Proposed New Standard Practice for Probable Maximum Loss (PML) Evaluations for Earthquake Due-Diligence Assessments — WK12372

Transmittal for Ballot Items to ASTM Subcommittee E06.25 on Whole Buildings and Facilities

August 10, 2006

To:	Members of ASTM Subcommittee E06.25 on Whole Buildings and Facilities Additional members of Task Group E06.25.82 on Maximum Probable Loss
Copy to:	Charles Thiel, Task Group Co-Chair David McCormick, Task Group Co-Chair
From:	Gerald Davis, Subcommittee Chair, E06.25 on Whole Buildings and Facilities
Subject:	Comments and notes on document from E06.25.82 for Subcommittee Ballot

1. The document identified first above has been transmitted to ASTM to be balloted as Subcommittee level. Please do vote, whether you vote affirmative, negative or abstain. For a valid ballot action, 60% of those eligible to vote must do so, and of those who vote affirmative or negative (that is, who do not abstain) two thirds must vote affirmative.
2. Many thanks to Chuck Thiel, the principal author both of the original E2026 and the current two proposed standards. Thanks also to his co-chair, David McCormick, who has collaborated and helped the process along this year. Appreciation also to the members of the task group E06.25-82 and to the Mortgage Bankers Association, which hosted a team of active contributors to this effort with many telephone conference meetings with increasing frequency and duration, culminating in extended daily meetings in the last days.
3. In Section 2.1, Referenced documents, this ballot item shows the proposed new title of E2026, and not the year nor the title of E2026-99. This reflects the hope that the revision of E2026 will be approved without delay. If the official version of E2026 has not changed at the time that XA is balloted at the E06 main committee level, then the reversion to the prior title will be done automatically.
4. In Section 3, Terminology, building contents are excluded from the evaluations considered for Commercial Mortgage Backed Securities and other financial transactions about loans, because most mortgages secured by a building do not cover building contents, which are the property of the occupant or tenant, which often is not the building owner.

5 Requirements for the Relying Agent to certify that the Provider's report meets the requirements of XA and E2026 to the best of their knowledge has been deleted. Although the idea has some merit there were issues that could not be resolved so that the process would achieve its intended purpose.

ASTM XA: New Work Item WK12372

Draft of August 10, 2006

Standard Practice for Probable Maximum Loss (PML) Evaluations for Earthquake Due-Diligence Assessments

INTRODUCTION

The Standard Practice for Probable Maximum Loss (PML) Evaluations for Earthquake Due Diligence Assessments is intended to provide Users with an evaluation norm for the characterization of the risks posed by earthquakes to real estate for use in making equity investments, lending, and financial transactions, including securitized mortgage lending by mortgage originators, underwriters, rating agencies, and purchasers of bonds secured by the real estate. Specific requirements are provided for *Commercial Mortgage-Backed Securities* and for ~~all~~ other ~~financial~~ commercial real estate transactions.

This Standard Practice (Practice) only considers earthquake-caused damage to buildings from ground failure or shaking. It does not include earthquake-related damage to building contents, fire damage, water damage caused by sprinkler discharge, loss of revenues, or liabilities incurred in legal judgments.

Comment [g1]: Editorial: All other financial transactions is too broad and implies areas not covered by XA. Commercial real estate transactions narrows the scope of was intended to be addressed by XA.

Comment [g2]: Editorial: For consistency with first sentence above.

1. Scope

1.1 Purpose—This Practice establishes practice and 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 and/or modification of the building(s).

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 Objectives—The objectives of this Practice are as follows:

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

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

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

1.3 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.

2. Reference Documents

2.1 ASTM E2026, Standard Guide for the Seismic Risk Assessment of Buildings

2.2 Uniform Building Code, 1997 Edition, International Conference of Building Officials, Whittier, California.

2.3 International Building Code, 2006 Edition, International Code Council, Country Club Hills, Illinois.

Comment [g3]: Editorial: typo

2.4 The following standards of the American Society of Civil Engineers provide technical guidance for the evaluation of new and existing buildings.

2.4.1 ASCE 7, American Society of Civil Engineers, Minimum Design Loads for Buildings and Other Structures

2.4.2 ASCE 31, American Society of Civil Engineers, Seismic Evaluation of Existing Buildings

2.4.3 ASCE 41, American Society of Civil Engineers, Seismic Rehabilitation of Existing Buildings

3. Terminology

See also definitions in ASTM E2026

3.1 *DBE, n*—Design Basis Earthquake, as defined in ASTM E 2026.

~~3.1.1 Discussion. It is determined by a probabilistic seismic hazard analysis, the horizontal peak ground acceleration at the site with a 10% probability of exceedance in 50 years, equivalent to on average to 475 year time period for exceedance, or a 0.2105% annual probability of occurrence.~~

Comment [g4]: Editorial: DBE already defined in E2026 and this discussion item was mentioned in the DBE definition in E2026.

3.2 *Provider, n*—organization and individual that completes the seismic risk assessment.

3.3 *MCE, n*—Maximum Capable Earthquake as defined in ASTM E2026.

~~3.3.1 Discussion: This is the average horizontal peak ground acceleration at the site caused by the maximum capable earthquake that can impact the site.~~

Comment [g5]: Editorial: This discussion is slightly different than E2026, which states, "earthquake that can occur within the region that produces the largest average ground motion at the site of interest". Better to rely solely on E2026 to avoid conflicting interpretations.

3.4 *Probable Loss (PL), n*— Probable Loss as defined in ASTM E2026. Discussion. When there are multiple buildings in the seismic risk assessment, then the PL for the group of buildings is to be determined as specified in ASTM E2026.

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

3.5.1 Discussion. Probable Maximum Loss, shall be defined by the User from SL or PL values using definitions of ASTM 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) of 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 *Scenario Loss (SL)— n*- Scenario Loss as defined in ASTM E2026.

3.6.1 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 ASTM E2026.

3.7 *SEL, n*—Scenario Expected Loss as defined in ASTM E2026.

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

3.8 *SEL $_{DBE}$, n*—The scenario expected loss due to the occurrence of DBE site ground motions.

3.9 SEL $_{MCE}$, n—The scenario expected loss due to the occurrence of MCE site ground motions.

3.10 SUL, n—Scenario Upper Loss as defined in ASTM E2026.

3.10.1 Discussion. When there are multiple buildings in the assessment then the SUL for the group of buildings is to be determined as specified in ASTM E2026.

3.11 *SUL $_{DBE}$, n*—The scenario upper loss due to the occurrence of DBE site ground motions.

3.12 *SUL $_{MCE}$*, n—The scenario upper loss due to the occurrence of MCE site ground motions.

~~3.13 Significant damage, n— Damage to architectural and structural elements of the building that exceeds 5 percent of the replacement cost of construction for the property from site failure by liquefaction, landsliding, or other earthquake-induced site response other than shaking, including cost of restoration of the site topography.~~

Comment [g6]: Substantive: MBA Working Group members expressed concerns about the level of damage required to represent "significant" damage. The concern was defining what is significant is highly subjective and varies by property owner. Reference to significant damage also removed from 5.5.1.2

~~3.13.1 *Discussion*. Conditions resulting from the lack of routine maintenance, miscellaneous repairs, operating maintenance, etc. 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 of the foundation is resistant. Damage limited to underground utilities or slabs on grade is not significant.~~

3.14 *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. Significance and Use

4.1 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.

4.2 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.

4.3 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.

5. Due-Diligence Investigation

5.1 The Site Stability, Building Stability and Building Damageability of the property shall be assessed.

5.2 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 and site improvements, and/or a proposed seismically retrofitted condition of the building(s) or its sections.

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

5.2.2 The proposed seismic modifications of the building~~(s)~~ systems and site improvements must be sufficiently described to allow evaluation of the modifications by a qualified third party.

Comment [g7]: Editorial: provides greater specificity to what is being examined.

5.3 The ASTM E2026 level of investigation shall be specified by the User. The same level of investigation should be performed for each aspect of the seismic risk assessment. Appendix A gives guidance on the setting of the level of investigation.

5.4 The qualifications of the Provider shall be specified as required for the level of investigation specified in Section 5.3 by ASTM E2026. The qualifications level must be equal to or higher than the corresponding level specified in Section 5.3. Appendix A.3 gives further guidance on the setting of minimum qualifications.

5.5 PML Report—The Section 5 findings shall be reported in conformance to the requirements of ASTM E2026 for the level of investigation specified by the

User in Section 5.3, by a Provider qualified in accordance with the requirements of Section 5.4, with the following sections:

5.5.1 A summary that contains the conclusions of the seismic risk assessment:

5.5.1.1 Location of the building(s) and characterization of the site soils, surface terrain and gravity and ~~lateral load~~ seismic-force resisting systems.

5.5.1.2 Stability determination of each building site under consideration when subjected to ~~in~~ the seismic loadings for the building site location and building characteristics and for the level of investigation specified as set forth in ASTM E2026, Section 9. ~~The possibility of site instability of the soils supporting the building is to be evaluated. The site is considered unstable if significant damage is caused to the building by the site failure estimated to have occurred, not including other shaking caused damage to the building.~~

5.5.1.3 Stability determination of each building under consideration in the seismic loadings for the building site location and building characteristics and for the level of investigation specified, as set forth in ASTM E2026, Section 8.

5.5.1.4 The PML value for the building or group of buildings as a whole, if there are multiple buildings in the seismic risk assessment and for the level of investigation specified.

5.5.1.4.1 For Commercial Mortgage Backed Securities the PML is defined as the SEL_{DBE} .

5.5.1.4.1 For other applications the PML shall be User-defined.

5.5.1.5 A specification of the level of investigation for each assessment and a review of the methods used and the personnel engaged.

5.5.1.6 The Provider's report must include results for each of the conditions 5.2 that apply.

5.5.1.7 Appropriate reliance language for the report and signature ~~and stamp~~ of the Provider.

5.5.1.8 All deletions and deviations from this Practice (if any) shall be listed individually and in detail and all additions should be listed.

5.5.1.9 The report conclusion shall include the following statement: "We have performed a Probable Maximum Loss (PML) Evaluation for Earthquake Due Diligence Assessment in conformance with the scope and limitations of ASTM Practice E 2026 and XA for a Level XX (Specify) assessment of [insert address or legal description], the property. Any exceptions to, or deletions from, this Practice are described in Section [ ] of this report. This Probable Maximum Loss (PML) Evaluation for Earthquake Due Diligence Assessment has determined the PML to be [ ]%". PML is defined as [fill in the definition used].

5.5.2 A body of the report that provides:

Comment [g8]: Substantive: surface terrain must also be examined and seismic-force provides for additional forces than lateral load.

Comment [g9]: Editorial: clarifying language.

Comment [g10]: Substantive: See prior objection to significant damage in 3.1.13.

Comment [g11]: Substantive: We are concerned about this for several reasons: (1) If state law requires the stamp to be affixed, then the professional should follow the state law. The requirement of professional to follow state law does not need to be affirmatively stated in E2026. (2) Secondly, level 0 investigations that are intended to be the most cursory investigation level, may force providers with professional stamps not to perform this level of investigation because stamping the report would require a greater level of investigation than the Level 0 methodology.

5.5.2.1 All detailed reporting information required by ASTM E2026, including the basis and background for the work performed in support of the conclusions presented in the report.

5.5.2.2 Loss values for each building and if appropriate, for the group of buildings, including SEL and SUL values for MCE and DBE earthquake ground motions, as well as the ~~PL values for loss probabilities associated with at least six (6) return periods ranging from 10 to 2425 years and probability of exceedance in at least four probabilities ranging including 1%, 10% and 50%.~~ mean and upper-bounded loss expectations caused by the occurrence of site-specific earthquake ground motions associated with 50, 100 and 200 year return periods, as a minimum.

5.5.2.3 Report of any other information required by the User, which may include business interruption, and contents damageability.

5.5.2.4 The organization that commissioned the report and the professional liability limitations of the report Provider shall be disclosed in the report.

5.5.3 Attachments and appendices to the report as appropriate.

Comment [g12]: Substantive: Concerns raised by users was this was too much information for them to adequately process. Input that the MBA received from both the provider and user communities was that all the required information in 5.5.2.2 would significantly escalate seismic report preparation costs. This opinion is based not only upon Mr. Thiele's comments made during the April 2006 ASTM meeting in Toronto but also reflects the opinion of the MBA Seismic Working Group, that PL values estimated per E2026 are beyond the current capability of many providers. The inclusion of single event loss estimates for 50, 100, and 200 year return period earthquake ground motions, as a minimum, reflects the MBA user Seismic Working Group consensus for seismic report portability. The proposed changes would allow for a significant, but not overwhelming, amount of information to be provided in the body of the seismic report. However, users would also have the ability to request additional information if the base level of information in the MBA proposal is insufficient.

APPENDIX A — LEVEL OF INVESTIGATION

The materials in this Appendix A may be utilized, but is not required, by a User to assist in making decisions necessary to implement the requirements of the Practice XA.

A.1 The selection of the level of the investigation performed should be guided by the level of uncertainty in the result that is acceptable to the User. Two guidance tables are provided: 1) based upon the level of uncertainty in the results and 2) based upon the building replacement cost.

A.1.1 If the degree of uncertainty is the guiding consideration in selecting the level of investigation, then the matrix of Table A1, Alternate 1 is offered as a guide to selection of the levels of investigation to match the acceptable level of uncertainty. The zone references are from the map of seismic zones as it appears in the 1997 edition of the Uniform Building Code (4), which is reproduced in Fig. 1. The acceptance uncertainty levels are not defined, but are given to reflect the progression of investigation levels with changes in acceptable uncertainty.

A.1.2 If the cost of replacement of the building is the guiding consideration in selecting the level of investigation, then the Table A1, Alternate 2 is offered as a guide to selection of the levels of investigation to match the acceptable level of uncertainty.

The rationale for changing requirements for different property values is as follows. It is expected that the uncertainty in seismic loss for a given property will decrease significantly with increasing level of investigation. Since most loans will be part of a limited group of financial commitments, the larger an individual loan, the greater is its participation as a fraction of the total risk of the group. A method to reduce the level of uncertainty is to require a higher level ASTM assessment for the greater value property. When the pool gets larger, say for a security, then the impact is the same. Therefore, it was assumed in preparing the table threshold values that some

parity was needed to keep the uncertainties of the same order for groups of lower property values compared to one larger property.

It should be noted that the costs of doing higher-level investigations are higher and they do not go up linearly, so there is an administrative cost of the decisions made based on this table.

A.2 The seismic zone references in Table A1 are from the map of seismic zones as it appears in the 1997 Edition of the Uniform Building Code (3.2) which is reproduced in Fig. A1. While there are more recent seismic risk maps, these generally require specific information on the seismic response characteristics of the site and structure that are seldom available before the seismic risk assessment has begum. Therefore, for ease and consistency of use, the 1997 map is used.

A.3 Level 0 investigations are considered to provide the highest uncertainty of results of any investigation. Some moderation of this uncertainty can be achieved by requiring the person(s) performing the assessment to be a licensed professional and qualifications for an ASTM E2026 Level 1 investigation, rather than the minimal requirements for a Level 0 investigation.

TABLE A1 *Recommended levels of minimum levels of investigation based on the seismic zone of the property and the acceptable level of uncertainty of the User or Building Replacement Cost. The seismic zones are those of the 1997 Edition of the Uniform Building Code, see Figure A1. BS refers to the Building Stability assessment, SS to the Site Stability assessment, and BD to the Building Damageability assessment; the number following the abbreviation is the level of investigation; i.e., BD0 is a Building Damageability Level 0 ASTM E2026 assessment.*

Alternate 1: Based on seismic zone of the property and the acceptable level of uncertainty of the User

Acceptable Uncertainty Level	Seismic zone/UBC-97			
	Zones 0, 1	Zones 2A, 2B	Zone 3	Zone 4
Very low	None	BS01, SS01, BD01	BS12, SS12, BD12	BS23, SS23, BD23
Low	None	None	BS1, SS1, BD1	BS2, SS2, BD2
Moderate	None	None	BS0, SS0, BD0	BS1, SS1, BD1
High	None	None	None	BS0, SS0, BD0

Alternate 2: *Based on seismic zone of the property and the ~~acceptable level of uncertainty of the User~~ building replacement cost.*

X, Building Replacement Cost	Seismic zone/UBC 1997			
	0, 1,	2A & 2B	3	4
$0M<X≤$5 M	None	None	BS0, SS0, BD0	BS0, SS0, BD0
$5M<X≤$15 M	None	None	BS0, SS0, BD0	BS1, SS1, BD1
$15M<X≤$50 M	None	None	BS1, SS1, BD1	BS1, SS1, BD1
$50M<X≤$100 M	None	BS0, SS0, BD0	BS1, SS1, BD1	BS2, SS2, BD2
$100M<X	None	BS1, SS1, BD1	BS2, SS2, BD2	BS23, SS23, BD23

Comment [g13]: Substantive: Users have indicated that a major determinant of the level of study that will be implemented is highly influenced by building replacement cost, with higher value buildings receiving a higher level of examination.

Comment [g14]: Substantive: Comment references level of investigation by acceptable uncertainty level in the table. In Level of investigation increased based upon input by seismic study reviewers with low risk tolerance.

Comment [g15]: Substantive: Users have indicated that a major determinant of the level of study that will be implemented is highly influenced by building replacement cost, with higher value buildings receiving a higher level of examination.

Comment [g16]: Substantive: Users have indicated that a major determinant of the level of study that will be implemented is highly influenced by building replacement cost, with higher value buildings receiving a higher level of examination.

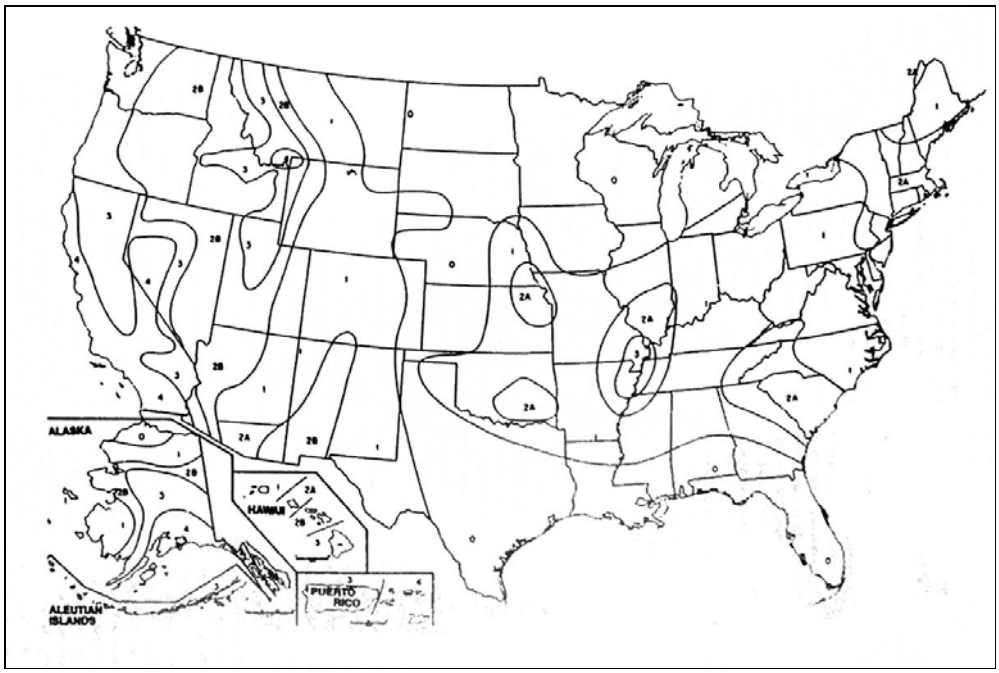

Figure A1. *Seismic Zone Map of the United States Taken from the 1997 Edition of the Uniform Building Code.* *97 UBC MAP TO REPLACE THIS 1994 EDITION MAP WHEN COPYRIGHT PERMISSION IS GRANTED.*