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AnAmerican National Standard

Standard Practice for Probable Maximum Loss (PML) Evaluations for Earthquake Due-Diligence Assessments[1,2]

This standard is issued under the fixed designation E2557; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This practice establishes standard-of-care for evaluation and classification of the financial risks from earthquake damage to real estate improvements for use in financial transactions. As such, this practice permits a user to satisfy, in part, their real estate transaction due-diligence requirements with respect to assessing and characterizing a property's potential losses from earthquakes. This practice is intended to address only physical damage to the property from site and building response.

1.1.1 Hazards addressed in this practice include earthquake ground shaking, earthquake-caused site instability, including faulting, subsidence, settlement landslides and soil liquefaction, earthquake-caused tsunamis and seiches, and earthquake-caused flooding from dam or dike failures.

1.1.2 Earthquake-caused fires and toxic materials releases are not hazards considered in this practice.

1.1.3 This practice does not purport to provide for the preservation of life safety, or prevention of building damage associated with its use, or both.

1.1.3.1 This practice does not address requirements of any federal, state, or local laws and regulations of building construction or maintenance. Users are cautioned that current federal, state, and local laws and regulations may differ from those in effect at the times of construction or modification of the building(s), or both.

1.1.3.2 This practice does not address the contractual and legal obligations between prior and subsequent Users of PML reports or between providers who prepared the report and those who would like to use such prior reports.

1.1.3.3 This practice does not address the contractual and legal obligations between a provider and a user, and other parties, if any.

1.1.4 It is the responsibility of the owner of the building(s) to establish appropriate life-safety and damage prevention practices and determine the applicability of current regulatory limitations prior to use.

1.2 Considerations not included in the scope: the impacts of damage to building contents, loss of income(s), rents, or other economic benefits of use of the property, or from legal judgments, fire sprinkler water-induced damage or fire.

1.3 The values stated in inch-pound units are to be regarded as standard. The values given in parentheses are mathematical conversions to SI units that are provided for information only and are not considered standard.

2. Referenced Documents

2.1 *ASTM Standards:*[3]

E2026 Guide for Seismic Risk Assessment of Buildings

2.2 *Other Standards:*[4]

UBC-97 Unifrom Building Code, 1997 Edition

International Building Code 2006 Edition

2.3 *ASCE Standards:*[5]

ASCE 7 Minimum Design Loads for Buildings and Other Structures

ASCE 31 Seismic Evaluation of Existing Buildings

ASCE 41 Seismic Rehabilitation of Existing Buildings

3. Terminology

3.1 See also definitions in Guide E2026.

3.2 *DBE, n*—Design Basis Earthquake, as defined in Guide E2026.

3.3 *lateral load-resisting system, n*—Lateral Load Resisting System, as defined in Guide E2026.

3.4 *MCE, n*—Maximum Capable Earthquake as defined in Guide E2026.

3.5 *PML, n*—Term historically used to characterize building damageability in earthquakes.

[1] This practice is under the jurisdiction of ASTM Committee E06 on Performance of Buildings and is the direct responsibility of Subcommittee E06.25 on Whole Buildings and Facilities.

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[3] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

[4] Available from International Organization for Standardization (ISO), 1 rue de Varembé, Case postale 56, CH-1211, Geneva 20, Switzerland, http://www.iso.ch.

[5] Available from American Society of Civil Engineers (ASCE), 1801 Alexander Bell Dr., Reston, VA 20191, http://www.asce.org.

3.5.1 *Discussion*—Probable maximum loss, shall be defined by the user from SL or PL values using definitions of Guide E2026. For SL-based measures include in the report the specified earthquake or ground motion for which it is to be evaluated and stipulate whether it is an expected value (SEL) or upper value (SUL). For PL-based measures, the return period for non-exceedance shall be specified, or the probability of exceedance in a given time period provided.

3.6 *probable loss (PL), n*—Probable Loss as defined in Guide E2026.

3.6.1 *Discussion*—When there are multiple buildings in the seismic risk assessment, then the damageability values for the group of buildings is to be determined as specified in Guide E2026.

3.7 *provider, n*—organization and individual that completes the seismic risk assessment.

3.8 *scenario loss (SL), n*—As defined in Guide E2026.

3.8.1 *Discussion*—When multiple buildings are in the seismic risk assessment, then the SL for the group of building is to be determined as specified in Guide E2026.

3.9 *SEL, n*—As defined in Guide E2026.

3.9.1 *Discussion*—When there are multiple buildings in the assessment then the SEL for the group of buildings is to be determined as specified in Guide E2026.

3.10 SEL_{DBE}, *n*—The scenario expected loss due to the occurrence of DBE site ground motions.

3.11 SEL_{MCE}, *n*—The scenario expected loss due to the occurrence of MCE site ground motions.

3.12 *significant damage, n*—Damage costs that exceeds five percent of the replacement cost of construction for the building caused by site failure from soil liquefaction, landsliding, or other earthquake-induced site response other than shaking. Damage cost for this purpose includes the cost of the site topography away from the building.

3.12.1 *Discussion*—Conditions resulting from lack of routine maintenance, miscellaneous repairs, operating maintenance, and so forth are not considered a deficiency. The damage is not significant if it does not affect the structural elements of the building because the movement is not substantial or the foundation is resistant to settlement-induced damage. Damage limited to underground utilities or slabs on grade is not significant.

3.13 *SUL, n*—As defined in Guide E2026.

3.13.1 *Discussion*—When there are multiple buildings in the assessment then the SUL for the group of buildings is to be determined as specified in Guide E2026.

3.14 SUL_{DBE}, *n*—The scenario upper loss due to the occurrence of DBE site ground motions.

3.15 SUL_{MCE}, *n*—The scenario upper loss due to the occurrence of MCE site ground motions.

3.16 *third party, n*—A technically qualified individual and organization that has not been engaged in the design or modifications of the building(s), and is not part of the due-diligence team that provided the earthquake loss assessment.

4. Summary of Practice

4.1 The objectives of this practice are as follows:

4.1.1 To synthesize and document good commercial practice for the determination and rating of seismic risk for buildings.

4.1.2 To facilitate standardization of earthquake risk evaluation terminology for financial transactions.

4.1.3 To establish an industry standard for the requirements to evaluate the financial risk for real estate.

5. Significance and Use

5.1 This practice is intended for use as a voluntary standard by parties who wish to undertake the seismic risk assessment of properties. The goal is for users to objectively and reliably compare the financial risks of earthquake damage to buildings, or groups of buildings, on a consistent basis.

5.2 This practice is designed to provide requirements for the evaluation of earthquake damage risk so that technical reports prepared for the evaluation and rating of seismic risk of a building(s) will be adequate for use by other entities. Potential users including, but are not be limited to, those making equity investments, lending, and financial transactions, including securitized mortgage lending by mortgage originators, loan servicers, underwriters, rating agencies, and purchasers of bonds secured by the real estate.

5.3 The use of this practice may permit a user to satisfy, in part, their requirements for due diligence in assessing a property's potential for losses associated with earthquakes for real estate transactions.

6. Due-Diligence Investigation

6.1 The site stability, building stability and building damageability of the property shall be assessed.

6.2 The user shall specify the condition of the property to be evaluated. The seismic performance can be evaluated for the property in its current condition, or as changed by proposed modification of the seismic response of the soils supporting the building or a proposed seismically retrofitted condition of the building(s) or its sections, or both.

6.2.1 The proposed seismic modifications of the site must be sufficiently described to allow evaluation of the modifications by an independent qualified party.

6.2.2 The proposed seismic modifications of the building systems must be sufficiently described to allow evaluation of the modifications by a qualified third party.

6.3 The Guide E2026 level of investigation shall be specified by the user. The same level of investigation should be performed for each type of the seismic risk assessment. Appendix X1gives guidance on the setting of the level of investigation.

6.4 The qualifications of the provider shall be specified as required for the level of investigation specified in 6.3 by Guide E2026. The qualifications level must be equal to or higher than the corresponding level specified in 6.3. Appendix X1 gives further guidance on the setting of minimum qualifications.