Authorized User acknowledges that the ownership of all rights to the USRC trademarks and logos remains with USRC. USRC may at its absolute discretion, restrict, amend or cancel its authorization to use or display its trademarks and logos, by written notice to the Authorized User, who shall within fourteen days, comply with the restrictions, modifications or cancelation.

Authorized Users shall only use or display the trademark and logos as defined by these USRC Terms and Conditions. The logo may be used only in the form provided by the USRC to the Authorized User. The logo may not be placed on product packaging, ads, or be used as a visual reference to USRC rating claims in product literature. For example, the logo cannot be placed next to text that says "Building A likely to receive X stars under the USRC Rating System." The logo may be placed on an approved web site as a link to the USRC's web home page (www.usrc.org). It may not be used to link to other pages on the Web site or to link to any other third party web sites. When used in print, the logo shall be accompanied by the URL of the USRC website. Literature in which this logo appears must contain the following acknowledgement: " 'USRC' and related logo is a trademark owned by the U.S. Resiliency Council and is used by permission."

The logo shall not appear in any placement, online or in print, which could be construed to imply that the USRC endorses or approves any activity, product or organization that is not explicitly endorsed or approved by the USRC.

USRC TRANSACTION RATING *earthquake*	USRC TRACKING NUMBER:
	Certified Rating Professional:
SAFETY ★★★☆☆	Building Owner[1]:
DAMAGE ★★☆☆☆	Rating Owner (if different):
RECOVERY ★★☆☆☆	Parcel No.:
Effective Date:	Building Name:
Expiration Date[2]:	Street Address:
	City: State: Zip Code:

RATING DEFINITIONS

	SAFETY	DAMAGE	RECOVERY
Four- and Five-Star ratings are available only for USRC Verified Ratings.			
★★★☆☆	**Loss of life unlikely** Expected performance results in conditions that are unlikely to cause loss of life	**Significant Damage** Repair Cost is likely less than 20% of building replacement cost.	**Within weeks to months** The expected performance may result in delay of basic functionality from weeks to months, excluding external factors.
★★☆☆☆	**Loss of life possible in isolated locations** Expected performance results in partial collapse or falling objects which have a potential to cause loss of life at some locations within or around the building.	**Substantial Damage** Repair Cost is likely less than 40% of building replacement cost.	**Within months to a year** Expected performance may result in delay of basic functionality from months to a year.
★☆☆☆☆	**Loss of life likely in the building** Expected performance results in building collapse which has a high potential for deaths of people who are in or around the building.	**Severe Damage** Cost of replacement or repair is likely greater than 40% of building replacement cost.	**More than a year** Expected performance may result in delay of basic functionality for at least one year or more.
NE *(not evaluated)*	*NE is not allowed for Safety.*	Repair Cost has not been evaluated.	Recovery of basic functionality has not been evaluated.

Additional Detail For USRC Rating Definitions:

For earthquake hazards, this Rating is based on the building's expected performance, using USRC adopted technical methodologies, in earthquake events similar to those used in building codes and standards for design of new structures. The particular hazard level used for this rating is defined in the separate Evaluation Report.

SAFETY: The potential for people in the building to get out after a disaster and avoid bodily injuries or loss of life. A Safety rating is required in all building evaluations. A Safety rating does not include possible injuries from building contents (e.g. furniture)

DAMAGE: Repair cost as a percentage of the building's overall replacement cost prior to the event, including the cost of damage to structural, architectural, mechanical, electrical and plumbing components of a building. It does not include damage caused by water and gas pipes that may break/leak as a result of the event or damage to the contents.

Repair Cost does not include the cost of business interruption associated with loss of use or occupancy restrictions, or overall market conditions in effect following the event, such as post-event increases in local construction costs. It does not include costs such as historic preservation requirements or mandatory upgrades triggered by building code regulations.

RECOVERY: An estimate of the minimum timeframe to carry out sufficient repairs and to remove major safety hazards and obstacles to regain occupancy and basic function of the building, but not necessarily to repair all non-structural elements and finishes, or regain all functions and operations as they existed prior to the event. Full restoration of the building and operations may take considerable additional time and be a function of several factors not considered in this rating dimension, including external infrastructure (e.g. utilities, transportation), damage to building contents, or the condition of adjacent buildings.

[1] This Rating is nontransferable with the sale of the building.

[2] This Rating expires either on the date noted or the effective date of any occurrence that could affect the Rating, whichever is sooner.

Continued on Page 2

USRC Tracking No.:
USRC Transaction Rating (Page 2 of 2)

USRC RATING REVIEW

Transaction Ratings are subject to random Technical Review for the purpose of confirming that the Certified Rating Professional has applied the applicable procedures as they were intended. Not every Transaction Rating receives a Technical Review.

CONFIDENTIALITY, USE AND VERIFICATION OF USRC RATINGS

This USRC Transaction Rating shall remain confidential and shall be used for satisfying due-diligence information gathering efforts of the Rating Owner and authorized third parties. A Transaction Rating is not transferable, and should not be relied on by a third party without consent of the Rating Owner.

Acceptable use of USRC Transaction Ratings is as stated in this certificate and USRC Policies. The Rating and any associated USRC logos or rating symbols cannot be publicly displayed or used in marketing materials by the Rating Owner or third parties.

Verification of the authenticity of this certificate may be obtained from the USRC web portal at www.USRC.org/portal/ratinglookup

LIMITATIONS

A USRC Rating is a qualitative summary of results from a separate Evaluation, performed by a qualified engineer who is certified by but not employed by the USRC, of a building's anticipated performance in a natural hazard. Ratings are intended to communicate building performance in consistent terms that are understandable by the general public.

The Evaluation underlying this Rating uses technical methodologies which require the exercise of engineering judgement within standards of care customarily exercised by qualified professionals practicing under similar circumstances. This Rating is valid only for the type and level of hazard that was evaluated and is also subject to all other limitations stated in the Evaluation Report on which it is based. Additional specific limitations are stated in the USRC Rating definitions.

The performance of this building in an event may differ from the description associated with its assigned Rating, due to the qualitative nature of the Rating, the uncertainties inherent in the underlying Evaluation, and the variability of events to which the building is exposed.

Continued validity of this specific Rating could be affected at any time with or without the knowledge of the building owner or the USRC. The following is a non-exhaustive list of occurrences that could require the Rating to be re-evaluated:

- Any major alteration, including any alteration that affects the building mass, structural system, or nonstructural components
- Building damage (e.g. earthquake, fire, corrosion) or significant deferred maintenance
- Advances in science or engineering, including but not limited to lessons learned in events

The USRC rating itself is not an engineering work product and does not represent an engineering opinion of the USRC. The USRC is not responsible for engineering work products of the engineer who performed the underlying Evaluation. USRC expressly disclaims any and all liability relating to claims involving building performance under any circumstances.

RELATED DOCUMENTS: The USRC does not necessarily retain or archive documents related to a Rating.

Certified Rating Professional:	
Evaluation Methodology:	
Evaluation Report as a basis of the Rating:	*document name, author, date*
USRC documents used to generate the Rating:	*document name, version, date*
Docket File:	*docket name, author, date (contains all submitted information on building)*

This USRC Transaction Rating is only valid when signed below by a USRC representative and when accompanied by a sealed USRC Transaction Rating CRP Submission Form.

USRC Executive Director

Date

USRC VERIFIED RATING *earthquake*	**USRC TRACKING NUMBER:** **Certified Rating Professional:**
SAFETY ★★★☆☆ **DAMAGE** ★★★☆☆ **RECOVERY** ★★★☆☆ **Effective Date:** **Renewal Date[2]:**	**Building Owner[1]:** **Rating Owner** (if different): **Parcel No.:** **Building Name:** **Street Address:** **City:** **State:** **Zip Code:**

RATING DEFINITIONS

	SAFETY	DAMAGE	RECOVERY
★★★★★	**Injuries and blocking of exit paths unlikely**: Expected performance results in conditions unlikely to cause injuries or to keep people from exiting the building.	**Minimal damage**: Repair Cost likely less than 5% of building replacement cost.	**Immediately to within days**: The expected performato nce will likely result in people being able to quickly re-enter and resume use of the building from immediately to a few days, excluding external factors.
★★★★☆	**Serious injuries unlikely**: Expected performance results in conditions that are unlikely to cause serious injuries.	**Moderate damage**: Repair Cost likely less than 10% of building replacement cost.	**Within days to weeks**: The expected performance may result in delay of basic functionality for days to weeks , excluding external factors.
★★★☆☆	**Loss of life unlikely**: Expected performance results in conditions that are unlikely to cause loss of life.	**Significant damage**: Repair Cost likely less than 20% of building replacement cost.	**Within weeks to months**: The expected performance may result in delay of basic functionality for weeks to months, excluding external factors.
★★☆☆☆	**Loss of life possible in isolated locations**: Expected performance results in conditions associated with partial collapse or falling objects, which have a potential to cause loss of life at some locations within or around the building.	**Substantial damage**: Repair Cost likely less than 40% of building replacement cost.	**Within months to a year**: Expected performance may result in delay of basic functionality for months to a year.
★☆☆☆☆	**Loss of life likely in the building**: Expected performance results in conditions associated with building collapse, which has a high potential to cause death within or around the building.	**Severe damage**: Repair Cost likely greater than 40% of building replacement cost.	**More than one year**: Expected performance may result in delay of basic functionality for at least one year or more.
NE *(not evaluated)*	*NE is not allowed for Safety.*	Repair Cost has not been evaluated.	Recovery basic functionality has not been evaluated.

For earthquake hazards, this Rating is based on the building's expected performance, using USRC adopted technical methodologies, in earthquake events similar to those used in building codes and standards for design of new structures. The particular hazard level used for this rating is defined in the separate Evaluation Report.

SAFETY: The potential for people in the building to get out after a disaster and avoid bodily injuries or loss of life. A Safety rating is required in all building evaluations. A Safety rating does not include possible injuries from building contents (e.g. furniture)

DAMAGE: Repair cost as a percentage of the building's overall replacement cost prior to the event, including the cost of damage to structural, architectural, mechanical, electrical and plumbing components of a building. It does not include damage caused by water and gas pipes that may break/leak as a result of the event or damage to the contents.

Repair Cost does not include the cost of business interruption associated with loss of use or occupancy restrictions, or overall market conditions in effect following the event, such as post-event increases in local construction costs. It does not include costs such as historic preservation requirements or mandatory upgrades triggered by building code regulations.

RECOVERY: An estimate of the minimum timeframe to carry out sufficient repairs and to remove major safety hazards and obstacles to regain occupancy and basic function of the building, but not necessarily to repair all non-structural elements and finishes, or regain all functions and operations as they existed prior to the event. Full restoration of the building and operations may take considerable additional time and be a function of several factors not considered in this rating dimension, including external infrastructure (e.g. utilities, transportation), damage to building contents, or the condition of adjacent buildings.

[1] This Rating is nontransferable with the sale of the building. Change of building ownership requires the new owner to contact the USRC for registration update of the Rating. Continued use of the prior Rating might be possible, or re-Rating might be required.

[2] Prior to the renewal date, a registration update must be submitted, including a description of any alterations that occurred in the building since issuance of the Rating or the prior renewal, or if no alterations occurred, the original Evaluation. A registration update does not necessarily require a new Evaluation or Rating.

Continued on Page 2

USRC Tracking No.:
USRC Verified Rating (Page 2 of 2)

USRC RATING REVIEW

All USRC Verified Ratings are subject to Technical Review with the purpose of confirming that the Certified Rating Professional has applied the applicable procedures as they were intended. Some USRC Verified Ratings are also subject to Elevated Review with the purpose of confirming that the results of the Evaluation justify the Rating given.

CONFIDENTIALITY, USE AND VERIFICATION OF USRC RATINGS

This USRC Verified Rating shall remain confidential unless authorized by the Rating Owner. The Rating should not be relied on by a third party without the consent of the Rating Owner.

Acceptable use of USRC Verified Ratings is as stated in this certificate and USRC Policies. The Rating and any associated USRC logos or rating symbols may be publicly displayed or used in marketing materials by the Rating Owner or third parties authorized by the Rating Owner, in adherence with USRC policies.

Verification of the authenticity of this certificate may be obtained from the USRC web portal at www.USRC.org/portal/ratinglookup

LIMITATIONS

A USRC Rating is a qualitative summary of results from a separate Evaluation, performed by a qualified engineer who is certified by but not employed by the USRC, of a building's anticipated performance in a natural hazard. Ratings are intended to communicate building performance in consistent terms that are understandable by the general public.

The Evaluation underlying this Rating uses technical methodologies which require the exercise of engineering judgement within standards of care customarily exercised by qualified professionals practicing under similar circumstances. This Rating is valid only for the type and level of hazard that was evaluated and is also subject to all other limitations stated in the Evaluation Report on which it is based. Additional specific limitations are stated in the USRC Rating definitions.

The performance of this building in an event may differ from the description associated with its assigned Rating, due to the qualitative nature of the Rating, the uncertainties inherent in the underlying Evaluation, and the variability of events to which the building is exposed.

Continued validity of this specific Rating could be affected at any time with or without the knowledge of the building owner or the USRC. The following is a non-exhaustive list of occurrences that could require the Rating to be re-evaluated:

- Any major alteration, including any alteration that affects the building mass, structural system, or nonstructural components
- Building damage (e.g. earthquake, fire, corrosion) or significant deferred maintenance
- Advances in science or engineering, including but not limited to lessons learned in events

The USRC rating itself is not an engineering work product and does not represent an engineering opinion of the USRC. The USRC is not responsible for engineering work products of the engineer who performed the underlying Evaluation. USRC expressly disclaims any and all liability relating to claims involving building performance under any circumstances.

RELATED DOCUMENTS: The USRC does not necessarily retain or archive documents related to a Rating.

Certified Rating Professional:	
Evaluation Methodology:	
Evaluation Report as a basis of the Rating:	*document name, author, date*
USRC documents used to generate the Rating:	*document name, version, date*
Docket File:	*docket name, author, date (contains all submitted information on building)*

This USRC Verified Rating is only valid when signed below by a USRC representative and when accompanied by a sealed USRC Verified Rating CRP Submission Form.

USRC Executive Director

Date

APPENDIX B
CERTIFICATION, DISCIPLINE, AND APPEALS POLICIES

U.S. Resiliency Council
Certification, Discipline, and Appeals Policies (CDAP) Version 1.1

1 Introduction

This Certification, Discipline, and Appeals Policy (CDAP) covers USRC policies for:

- certification of professionals, as qualified, to prepare and submit building evaluations to receive a USRC rating and to review those evaluations on behalf of the USRC;
- discipline of USRC certified professionals with respect to adherence to USRC policies only; and
- appeals of denial of certification or disciplinary actions

This manual has been prepared by USRC committees and approved by the USRC Board of Directors. This document will undergo updates, revisions and expansion as the USRC determines necessary. Users of this document should regularly check the USRC website (www.usrc.org) for updates.

2 Certification

Two categories of certification have been established by the USRC: *Certified Rating Professional* (CRP) and *Certified Rating Reviewer* (CRR). Additional categories, such as for professionals certified to rate or review only specific building types (e.g. residential) may be established in the future.

CRP's and CRR's are eligible to develop or review building evaluations submitted for a USRC building rating, subject to the limitations and expectations described herein.

2.1 Certification for Certified Rating Professionals (CRP)

Applicants to be a CRP must first register with the USRC to be able to access and submit an application to the USRC using the electronic form provided by the USRC on its web portal (www.usrc-portal.org). Applicants must fill out all portions of the application; missing information may delay review of the application or result in denial of certification.

The cost to become a USRC Certified Rating Professional is $600 for individuals with a $100 annual renewal fee. Individual and corporate members enjoy discounts on certification application fees. The application fee includes a one year individual membership in the USRC and the cost of attending two required web based seminars on the two USRC approved methodologies for seismic evaluations – ASCE 41 and FEMA P58. Applicants will submit the application fee on-line through the USRC website. The fee is nonrefundable. The requirements to become a USRC Certified Rating Professional are listed below.

The following sections are contained in the CRP application and resume, which should not exceed 3 pages:

1. Certification Scope (All Buildings or Residential (SFR and 1-4 units)
2. **Postsecondary engineering education:** Institution name, years attended, major(s), degree(s) conferred
3. **Professional engineering licenses**. A successful applicant will be expected to have a

professional engineering license that emphasizes civil or structural engineering. For each license, the applicant will be expected to answer and explain affirmative responses to the following questions:

4. Is this license inactive (Yes/No)
5. Has this license ever been revoked (Yes/No)
6. Has any disciplinary action ever been taking regarding this license (Yes/No)
7. **Experience Record**. A successful application will demonstrate the following:
    - 5 years minimum engineering experience following the date they obtained professional licensure (Civil Engineer, Professional Engineer, etc.).
    - Applicant shall describe and demonstrate qualifying examples of worked performed in the design, retrofit and/or evaluation of new and existing buildings, specifically related to natural hazards, different building types, and using evaluation methodologies adopted by the US Resiliency Council (USRC). See the USRC website, www.usrc.org, or this Rating Implementation Manual for technical methodologies which the USRC has adopted. Examples cited should be detailed enough to describe the hazard, building type, methodology used and level of analysis performed (e.g. static. dynamic, linear, non- linear).
8. **Supplementary questions**. As part of the application process, the applicant will provide a resume with additional information that will be helpful in assessing the applicant's qualifications to become a Certified Rating Professional. This information includes:
    - Membership in professional organizations
    - Other experience in assessing building performance before or after a disaster
    - Publications and presentations
    - Other relevant professional experience
    - List of approved USRC training courses taken. As of the current date of this document, no USRC training courses have been developed. Once courses have been developed, new applicants will be required to take at least one course following certification and prior to submitting their first building evaluation, and existing CRP's will be expected to take an approved course before their first USRC certification renewal.
9. **Professional references**. Applicants will be expected to submit three references from professional colleagues or supervisors who are familiar with the applicant's work and professional character. Forms will be emailed to the references by the USRC. References will complete the reference form and return them to the USRC via email. References may not be related to the applicant and will be expected to provide information regarding the applicant including:
    - References' Contact information, including licensure
    - Professional relationship with the applicant
    - Number of years working with or supervising the applicant.
    - Specific examples of the work performed by the applicant related to specific natural hazards, building types, and evaluation methodologies.
10. **USRC Terms and Agreement Requirements:** All applicants will be expected to agree to adhere to the USRC terms and conditions listed or referenced in the application. Terms and conditions can be viewed on the USRC website. If the applicant does not specifically agree to the USRC terms and conditions, the application will not be considered by the

USRC. Among the terms and conditions are:

- Many state boards of professional licensing have wording similar to the following: "A licensed professional engineer shall practice and perform engineering work only in the field or fields in which he/she is by education and experience fully competent and proficient." USRC Certified Rating Professionals are solely responsible for adhering to codes of professional practice and ethics stipulated by the licensing boards of the states in which they practice. The USRC makes no warranty of the work developed by the Certified Rating Professional, and does not indemnify the Certified Rating Professional for any work performed. Certified Rating Professionals shall agree to indemnify the USRC for all worked performed by the Certified Rating Professional and submitted to the USRC.

- The applicant agrees that all decision on appeals and disciplinary actions are at the discretion of the USRC and are final.

2.2 Certification for Certified Rating Reviewer (CRR)

Applicants to be a CRR must first register with the USRC to be able to access and submit an application to the USRC using the electronic form provided by the USRC on its web portal. Applicants must fill out all portions of the application; missing information may delay review of the application or result in denial of certification.

In addition to the requirements to be a CRP, a USRC Certified Rating Reviewer is expected to have additional qualifications as described below.

1. **Professional engineering licenses.** A successful applicant will be expected to have the highest professional engineering licensure offered in the state in which they practice. For example, in California, the highest professional engineering licensure is the designation of "Structural Engineer," while in Texas there is no higher designation than the standard "Professional Engineer." In states that offer a Structural Engineer designation 5 years minimum qualifying experience beyond the date of licensure is required, or, in lieu of that designation an applicant may have a combination of a Professional Engineering License, a PhD in structural or civil engineering and 5 years minimum qualifying experience. In states with no Structural Engineering designation, a Professional Engineering license and a minimum of 10 years of experience is required.
2. **Experience Record.** It is the intent that the USRC will assign Reviewers to review building evaluations based on their familiarity and experience in reviewing similar buildings and hazards. A successful applicant will list building types, hazards and methodologies which the applicant believes he/she is qualified to review, and demonstrate specific experience in reviewing the design and/or evaluation of such buildings and hazards.

Application fees, membership discounts, and annual renewal fees are the same as for Certified Rating Professionals. Reviewers will be compensated by the USRC at the rate of $200 per hour, subject to USRC Terms and Conditions

2.3 Certification Status

The certification status of a prospective, current or former CRP or CRR shall be classified as either:

Applicant, Active, Lapsed, Inactive or *Revoked.* Only professionals with an Active Certification are allowed to submit building evaluations to receive a USRC rating or to review rating evaluations.

Certification will remain active contingent upon: the renewal through submission of an annual fee, evidence of continuing education as required by policies, and evidence of having performed ratings in the previous year. To allow for the startup of the USRC, the requirement for having performed ratings in the previous year may be waived at the discretion of the USRC.

Professionals who do not renew their certification by the anniversary of their original certification will be considered to have a Lapsed Certification. Professionals with lapsed certification may submit a form along with prescribed fees to reactivate certification within 90 days of becoming lapsed. Reactivation will normally occur without a formal review of the applicant.

A professional with a lapsed certification older than 90 days shall be considered Inactive. Professionals with an Inactive Certification may submit a form to reactivate certification, along with prescribed fees. Reactivation will require a formal review by the USRC Certification Committee.

A professional may have their certification revoked according to Section 3 – Discipline. Professionals with a Revoked Certification must submit a new application for certification, along with prescribed fees, which will be reviewed by the USRC Certification Committee.

2.4 Certification Review Process

The USRC Certification Committee shall be responsible for approving the certification of Certified Rating Professionals and Certified Rating Reviewers. Applications for certification either as a CRP or a CRR shall be reviewed by USRC staff. Minor discrepancies in an application may be resolved by the applicant upon notification by USRC staff. Once an application is deemed complete it shall be forwarded to the Certification Committee.

The Certification Committee will review each application, considering completeness, conformance to expectations of the application and the references received. Committee members will endeavor to complete an application review within 45 days of receiving all required information, either by approving or rejecting the candidate. All applications shall be considered confidential and information will not be shared outside the Committee. Successful candidates will be approved by a majority of voting members. The USRC will notify the applicant in writing of the approval or rejection of certification. If the application is rejected, reasons for the rejection will be provided. Application fees are non-refundable.

3 Discipline

Discipline may be considered under the following circumstances: if a CRP's certification has lapsed or is inactive, and the professional submits a building evaluation for a rating; the USRC is made aware that a CRP or CRR may have misrepresented him or herself on their certification application; or a written complaint is lodged with the USRC about the performance of a CRP or a CRR *with respect to USRC policies*.

The first time a CRP with a lapsed or inactive certification submits a building for evaluation, the USRC shall warn the professional and notify the owner applicant that the rating application will not

be considered until the professional's certification becomes active. The second time a CRP with a lapsed or inactive certification submits a building for evaluation, the USRC shall revoke the professional's certification, and notify the owner applicant that the application has been disqualified.

Disciplinary action shall be warranted in the following cases: if the CRP or CRR has misrepresented him or herself on their application for certification; or if the professional has been found to have violated the USRC policy of conduct.

Disciplinary action by the USRC will not be reported to state licensing boards and is not meant to affect the engineer's ability to practice engineering as his or her license permits.

3.1 The Discipline Committee

The Discipline Committee shall consist of 3 licensed engineers and 3 non-engineering professionals within the resiliency industry. The USRC Executive Director shall serve as an ex-officio non-voting member of the committee.

3.2 Discipline Process

If the USRC receives a written complaint about a certified professional, either from an individual or an entity, the Executive Director and one other committee member will review it and determine whether the complaint warrants review by the entire committee, or if it is generally without merit. The USRC shall forward complaints warranting review by the full committee to each committee member. Committee members will endeavor to complete a disciplinary review within 60 days.

Two committee members will be selected to contact the entity or individual filing the complaint, and separately, the professional against whom the complaint was filed, to request information regarding the complaint for consideration by the Discipline Committee.

The committee will meet by conference call to discuss the complaint and vote on disciplinary action. All information with respect to disciplinary action shall be considered confidential, and information will not be shared by committee members with anyone, except as required by law.

At least four committee members must agree on the disciplinary action to be taken against the professional. Disciplinary action may consist either of a warning or revocation of certification. Professionals who have been disciplined will be notified by the USRC along with the reasons for the disciplinary action. Disciplinary action will take effect 15 days after the professional has been notified unless an appeal is made. In the event of an appeal, disciplinary action shall be tabled until the appeal is resolved.

Professionals who have had their certification revoked will be removed from the active list of certified professionals maintained by the USRC and which is posted on the USRC website. A confidential list of engineers with a revoked certification will be maintained by the USRC.

If a professional's certification is revoked, building evaluations currently pending before the USRC that have been submitted by the professional will be rejected.

4 Appeals of certification denial or disciplinary action

This section refers only to appeals of certification denial or of disciplinary action. Appeals of a rating provided by the USRC for a building evaluation is described in Section 5. An applicant whose certification application has been denied, or a CRP or CRR who has been disciplined by the USRC, shall have 15 business days to request an appeal from the date they are notified by the USRC. The appeal shall be made in writing to the USRC Executive Director. The reasons for the appeal shall be clearly stated in the appeal letter.

An Appeals Committee consisting of the Executive Director, one member of the Certification or Discipline Committees (*whichever is not the subject of the appeal)* and one USRC Board member shall consider appeals. The Appeals Committee shall review the appeal, and conduct independent phone conversations with the appellant and one member of the committee that is the subject of the appeal, to gather further information.

The Appeals Committee shall vote to either uphold or deny the appeal. A majority vote is required. The USRC will notify the appellant of its decision within 15 business days of the appeal. The decision of the Appeals Committee is final.

5 Appeals of ratings

This section is under development.

APPENDIX C
RATING REVIEW PROCEDURES

1 Introduction

The evaluation procedures used to determine the USRC Transaction and Verified Building Ratings performed by a USRC Certified Rating Professional (CRP) are subject to an independent Technical Review, and in some cases, an Elevated Review by a USRC Certified Rating Reviewer (CRR). The review is an essential part of the building rating system and helps to ensure that an appropriate and consistent standard of care is adhered to for all building performance assessments.

Reviews are intended to validate a rating and the appropriate application of rating system methodologies, not to be a comprehensive re-verification of all criteria, analysis, design procedures and calculations undertaken by the qualified USRC CRP. In cases where a project submittal has undergone prior qualified peer reviews, the USRC Rating Review Committee (RRC) may waive certain additional Elevated Technical Review requirements as noted herein.

The Technical Review will include a review of available construction documents, information on the condition of the building, structural design criteria, analytical models and any reports prepared by the CRP.

This manual has been prepared by USRC committees and approved by the USRC Board of Directors. document that will undergo updates, revisions and expansion as the USRC determines necessary. Users of the document should regularly check the USRC website (www.usrc.org) for updates.

2 Levels of Technical Review

2.1 Transaction Rating

The first Transaction Rating from a CRP will be technically reviewed and then every 1 in 7 Transaction Ratings, randomly selected, will be subjected to a technical review.

If a serious discrepancy is found as a part of a technical review it will be referred to the Rating Review Committee (RRC) for disposition. The RRC will have the authority to review prior ratings (at USRC expense) and/or require technical review of up to the next 5 ratings from that CRP at the CRP's expense. If egregious gaming of the system is deemed to have occurred, the RRC may at its discretion, refer the CRP to the Discipline Committee for loss of their Certification subject to USRC policies on disciplinary action and appeals.

2.2 Verified Rating

All Verified Ratings will be technically reviewed. Those defined in Section 4 will be subjected to an elevated review.

3 Technical Review

As a minimum, the following design information will be assessed as part of a Technical Review:

3.1 Basic Review for Both Methodologies

- The building description (gravity framing system, building cladding, building use), including number of stories, plan dimensions, and configurations
- The configuration and detailing of the seismic force resisting system
- The building site characteristics, geotechnical report including geological hazards
- Review of building drawings or information of equal utility
- Comparison of the rating with similar buildings in the USRC database

3.2 ASCE 41 Based Evaluation

- Photographs of the building plus date of site visit
- Review of Tier 1 check list items
- Review of check list items where engineering judgement or a Tier 2 check was used to change a non-compliant item to compliant
- Review of the translation from the checklist to the rating Review of Tier 1 check list items

3.3 FEMA P58 Based Evaluation

- FEMA P-58 Input/Analysis Items (See list in table of Section 6).

4 Elevated Review

An elevated (more detailed) technical review of the evaluation methodology, associated calculations and rating translation will be required for the following buildings noted below for all Verified Ratings. Many of these projects may have had a code or owner mandated peer review. If key components of a USRC elevated review have been peer reviewed prior to the Rating submittal, the USRC Rating Review Committee (RRC) may move the project from an Elevated Review into the Technical Review category. Buildings requiring an elevated review are:

- Buildings with a Rating of 4 or 5 stars in any dimension
- Buildings defined by current code level Risk Category Type III and IV
- Vulnerable building types that have a three star or greater Safety rating
  - Unreinforced masonry
  - Reinforced concrete buildings designed pre-1985 UBC
  - Soft / Weak Story Buildings as defined by ASCE 41 standard
  - Steel Moment Frame Buildings designed pre-2000, unless the pre-Northridge connection issue has been addressed
  - Other known non-ductile framed systems

Buildings that have a three star or greater Safety rating with significant geologic site hazards as determined from USGS or CDMG maps, or site-specific geotechnical investigations

- Liquefaction
- Slope Failure
- Surface Fault Rupture

Other unusual systems defined as any building that is not one of the common building types defined in ASCE 41 or would not qualify to be evaluated using the Tier 1 procedure in ASCE 41.

The following items will be included as part of an Elevated Review in addition to those requirements for a Technical Review.

4.1 Prior Peer Review

If all of the following key components have been peer reviewed prior to the Rating submittal, the USRC Rating Review Committee (RRC) may move the project from an Elevated Technical Review into the Technical Review category. Sufficient documentation demonstrating the extent of prior peer review shall be included in the submittal.

- Review of the drifts and floor accelerations from analytical models (if response history analysis used)
- Review of the site specific hazard report and a comparison with USGS spectra (if site-specific done)
- Review of time histories (if response history analysis used)
- Review of liquefaction report and associated analyses (if applicable)
- Review of landslide/slope stability report and associated analyses (if applicable)

4.2 ASCE 41 Based Evaluation

Review of Technical Review items plus the following:

- Review of building drawings and geotechnical reports or information of equivalent utility
- Detailed review of key Tier 2 & 3 ASCE 41 checks to resolve non-compliant items
- Review of the translation and where engineering judgement was used

4.3 FEMA P58 Based Evaluation

Review of Technical Review items plus the following:

- FEMA P-58 Input/Analysis Items (See spreadsheet list). All colored cells on the spreadsheet
- Other elevated review triggers

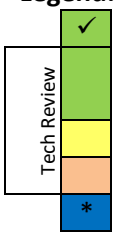
5 Technical Reviewer's Report

The certified reviewer shall prepare a brief standardized report that covers the review performed and the appropriateness of the submitted rating. The format of this report is under development.

6 FEMA P58 Evaluation review checklist

USRC Review Requirements for P-58 Analyses (rough draft for review and comment)
Draft by C.B. Haselton and D. Cook (HB-Risk employee)
Last Updated: July 6, 2015

Legend:



Item needs no review.
Item needs only basic review (needs review when default values are overridden, need to ensure that the inputs are in agreement with the building, etc.).
Item needs moderate review.
Item needs careful review.
Elevated review required.

Note: These are technical review requirements specific to the FEMA P-58 Methodology and there may be additional requirements laid on top of these by the overall USRC process. For example, the overall USRC procedure may require that Risk Category III-IV buildings have an elevated review, but this is more an administrative decision that a technical requirements specific to the FEMA P-58 procedure, so this would not be marked as requiring elevated review in this file).

Note: This presumes that 4-5 star buildings will already require elevated review; if this does not end up being the case, then please see the more detailed table for more information.

Basic Building and Site Information:

	FEMA P-58 Input/Analysis Item
	Building structural system type
	Design year / Code year
	Number of stories
	Story height
	Total building square footage
	Building occupancy type
	Risk Category
	Building replacement cost (if overwritten; if the P-58 subcommittee creates default values to use here)
	Total loss threshold
	Regional cost multiplier
	Date cost multiplier
--	Effective Periods (see site hazard and simplified method sections)

Analysis Options:

	FEMA P-58 Input/Analysis Item
	Number of Realizations

Site Hazards:

	FEMA P-58 Input/Analysis Item
	Period for hazard analysis (just to ensure consistency with use in Simplified Method, not way off from building period).
	Site Class (if USGS default is overridden)
✓	Site Hazard Curve: USGS default option
	Site Hazard Curve: User-input hazard option (compare to USGS curve) (note that probably already peer reviewed and limited to code 80%; likely require this 80% cap without elevated review).

Structural Responses:

	FEMA P-58 Input/Analysis Item
	Simplified Method Option: Effective building periods
	Simplified Method Option: Vy (important for accel.)
	Simplified Method Option: DeltaY (important for residual)
✓	Simplified Method Option: Drift/PFA/Residual responses
	Any handling of irregularities in the simplified responses predictions
*	RHA Option: Ground motion selection and scaling
*	RHA Option: Modeling for the RHA
*	RHA Option: Sanity check of structural responses

Collapse Capacity and Behavior, and Residual Drift Capacity:

	FEMA P-58 Input/Analysis Item
	FEMA P-154 Checklist
	Collapse fragility curve (comes from FEMA P-154, so only if overwritten)
	Collapse modes (will be made an input, but should some from FEMA P-154)
	Building population model (will be made an input, only needs review is differs from P-58 defaults)
	Building residual drift capacity (median and beta)

Building Structural and Non-Structural Components:

	FEMA P-58 Input/Analysis Item
	Building Contents: Building information inputs that are used for the pre-populations.
	Building Contents: Auto-populated values
	Building Contents: Input capacities for non-structural components requiring inputs (computed using ASCE7 Chp. 13)
	Building Contents: User-overrides to default component types and quantities
*	Completely new user-defined fragilities (if done)

APPENDIX D - ASCE 41 BASED EVALUATION METHODOLOGY

The Structural Engineers Association of Northern California (SEAONC) granted the USRC permission to use the work and property described in the SEAONC Earthquake Performance Rating System (EPRS) that are specifically related to the use of ASCE 41-13, in the development of a USRC Rating System. Any differences between this USRC document and related SEAONC documents are solely the work of the USRC and do not reflect any opinion, endorsement, or approval by SEAONC. The SEAONC EPRS users guide and ASCE 41-13 translation procedures can be viewed at these links:

https://cdn.ymaws.com/www.seaonc.org/resource/resmgr/bookstore/free_publications/earthquake_performance_users.pdf

https://cdn.ymaws.com/www.seaonc.org/resource/resmgr/bookstore/free_publications/eprs_asce_41-13_translation_.pdf

The translation below is intended for use with the SEAONC EPRS. Any adjustments that may be needed to apply this methodology to USRC Rating definitions are solely the responsibility of the Certified Rating Professional. The Dimensions and Definitions used by the USRC may differ in specific wording from those contained in the SEAONC documents, however the user will apply a direct translation from the USRC-adopted translation procedure to the USRC Rating System as described below:

SEAONC EPRS Dimension	USRC Rating Dimension		SEAONC EPRS Star Rating	USRC Rating
Safety	Safety		5 star 4 star 3 star 2 star 1 star	4 star* 4 star 3 star 2 star 1 star
Repair Cost	Damage		5 star 4 star 3 star 2 star 1 star	4 star* 4 star 3 star 2 star 1 star
Recovery	Recovery		5 star 4 star 3 star 2 star 1 star	4 star* 4 star 3 star 2 star 1 star

* A more advanced analysis than one based on ASCE 41 procedures is necessary to achieve a USRC 5-star safety, damage or recovery rating. Refer to Appendix E, FEMA 58 Evaluation Methodology.

The SEAONC EPRS is currently the only USRC accepted methodology to determine the safety rating based on ASCE 41. The engineer developing a USRC Rating may opt to perform a custom repair cost and recovery time evaluation using either ST-RISK, HAZUS or FEMA P58 and substitute the USRC damage and recovery dimension ratings with values obtained from these methodologies.

APPENDIX E
FEMA P58 BASED RATING METHODOLOGY

Compiled by C.B. Haselton, B. McDonald, and Casey Champion
Last Updated August 13, 2015

1 Methodology Basis

Where the USRC building rating approach is based on the FEMA P-58 methodology (FEMA 2012), as documented in the September 2012 reports on the topic (ATC 2011). The FEMA P-58 approach is supplemented with use of FEMA 154 (FEMA 2015) to estimate the needed input collapse capacity information, as described later in this document. Additionally, for the Recovery Time dimension, the FEMA P-58 approach is supplemented by the REDi Functional Recovery Time methodology (Almufiti and Willford 2013). The USRC Building Rating should be completed in accordance with the requirements of the FEMA P-58 methodology and the requirements of this document.

2 Rating Acceptance Criteria

The third column of the following three tables provides the numerical acceptance criteria for achieving various USRC rating levels using the FEMA P-58 assessment methodology.

Safety Rating Criteria

Rating	Expected Safety Performance	Detailed FEMA P-58 Rating Methodology Criteria
*****	**Injuries and blocking of exit paths unlikely** Expected performance results in conditions unlikely to cause injuries or to keep people from exiting the building.	The requirements shall be met for 4-star. The likelihood of a building occupant being fatality injured, considering both building collapse and other non-collapse falling hazards, is less than 0.00003 for a 475-year event. Egress routes are expected to be intact, with the building meeting the specific requirements below for a 475-year event.
****	**Serious injuries unlikely** Expected performance results in conditions that are unlikely to cause serious injuries.	The likelihood of a building occupant being fatality injured, considering both building collapse and other non-collapse falling hazards, is less than 0.0001 for a 475-year event. The likelihood of a building occupant being injured, considering both building collapse and other non-collapse falling hazards, is less than 0.02 for a 475-year event.
***	**Loss of life unlikely** Expected performance results in conditions that are unlikely to cause loss of life.	The likelihood of a building occupant being fatally injured, considering both building collapse and other non-collapse falling hazards, is less than 0.0004 for a 475-year event.

**	**Loss of life possible in isolated locations** Expected performance results in partial collapse or falling objects which have a potential to cause loss of life at some locations within or around the building.	The likelihood of a building occupant being fatally injured, considering only building collapse, is less than 0.004 for a 475-year event. Fatalities due to falling hazards are not considered.
*	**Loss of life likely in the building** Expected performance results in building collapse which has a high potential for deaths of people who are in or around the building.	The building was evaluated but did not meet the 2-star rating criteria.

For egress route being intact for a 5-star safety rating, the following are the specific requirement for egress routes for a 475-year ground motion:

- Stairs are expected to be functional, with either of the following requirements being met:
- Stairs shall be shown to have less than 5% chance of losing live-load carrying capacity (at the worst-case story).
- Stairs and ramps that are not integral with the structural system shall be detailed to accommodate the seismic relative displacements according to ASCE 7 Section 13.3.2. Stairs and ramps that are integral with the structural system shall be designed with the overstrength factor of the seismic force-resisting system, but not less than 2.5.
- Components in egress routes are shown to have a small chance of falling and impeding egress (with not more than 5% probability on average over all egress routes). At least the following list of such items must be assessed.
  - Ceilings shall be shown to have a small chance of total grid collapse.
  - HVAC ducting shall be shown to have a small chance of ducting dropping from the ceiling.
  - Piping along egress routes which contain hazardous materials shall be shown to have a small chance of leaking.
  - Parapets over egress routes shall be shown to have a small chance of collapse.
  - Doors are expected to be functional; mean residual story drifts shall be less than 0.0025; alternatively, egress doors shall be capable of accommodating the mean peak interstory drift.

Masonry partitions around stairs or other egress routes are not permissible unless capable of reliably accommodating the mean drift and acceleration demands.

Damage Rating Criteria

Rating	**USRC Damage Rating**	**Detailed FEMA P-58 Rating Methodology Criteria**
*****	**Minimal Damage** Repair Cost likely less than 5% of building replacement cost	The mean repair cost in a 475-year event is less than 5% of building replacement cost
****	**Moderate Damage** Repair Cost likely less than 10% of building replacement cost.	The mean repair cost in a 475-year event is less than 10% of building replacement cost.

***	**Significant Damage** Repair Cost likely less than 20% of building replacement cost.	The mean repair cost in a 475-year event is less than 20% of building replacement cost.
**	**Substantial damage** Repair Cost likely less than 40% of building replacement cost.	The mean repair cost in a 475-year event is less than 40% of building replacement cost.
*	**Severe Damage** Repair Cost likely greater than 40% of building replacement cost.	The mean repair cost in a 475-year event is greater than or equal to 40% of building replacement cost.
NE	**Not Evaluated** Repair Cost has not been evaluated.	

Recovery Rating Criteria

Rating	USRC Recovery Rating	Detailed FEMA P-58 Rating Methodology Criteria (using REDi Functional Recovery Time)
*****	**Within hours to days.** The expected performance will likely result in people being able to quickly re-enter and resume use of the building from immediately to a few days, excluding external factors.	The median recovery time after a 475-year event is less than 5 days.
****	**Within days to weeks.** The expected performance may result in delay of minimum operational use from days to weeks, excluding external factors.	The median recovery time after a 475-year event is less than 4 weeks.
***	**Within weeks to months.** The expected performance may result in delay of minimum operational use from weeks to months, excluding external factors.	The median recovery time after a 475-year event is less than 6 months.
**	**Within months to a year.** Expected performance may result in delay of minimum operational use from for months to a year.	The median recovery time after a 475-year event is less than one year.
*	**More than a year** Expected performance may result in delay of minimum operational use for at least one year or more.	The median recovery time after a 475-year event is greater than one year.
NE	**Not Evaluated** Time to Regain Basic Function has not been evaluated.	

3 Use of FEMA 154 for Estimating the Building Collapse Capacity

3.1 Overview

When using the FEMA P-58 methodology to determine the building ratings, a collapse fragility curve is a required input, and this building performance metric is not something that most engineers are accustomed to estimating. Accordingly, the USRC P-58 rating process utilizes the FEMA 154 checklist method to estimate the collapse fragility curve for a building. This collapse fragility curve affects the results for all rating dimensions, but especially influences the results for the Safety dimension. Note that the development of the detailed P-58 Safety rating criteria and the associated threshold values are predicated on this use of the FEMA 154 methodology to estimate the building collapse fragility curve. Further background on the development of the Safety dimension acceptance criteria is discussed in subsequent sections.

Process and Allowable Default Values when using the FEMA 154 Approach to Estimate the Building Collapse Capacity

This section documents the process by which the rater can use FEMA 154 to estimate the collapse fragility curve for the building. Note that the Safety dimension acceptance criteria have been calibrated to the use of FEMA 154, so this approach should be used to estimate the collapse fragility. It should also be noted that the use other methods to estimate the collapse fragility, such as incremental dynamic analysis or referenced values in ASCE 7, could lead to highly conservative estimates of the Safety rating. The FEMA 154 results tend to lead to lower collapse probabilities than some other common methods and other methods should be used with caution when completing a USRC rating (e.g. it would be very conservative to just assume a 10% collapse probability at the MCE_R for a new Risk Category II building).

The first step to estimating the building collapse capacity using FEMA 154 is to complete the checklists and compute the resultant "score" (S value) for the building. A Level 2 checklist should be used in this evaluation process. The S score provides the means to calculate a probability of "collapse" for an MCE_R ground motion, in accordance with the equation below. Note that the FEMA 154 definition of collapse (shown here as "collapse") is not equivalent to the actual collapse probability of the building. The probability of "collapse" used in FEMA 154 is the probability of total or partial collapse multiplied by the ratio of the building area affected by the collapse. In other words, the FEMA 154 definition of "collapse" probability is the likelihood of a collapse occurring and affecting a specific individual at a specific location in the building. Therefore, a conversion is needed when estimating the actual collapse fragility curve input for the FEMA P-58 methodology.

$$P[\text{"Collapse"}|MCE_R] = 10^{-S}$$

In order to convert the P["Collapse"|MCE_R], as defined in FEMA 154, to a P[Collapse | MCE_R] that can be used to estimate the collapse fragility curve used in the FEMA P-58 methodology (without the FEMA 154 area ratio normalization), an assumption of the collapse area ratio is required for the type of building being rated. Allowable default values of the collapse area ratio are provided in the table below for various types of buildings. These allowable default values were developed using the collapse factor values given for each system in FEMA 155 Table A-11 (2015), which combine

the collapse area ratios with the probability that collapse occurs when the building is in a HAZUS damage state five. In short, the default collapse area ratios in Table 1 indicate a partial building collapse that affects approximately 1/3 of wood buildings or 1/2 of steel buildings, and complete building collapse for concrete systems.

Table 1. Allowable Default Collapse Area Ratios by FEMA Building Type

Collapse Area Ratios by FEMA Building Type																
W1	W1a	W2	S1	S2	S3	S4	S5	C1	C2	C3	PC1	PC2	RM1	RM2	URM	MH
0.33	0.33	0.33	0.50	0.50	0.50	0.50	0.50	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.33

The above step provided an estimate for the P[Collapse | MCER] value and the only additional information needed to define the collapse fragility curve is the variability value β. The table below provides allowable default values by building type (from Table 8-1 of FEMA 155).

Table 2. Allowable Default Collapse Fragility Variability Values (lognormal standard deviations) by FEMA Building Type

Collapse Variability (β) FEMA Building Type																
W1	W1a	W2	S1	S2	S3	S4	S5	C1	C2	C3	PC1	PC2	RM1	RM2	URM	MH
0.55	0.55	0.58	0.61	0.59	0.60	0.59	0.56	0.70	0.47	0.60	0.70	0.89	0.73	0.73	0.60	0.52

The collapse fragility curve can now be computed using the resulting P[Collapse | MCE_R] and β values. In the FEMA P-58 analysis process, this collapse fragility curve should then be used in conjunction with a collapse mode that has a collapse area ratio, as defined in Table 1. Additionally, the fatality rate (likelihood of fatality for someone in the collapsed area of the building) is needed for the FEMA P-58 Safety rating calculations. Allowable default rates are provided below in Table 3. These allowable defaults come from Table 3 of the FEMA P-58 Background Document 3.7.8 (2012) and the Hazus Technical Manual (ref).

Table 3. Allowable Default Fatality Rates by FEMA Building Type

Fatality Rate by FEMA Building Type																
W1	W1a	W2	S1	S2	S3	S4	S5	C1	C2	C3	PC1	PC2	RM1	RM2	URM	MH
0.01	0.01	0.01	0.11	0.11	0.11	0.11	0.24	0.12	0.11	0.24	0.11	0.11	0.11	0.11	0.43	0.05

3.2 Extension of FEMA 154 with Scores for Enhanced Performance

The FEMA 154 checklist methodology was developed for rapid visual screening of buildings for potential seismic hazards. The checklist statements are tailored to identify building attributes that may contribute to poor seismic performance, such as irregularities. However, in its current form, the methodology does not capture the enhanced performance of buildings that were designed for larger seismic forces (i.e. Risk Category III and IV buildings) or buildings that incorporate base isolation.

Additional checklist statements have been added to the FEMA 154 screening tool that offer the opportunity to increase the estimated collapse capacity for buildings with enhanced seismic

performance. Risk Category III and IV benchmark buildings will have an additional score modifier applied that adjusts the calculated collapse capacity. Similarly, seismically isolated buildings have a separate score modifier included in the FEMA 154 assessment (not to be used in conjunction with the Risk Category III or IV modifiers).

The score modifiers for enhanced performance were developed by the USRC FEMA P-58 Subcommittee and are as follows:

Risk Category III structure: S = +0.4 (computed based on an expected shift in mean collapse capacity by a factor of 1.25).

Risk Category IV Structure: S = +0.8 (computed based on an expected shift in mean collapse capacity by a factor of 1.5).

Seismically isolated structure: S = +0.8 for structures complying with the gap requirements of ASCE 7-10 (S score estimated based on judgment).

Additionally, the following modifications and interpretations of the FEMA 154 checklists are allowable. If any of these modifications are utilized, the basis should be well documented and will be subject to review.

The retrofit score modifier in FEMA 154 only allows for either “no retrofit” or a “comprehensive building retrofit.” In the use of the FEMA 154 method, if a partial retrofit has been completed, it is allowable to remove the checklist deficiencies that were addressed by the retrofit.

If the retrofit meets performance objectives beyond 75% of new code, then it may be allowable to use the full basic score increase as if the building is a post-benchmark building.

If it can be demonstrated that a checklist item does not result in a reduction to the performance of a building, or if the item was properly accounted for in the original design (e.g. plan irregularity), it is allowable to remove the score reduction for this checklist item.

For building properties that are not reflected in the FEMA 154 checklist, engineering judgement can be used to provide modifications to the resulting collapse fragility curve. If this is done, then the rating will be subjected to an Elevated Technical Review.

4 Background On Acceptance Criteria Development for the Safety Dimension

4.1 Overview

As outlined in the previous sections, the collapse fragility curve is estimated using the FEMA 154 approach. This section documents how the Safety dimension acceptance criteria were calibrated to be consistent with the FEMA 154 checklist approach.

4.2 Threshold Score Values

In development of the Safety rating acceptance criteria, the following is a summary of the required underlying score (S) values used as the basis for developing each criterion:

S > 3.0 for 5-star
S > 2.5 for 4-star
S > 2.0 for 3-star
S > 1.0 for 2-star

Approach to Converting the MCE_R Collapse Probability to a 10% in 50 year Motion Collapse Probability

The output of the FEMA 154 checklist methodology is a collapse probability for an MCE_R ground motion, as defined in ASCE 7-10 (ASCE 2010). However, the USRC building rating approach is instead based on a 10% in 50 year ground motion (475-year event). The ratio between the MCE_R and 10% in 50 year ground motion hazard levels is expected to be approximately 1.5 when the MCE_R is controlled by the 2% in 50 year hazard value. However, in near-fault and transition zone regions, the MCE_R is capped deterministically and can be much lower than the 2% in 50 year hazard value.

When completing the FEMA P-58 building evaluation, the collapse probability for an MCE_R ground motion is computed and used to estimate the building collapse fragility curve (as explained in the previous sections). In the analysis process, collapse probabilities at other seismic hazard levels (e.g. the 10% in 50 year motion) are simply computed from this fragility curve assuming a lognormal distribution.

To set the acceptance criteria for the Safety dimension for a 10% in 50 year ground motion, a conversion factor of **1.5** was used as the ratio between the spectral accelerations for the MCE_R and the 10% in 50 year ground motion hazard levels. Note the ratio of 1.5 does not accommodate all transition or near-fault regions where this ratio is less; buildings at such sites will often be required to achieve a higher FEMA 154 score (S) in order to meet a specific Safety rating. This approach is appropriate because, based on the current building code design approaches, the real risk is higher for buildings at near-fault and transition zone sites. Note, however, that the score (S) thresholds were reduced slightly to accommodate most code compliant buildings at transition zone sites earning a 3-star safety rating.

4.3 Thresholds for Fatalities

To create the threshold values for each Safety rating level, the fatality rate for a 10% in 50 year motion was computed for each building type using the assessment approach outlined in the previous sections on how to apply the FEMA 154 methodology. This includes the calculated building score (S), the default collapse area ratio for the building type (Table 1), the default collapse fragility variability value β for the building type (Table 2), the default fatality rate for the building type (Table 3), and the conversion from MCE_R to the 10% in 50 year motion.

Table 4 illustrates the results of these baseline calculations for each building type and the average values are shown in the rightmost column. These average values are used, with appropriate rounding, to establish the threshold fatality rates for each Safety rating level, as shown below. Note

that the total allowable fatality rate for the three-star levels (and higher) is increased by a factor of two to account for the fact that the acceptance criteria for these Safety rating levels includes both fatalities from collapse and fatalities from falling hazards (which were shown to be approximately equal contributors, on average, in the benchmarking studies).

- Total fatality rate less than 0.00003 for 5-star (with criteria for injury rates also imposed).
- Total fatality rate less than 0.0001 for 4-star (with criteria for injury rates also imposed).
- Total fatality rate less than 0.0004 for 3-star
- Collapse-only fatality rate less than 0.004 for 2-star

Table 4. Computed Baseline Fatality Rates by FEMA Building Type

	P[fatality of given occupant| 10% in 50 year] by FEMA Building Type																Avg.
Score / Rating	W1	W1a	W2	S1	S2	S3	S4	S5	C1	C2	C3	PC1	PC2	RM1	RM2	URM	
S = 3.0 (5-star)	8.2E-07	8.2E-07	9.5E-07	1.1E-05	1.0E-05	1.0E-05	1.0E-05	1.9E-05	1.5E-05	4.2E-06	2.0E-05	1.3E-05	2.2E-05	1.5E-05	1.5E-05	3.6E-05	1.3E-05
S = 2.5 (4-star)	3.4E-06	3.4E-06	3.9E-06	4.4E-05	4.0E-05	4.2E-05	4.0E-05	7.8E-05	5.6E-05	1.8E-05	7.9E-05	5.1E-05	7.9E-05	5.6E-05	5.6E-05	1.4E-04	4.9E-05
S = 2.0 (3-star)	1.5E-05	1.5E-05	1.7E-05	1.8E-04	1.7E-04	1.7E-04	1.7E-04	3.3E-04	2.2E-04	7.9E-05	3.2E-04	2.0E-04	3.0E-04	2.2E-04	2.2E-04	5.8E-04	2.0E-04
S = 1.0 (2-star)	3.5E-04	3.5E-04	3.7E-04	3.6E-03	3.5E-03	3.6E-03	3.5E-03	7.0E-03	3.8E-03	1.8E-03	6.0E-03	3.5E-03	4.5E-03	3.6E-03	3.6E-03	1.1E-02	3.7E-03

4.4 Thresholds for Injuries

The injury rate threshold for a 4-star safety rating was calibrated based on the results of a FEMA P-58 rating method benchmarking study completed by many members of the USRC Technical Advisory Committee. The results of this study are documented in Cook et al. (2015). The target injury rate to meet a 4-star Safety rating was set such that the post-benchmark buildings in the validation study would need additional anchoring of nonstructural components, above code-minimum requirements, in order to meet the selected threshold. Based on this approach, the required injury rate to achieve a 4-star Safety rating is **0.02**.

Note that the validation studies utilized the FEMA P-58 normative quantities, as documented in the FEMA P-58 publications (FEMA 2012) along with some modifications from ongoing work on the ATC-58 Phase II project. Based on these default quantities being used in the calibration, this calibrated injury threshold is somewhat dependent from these FEMA P-58 default quantity values (especially that of lighting quantities, which cause falling hazards).

4.5 Thresholds for 5-Star Egress

The 5-star Safety requirements for egress are documented in the previous acceptance criteria table. These thresholds were developed to ensure a high likelihood that egress out of the building will be possible after a 10% in 50 year earthquake ground motion.

5 Use of the REDi Methodology for Recovery Dimension

5.1 Overview

The Recovery Time dimension analysis is based on the REDi Functional Recovery Time estimation method. This USRC rating approach is based on REDi Version 1.1, which includes some slight refinements over REDi Version 1.0 and which will be published shortly in Earthquake Spectra.

In accordance with the definitions of the Recovery Time ratings, the rating is based on the Functional Recovery repair time and includes the building related impeding factors that may delay the start of the building repairs (i.e. all impeding factors other than off-site electric power). For consistency with the REDi method, the median (instead of mean) Recovery Time value is used for this dimension.

In the reporting for the rating certificate, the total Functional Recovery time should be reported, and also the breakdown should be reported for how much of the Functional Recovery time comes from repair versus impeding factors.

5.2 Allowable Default Values

It is allowable to use the REDi recommended default values for the REDi method inputs (e.g. numbers of expected workers in the building doing the repairs, etc.). For shorter buildings that have a large footprint area, the REDi default values for numbers of workers can be much lower than the FEMA P-58 recommended value of one worker per 1,000 square feet. In such cases, where the REDi default values result in fewer than one worker per 1,000 square feet, it is allowable to increase the worker numbers to be a minimum of one worker per 1,000 square feet.

5.3 Analysis requirements when Completing the FEMA P-58 Analysis

Ground Motion Hazard

It is allowable to use either USGS hazard values or the results of a site-specific analysis. However, any site-specific analysis must comply with the minimum design spectral response accelerations in accordance with ASCE 7.

Structural Responses

Any rational method can be used for estimating the building structural response (e.g. FEMA P-58 Simplified Method for buildings up to 15-stories, response-history analysis, etc.).

Building Contents

The FEMA P-58 method provides normative quantities for expected building non-structural components (based on building occupancy and building size) and similar pre-populated values can

be done for structural components based on basic layout information of the building. These default quantities can be used without modification for up through 2-star ratings. For 3-star ratings, the default building component inventory must be given at least a brief review by the analyst and modifications should be made if any items are substantially different from what is in the building. For 4-star ratings, the component inventory list should be given further scrutiny and for 5-star ratings the component inventory list should accurately reflect the components in the building.

Building Replacement Time

When estimating the Functional Recovery Time for the Recovery Time rating, the full building replacement time should be used for analysis realizations that results in collapse or high levels of residual drift that result in building demolition. The building replacement time can be determined using any rational method, but the following are pre-approved default building replacement time values that may be used, with linear interpolation between the values and linear extrapolation for buildings above 30-story.

- 1-story: 9 months
- 5-story: 18 months
- 30-story: 30 months

5.4 Consideration of Residual Drifts

Residual drifts can have a large impact on the results of a FEMA P-58 analysis for some building types. Residual drifts need not be included in the analysis for up through 3-star ratings (for consistency with similar analyses done for due-diligence applications) but residual drifts must be included in the analysis for any ratings above 3-star.

5.5 Review Requirements for a FEMA P-58 Analysis and Building Rating

The review requirements for a FEMA P-58 based rating are provided in separate documentation.

APPENDIX F
USRC DEVELOPMENT PARTICIPANTS

Technical Advisory Committee Subcommittees

Dimensions and Definitions	Hazard Level for the Rating System	Certification and Discipline Criteria
Mark Moore (Chair)	Marko Schontanus (Chair)	Evan Reis (Chair)
Grace Kang	Marguerite Bello	Ken O'Dell
Jon Heintz	Robert Merkel	Matt Barnard
Sharyl Rabinovici	Dick Dreyer	Jason Coray
Robert Merkel	Kelly Cobeen	Peggy Van Eepoel
Marguerite Bello	Russell Berkowitz	Mike Davies
Mike Cochran	Amir Gilani	Peter Lee
Peter Lee	Daniel Zepada	

ASCE 31/41 translation Methodology	FEMA P-58 Methodology	Time Limit and Disclaimer
Doug Hohbach (Chair)	Brian McDonald (Chair)	Kate Stillwell (Chair)
David McCormick	Bill Tremayne	Robert Merkel
Michael Braund	Curt Haselton	Ken O'Dell
Saif Hussain	Jon Heintz	Michael Cochran
Brian Kehoe	Marguerite Bello	Daniel Zepeda
Albert Chen	Ibbi Almufti	Bryan Seamer
Brian McDonald	Amir Gilani	Rob Hendrickson
	Roger Parra	

Rating Types and Technical Review	TAC Voting Procedures
Peter Lee (Chair)	Kelly Cobeen (Chair)
Curt Haselton	Michael Braund
Jason Coray	Ron Mayes
Ken O'Dell	
Robert Merkel	
Doug Hohbach	
Marko Schotanus	
Kate Stillwell	

Founding Member Subcommittees

Governance Committee	Founding Members Benefits	Board Nomination
Evan Reis (Chair)	Stacy Bartoletti (Chair)	Chris Rojahn (Chair)
Chris Rojahn	Bryan Seamer	Eric Von Berg
David Friedman	Kevin Moore	Ryan Kersting
Eric Von Berg	Henry Gallart	Kevin O'Connell
Michael Cochran	Saif Hussain	Doug Hohbach
Rob Hendrickson	Peter Lee	Janiele Maffei
Ryan Kersting	Peggy Van Eepoel	Mary Comerio
Sharyl Rabinovici	Dick Dreyer	
Kate Stillwell	Brian Kehoe	
	Bill Warren	

Stakeholders Advisory Committee

Barbara Harrison	FLASH
Bill Petak	Social Science
Cesar Medina	Nazca Construction Management
Dave Stivers	Principal Capital
Dick McCarthy	State SSC
Eileen Decker	LA City
Eric Corey Freed	Organic Architect
Gail Goldberg	Exec. Dir ULI - LA
Ines Pearce	Communications
Janice Olshesky	Architect
Janiele Maffei	CEA
Jay Raskin	Architect
Jeff Soulages	Intel - Oregon
Jim Clark	Apartment Association of Greater LA
Johanna Cunningham	Apartment Association of Southern Cities
John Bwarie	Communications
John Hussey	Rudolph Sletten
John Robbins	Tenant Advisory Group
Judith Mitrani-Reiser	Johns Hopkins
Laurence Kornfield	San Francisco City
Laurie Johnson	EERI - Public P0olicy
Lucy Arendt	Social Science
Lucy Jones	LA City - USGS
Mark Kroll, Andrew Hudacek	Sares Regis - Developer

Martha Cox-Nitikman	Dir. Public Policy - BOMA - LA
Michael Lingerfelt	Architect
Patrick Otellini	San Francisco City
Peter Herzog	National Asso. of Industrial and Office Parks- NAIOP
Philip Arnatou	Colliers International
Rob Hendrickson	Attorney
Robert McIntire	Nova Partners
Ron Lyn	Building Dept. Clark County Nevada
Sharyl Rabinovici	Social Science/Public Policy
Sorrel Hanson	Marsh McLellan - Insurance
Stacey Lee	San Francisoc City
Steven Saunders	Contactor
Terry Brown	Architect
Thalia Polychronis	LA City
William Moor	Boeing
John Mohle	Clark Pacific - Contactors