ACTUARIAL STANDARDS BOARD

• EXPOSURE DRAFT •

Proposed Revision of
Actuarial Standard
of Practice
No. 38

Revised Edition

Catastrophe Modeling
(for All Practice Areas)

Comment Deadline:
January 15, 2021

Developed by the
Catastrophe Modeling Task Force of the
General Committee of the
Actuarial Standards Board

Approved by the
Actuarial Standards Board
September 2020

TABLE OF CONTENTS

APPENDIX

September 2020

TO: Members of Actuarial Organizations Governed by the Standards of Practice of the Actuarial Standards Board and Other Persons Interested in Catastrophe Modeling (for All Practice Areas)

FROM: Actuarial Standards Board (ASB)

SUBJ: Proposed Revision of Actuarial Standard of Practice (ASOP) No. 38

This document contains the exposure draft of a revision of ASOP No. 38, *Catastrophe Modeling (for All Practice Areas)*.

Please review this exposure draft and give the ASB the benefit of your comments and suggestions. Each written comment letter or email received by the comment deadline will receive appropriate consideration by the drafting committee and the ASB.

The ASB requests comments be provided using the Comments Template that can be found here and submitted electronically to comments@actuary.org. Include the phrase "ASB COMMENTS" in the subject line of your message. Please note: Any message not containing this exact phrase in the subject line will be deleted by our system's spam filter. Also, please indicate in the template if your comments are being submitted on your own behalf or on behalf of a company or organization.

The ASB posts all signed comments received to its website to encourage transparency and dialogue. Comments received after the deadline may not be considered. Anonymous comments will not be considered by the ASB nor posted to the website. Comments will be posted in the order that they are received. The ASB disclaims any responsibility for the content of the comments, which are solely the responsibility of those who submit them.

For more information on the exposure process, please see the ASB Procedures Manual.

Deadline for receipt of responses in the ASB office: **January 15, 2021**

History of the Standard

The ASB first began work on a standard for modeling in the late 1990s. Motivated primarily to address the role catastrophe modeling of earthquakes and hurricanes played in casualty ratemaking, this work was focused on the use of specialized models where the actuary would have to rely on a model that was developed by professionals other than actuaries. As a result of this work, the ASB approved ASOP No. 38, *Using Models Outside the Actuary's Area of Expertise*, in June of 2000 with the scope of the standard limited to the Property/Casualty area of practice. At the time, this was the only ASOP that specifically addresses modeling.

Over the ensuing years, the number and importance of modeling applications in actuarial science has increased, with the results of actuarial models often entering financial statements directly. Recognizing this trend, the ASB asked the Life Committee in 2010 to begin work on an ASOP focused on modeling. The Life Committee formed a task force to address this issue and, in February of 2012, a discussion draft titled *Modeling in Life Insurance and Annuities* was released. Nineteen comment letters were received.

Based upon this feedback and numerous other discussions on the topic of modeling, in December of 2012 the ASB created two multidisciplinary task forces under the direction of the General Committee: i) a general Modeling Task Force, charged with developing an ASOP to address modeling applications in all practice areas, and ii) a Task Force to consider expanding ASOP No. 38 to all practice areas while focusing exclusively on using catastrophe models.

An exposure draft titled *Modeling* was released in June 2013 with a scope that provides guidance to actuaries when selecting, designing, building, modifying, developing, or using models when performing actuarial services. ASOP No. 56, *Modeling*, was adopted by the ASB in December 2019. Changes have been made to this exposure draft of ASOP No. 38 to be consistent with ASOP No. 56 and other recent ASOPs.

The exposure draft of this revision of ASOP No. 38 was the work of the Catastrophe Modeling Task Force, whose membership has experience in life insurance, health insurance, property/casualty insurance, and enterprise risk management.

At the direction of the ASB, this standard was developed to apply to all practice areas and all forms of catastrophe models, including natural catastrophes such as hurricanes, earthquakes, and severe convective storms, and other catastrophes such as terrorist acts and pandemics.

Notable Changes from the Existing ASOP No. 38 Adopted in 2000

Notable changes from the existing ASOP No. 38 adopted in 2000 are summarized below. Additional changes were made to improve readability, clarity, or consistency.

1. The ASOP now applies to catastrophe models only.

2. The ASOP now applies to all practice areas.

3. The scope is expanded to include the activities "selecting, reviewing, and evaluating" models in addition to the existing activity of "using" a model when performing actuarial services.

Notable Changes from the 2014 Version of ASOP No. 38

Notable changes from the 2014 version of ASOP No. 38 are summarized below. Additional changes were made to improve readability, clarity, or consistency.

1. The scope was expanded to clarify that if the actuary determines that the guidance in the ASOP conflicts with the guidance in ASOP No. 56, the guidance of this ASOP will govern.

2. A new section specifically addressing reliance on data or other information supplied by others (section 3.8) has been added.

3. The guidance on documentation (section 3.9) has been updated and expanded to be consistent with current ASOPs.

The ASB voted in September 2020 to approve this exposure draft.

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The Actuarial Standards Board (ASB) sets standards for appropriate actuarial practice in the United States through the development and promulgation of Actuarial Standards of Practice (ASOPs). These ASOPs describe the procedures an actuary should follow when performing actuarial services and identify what the actuary should disclose when communicating the results of those services.

ACTUARIAL STANDARD OF PRACTICE NO. 38

CATASTROPHE MODELING (FOR ALL PRACTICE AREAS)

STANDARD OF PRACTICE

Section 1. Purpose, Scope, Cross References, and Effective Date

1.1 Purpose—This actuarial standard of practice (ASOP or standard) provides guidance to actuaries when performing actuarial services with respect to selecting, using, reviewing, or evaluating **catastrophe models**.

1.2 Scope—This ASOP applies to actuaries in any practice area when performing actuarial services with respect to selecting, using, reviewing, or evaluating **catastrophe models** to assess risk, including but not limited to models of hurricanes, earthquakes, severe convective storms, terrorist acts, and pandemics. This standard applies to the selection, use, review, or evaluation of **catastrophe models**, whether or not they are proprietary in nature.

This standard does not apply to models of operational risks. This standard also does not apply to models of economic risks that deal with instances of extreme events such as hyper-inflation or a stock market collapse. This standard also does not apply when the actuary is only designing, developing, or modifying a **catastrophe model** (or a portion of a **catastrophe model**).

The actuary should be guided by ASOP No. 56, *Modeling* when designing, developing, or modifying **catastrophe models** as well as when selecting, using, reviewing, or evaluating **catastrophe models**. If the actuary determines that the guidance in this ASOP conflicts with the guidance in ASOP No. 56, the guidance of this ASOP will govern.

If the actuary departs from the guidance set forth in this ASOP in order to comply with applicable law (statutes, regulations, and other legally binding authority), or for any other reason, the actuary should refer to section 4.

1.3 Cross References—When this ASOP refers to the provisions of other documents, the reference includes the referenced documents as they may be amended or restated in the future, and any successor to them, by whatever name called. If any amended or restated document differs materially from the originally referenced document, the actuary should consider the guidance in this ASOP to the extent it is applicable and appropriate.

1.4 Effective Date—This standard is effective for work performed on or after four months after adoption by the Actuarial Standards Board.

Section 2. Definitions

The terms below are defined for use in this actuarial standard of practice.

2.1 Assumption—A type of explicit **input** to a **catastrophe model** that is derived from **data**, represents possibilities based on professional judgment, or may be prescribed by law or others. When derived from **data**, an **assumption** may be statistical, financial, economic, mathematical, or scientific in nature, and may be described as a **parameter**.

2.2 Catastrophe Model—A representation of relationships among events based on statistical, financial, economic, mathematical, or scientific concepts and equations used to explain a system, to study the effects of different components, and to derive estimates based upon occurrences of large-scale, low-frequency, high-severity events.

2.3 Data—Facts or information that are either direct **input** to a **catastrophe model** or inform the selection of **input. Data** may be collected from sources such as records, experience, experiments, surveys, observations, benefit plan or policy provisions, or **output** from other models.

2.4 Expert—One who is qualified by knowledge, skill, experience, training, or education to render an opinion concerning the matter at hand.

2.5 Input—**Data** or **assumptions** used in a **catastrophe model** to produce **output**.

2.6 Intended Purpose—The goal or question, whether generalized or specific, addressed by the **catastrophe model** within the context of the assignment.

2.7 Output—The results of the **catastrophe model** including, but not limited to, point estimates, likely or possible ranges, and **data or assumptions** (as **input** for other models), behavioral expectations, or qualitative criteria on which decisions could be based.

2.8 Parameter—A type of statistical, financial, economic, mathematical, or scientific value that is used as **input** to **catastrophe models**. Examples of **parameters** include expected values in probability distributions and coefficients of formula variables.

Section 3. Analysis of Issues and Recommended Practices

3.1 Introduction—In performing actuarial services, an actuary may find it appropriate to select, use, review, or evaluate **catastrophe models**. When selecting, using, reviewing or evaluating a **catastrophe model**, the actuary should do the following:

a. determine the appropriate level of reliance on **experts**;

b. have a basic understanding of the **catastrophe model**;

c. evaluate whether the **catastrophe model** is appropriate for the **intended purpose**;

d. determine that appropriate validation has occurred; and

e. determine the appropriate use of the **catastrophe model** and its results.

The actuary's level of effort in understanding and evaluating a **catastrophe model** should be consistent with the **intended purpose** and the **catastrophe model output**'s materiality to the results of the actuarial analysis.

3.2 Appropriate Reliance on Experts—An actuary may rely on **experts** in the fields of knowledge used in the development of the **catastrophe model**. In determining the appropriate level of reliance, the actuary should consider the following:

a. whether the individual or individuals upon whom the actuary is relying are **experts** in the applicable field;

b. the extent to which the **catastrophe model** has been reviewed or opined on by **experts** in the applicable field, including any known significant differences of opinion among **experts** concerning aspects of the **catastrophe model** that could be material to the actuary's use of the **catastrophe model**; and

c. whether there are industry or regulatory standards that apply to the **catastrophe model** or to the testing or validation of the **catastrophe model**, and whether the **catastrophe model** has been certified as having met such standards.

3.3 Understanding of the Catastrophe Model—The actuary should be familiar with the basic components of the **catastrophe model** and understand both the user **input** and the **catastrophe model output**, as discussed below.

3.3.1 Catastrophe Model Components—The actuary should be familiar with the basic components of the **catastrophe model** and have a basic understanding of how such components interrelate within the **catastrophe model**. In addition, the actuary

should identify which fields of expertise were used in developing or updating the **catastrophe model** and should make a reasonable effort to determine if the **catastrophe model** is based on generally accepted practices within the applicable fields of expertise. The actuary should also be familiar with how the **catastrophe model** was tested or validated and the level of independent **expert** review and testing.

3.3.2 User Input—Certain user **input** may be required to produce **catastrophe model output** for the specific application. User **input** can include **assumptions** or **data**. If the **catastrophe model** requires user **input**, the actuary should evaluate the reasonableness of the user **input** and should have a reasonable understanding of the relationship between the user **input** and **catastrophe model output**. The actuary should take reasonable steps to confirm that the precision and accuracy of the user **input** are consistent with the **intended purpose**. With respect to the quality and availability of the user **input** to be used in the **catastrophe model**, the actuary should refer to ASOP No. 23, *Data Quality*.

3.3.3 Catastrophe Model Output—The actuary should determine that the **catastrophe model output** is consistent with the **intended purpose**.

3.4 Appropriateness of the Catastrophe Model for the Intended Purpose—The actuary should evaluate whether the **catastrophe model** is appropriate for the **intended purpose**. When using the **catastrophe model output**, the actuary should also consider limitations of the **catastrophe model**, modifications to the **catastrophe model output**, and the **assumptions** needed. Some additional considerations include the following:

3.4.1. Applicability of Historical Data—To the extent historical **data** are used in the development of the **catastrophe model** or the establishment of **catastrophe model parameters**, the actuary should consider the adequacy of the historical **data** in representing the range of reasonably expected outcomes consistent with current knowledge about the phenomena being analyzed.

3.4.2. Developments in Relevant Fields—The actuary should make a reasonable effort to be aware of significant developments in relevant fields of expertise. The actuary should evaluate whether such developments are likely to materially affect the current actuarial analysis.

3.5 Appropriate Validation—The actuary should evaluate the reasonableness of the **catastrophe model output**, considering the **input** and the **intended purpose**, taking into account factors such as the following:

a. how historical observations, if applicable, compare to results produced by the **catastrophe model**;

b. the consistency and reasonableness of relationships among various **output** results; and

c. the sensitivity of the **catastrophe model output** to variations in the user **input**.

3.6 Appropriate Use of the Catastrophe Model and Its Results—The actuary should use professional judgment to determine whether it is appropriate to use the **catastrophe model** results to develop the actuarial work product. The actuary should also use professional judgment to determine whether any adjustments to the **catastrophe model output** are needed to meet the **intended purpose**. The actuary should disclose any such adjustments in accordance with section 4.1.

3.7 Reliance on Another Actuary—The actuary may rely on another actuary who has selected, used, reviewed, or evaluated the **catastrophe model**. However, the relying actuary should be satisfied that the other actuary is qualified to select, use, review, or evaluate the **catastrophe model**, and that the **catastrophe model** is appropriate for the **intended purpose**. The actuary should disclose the extent of any such reliance.

3.8 Reliance on Data or Other Information Supplied by Others—When relying on **data** or other information supplied by others, the actuary should refer to ASOP No. 23 and ASOP No. 41, *Actuarial Communications*, for guidance.

3.9 Documentation—The actuary should consider preparing and retaining documentation to support compliance with the requirements of section 3 and the disclosure requirements of section 4. If preparing documentation, the actuary should prepare such documentation in a form such that another actuary qualified in the same practice area could assess the reasonableness of the actuary's work and should document the steps taken to comply with this standard in light of proprietary aspects of the **catastrophe model**, if any. The degree of such documentation should be based on the professional judgment of the actuary and may vary with the complexity and purpose of the actuarial services. In addition, the actuary should refer to ASOP No. 41 for guidance related to the retention of file material other than that which is to be disclosed under section 4.

Section 4. Communications and Disclosures

4.1 Required Disclosures in an Actuarial Report—When issuing an actuarial report to which this standard applies, the actuary should refer to ASOP Nos. 23 and 41. In addition, the actuary should disclose the following in such actuarial reports, as appropriate:

a. the **catastrophe model** used and the **intended purpose**;

b. a description of the user **input** that was incorporated into the **catastrophe model**, as discussed in section 3.3.2;

c. a description of adjustments made to the **catastrophe model** results, as discussed in section 3.6.; and

d. the extent of any reliance placed upon the work of another actuary, as discussed in section 3.7.

4.2 Additional Disclosures in an Actuarial Report—The actuary also should include the following, when applicable, in an actuarial report:

a. the disclosure in ASOP No. 41, section 4.2, if any material **assumption** or method was prescribed by applicable law;

b. the disclosure in ASOP No. 41, section 4.3, if the actuary states reliance on other sources and thereby disclaims responsibility for any material **assumption** or method selected by a party other than the actuary; and

c. the disclosure in ASOP No. 41, section 4.4, if, in the actuary's professional judgment, the actuary has otherwise deviated materially from the guidance of this ASOP.

4.3 Proprietary and Confidential Information—Nothing in this ASOP is intended to require the actuary to disclose proprietary or confidential information.

Appendix

Background and Current Practices

Note: This appendix is provided for informational purposes and is not part of the standard of practice.

Background

Hurricane Andrew in 1992 and the Northridge Earthquake in 1994 led actuaries involved in evaluating hurricane and earthquake exposures to recognize the severe inadequacy of the traditional, empirical actuarial methods used for ratemaking for these exposures. Recognizing the need to replace these methods, many actuaries began using stochastic computer simulation models for their actuarial analysis of hurricane and earthquake exposure. Computer simulation models had been commonly used for some time by actuaries and others for the purpose of evaluating probable maximum loss but had not been widely used for ratemaking.

Over time, the output from catastrophe models became commonly used by property/casualty actuaries in developing rates for catastrophic perils as well as many other risk management purposes.

Current Practices

Catastrophe models are now widely used by actuaries in all practice areas for risk management analyses and calculating expected losses due to hurricanes, earthquakes, and terrorist acts. More recently, catastrophe models have also been developed to simulate wildfires, severe convective storms, tsunamis, and pandemics.

In addition, due to changes in regulations and financial reporting requirements, the number and importance of modeling applications in actuarial science has increased, with the results of actuarial models often entering financial statements directly.

Lastly, due to the evolution of enterprise risk management (ERM) practices and regulations, there has been increased use of catastrophe modeling as part of insurer stress testing and risk management across all practice areas. This trend is likely to continue to evolve and heighten in light of the emergence of the novel coronavirus and the COVID-19 pandemic.