ACTUARIAL STANDARDS BOARD

● SECOND EXPOSURE DRAFT ●

Proposed Revision of
Actuarial Standard
of Practice
No. 39

Treatment of Catastrophe or Extreme Event Losses in Future Cost Estimates for Property/Casualty Risk Transfer and Risk Retention

Comment Deadline:
July 1, 2026

Developed by the
ASOP No. 39 Task Force of the
Casualty Committee of the
Actuarial Standards Board

Approved for Exposure by the
Actuarial Standards Board
March 2026

TABLE OF CONTENTS

APPENDIXES

March 2026

TO: Members of Actuarial Organizations Governed by the Standards of Practice of the Actuarial Standards Board and Other Persons Interested in the Treatment of Catastrophe or Extreme Event Losses Future Cost Estimates in Property/Casualty Risk Transfer and Risk Retention

FROM: Actuarial Standards Board (ASB)

SUBJECT: Actuarial Standard of Practice (ASOP) No. 39

This document contains the second exposure draft of a proposed revision of ASOP No. 39, *Treatment of Catastrophe or Extreme Event Losses in Future Cost Estimates for Property/Casualty Risk Transfer and Risk Retention*. Please review this exposure draft and give the ASB the benefit of your comments and suggestions. Each comment letter received by the comment deadline will receive consideration by the drafting committee and the ASB.

The ASB appreciates comments and suggestions on all areas of this proposed standard. 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 "ASOP No. 39 COMMENTS" in the subject line of your message. Also, please indicate in the template whether your comments are being submitted on your own behalf or on behalf of a company or organization.

The ASB posts all signed comments received on 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 on 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 comments: **July 1, 2026**

History of the Standard

Many property/casualty insurance products are, by their nature, subject to large aggregate losses resulting from relatively infrequent events or natural phenomena, also known as catastrophes or extreme events. These losses can cause extreme volatility in historical insurance data and generally require separate and different treatment from other losses in ratemaking methodologies and other actuarial analysis. Historically, the most common method was to calculate the ratio of actual catastrophe losses to non-catastrophe losses over a longer experience period and apply that ratio to expected non-catastrophe losses in the ratemaking formula.

In 1992 and 1994, two events occurred that changed the actuarial profession's view of catastrophe losses. The Hurricane Andrew and Northridge Earthquake catastrophes clearly demonstrated the limitations of relying exclusively on historical insurance data in estimating the financial impact of potential future events. In addition, property/casualty insurers (including self-insurers) and their actuaries began to focus on the impact that large individual events or sequences of events could have on the insurers' solvency, cash flow, and earnings.

The ASB adopted ASOP No. 39, *Treatment of Catastrophe Losses in Property/Casualty Insurance Ratemaking*, in 2000 to provide guidance to actuaries in evaluating catastrophe exposure and in determining a provision for catastrophe losses and loss adjustment expenses in property/casualty insurance ratemaking.

Since this ASOP was first adopted, there have been many developments in ratemaking and modeling. Actuarial practice has evolved to such an extent that the guidance in the original standard was no longer broad enough. The original standard was also limited in scope because it did not adequately address 1) events that impact casualty insurance or multiple insurance lines or 2) other events that the industry now faces, such as cyber-attacks, terrorism, and the effects of climate change. In addition, the original standard focused on the use of historical data as the default, but by 2020, this was no longer an accurate description of the current practice in estimating future catastrophe cost components. The ASB therefore approved a proposal to update ASOP No. 39 in 2021. The standard is also being updated to recognize ASOP No. 53, *Estimating Future Costs for Prospective Property/Casualty Risk Transfer and Risk Retention*, and ASOP No. 56, *Modeling,* as well as changes to ASOP No. 38, *Catastrophe Modeling (for All Practice Areas)*.

First Exposure Draft

The first exposure draft was released in February 2025 with a comment deadline of June 1, 2025. Ten comment letters were received and considered in making changes that are reflected in the second exposure draft.

Notable Changes from the First Exposure Draft

Notable changes from the first exposure draft are summarized below. Notable changes do not include changes made to improve readability, clarity, or consistency.

1. The definition of extreme event was removed. The revised definition of catastrophe includes extreme events. Language was adjusted accordingly throughout the standard. The revised definition of catastrophe in section 2.1 is consistent with ASOP No. 38.

2. The definition of catastrophe model in section 2.2 was modified to explicitly include deterministic scenario analyses. Language was adjusted accordingly throughout the standard.

3. The definition of compound events was removed.

4. Guidance on adjusting catastrophe model output was added in section 3.5.3.

Notable Changes from the Existing Standard

Notable changes from the existing standard are summarized below. Notable changes do not include changes made to improve readability, clarity, or consistency.

1. In section 1.2, the scope has been broadened to include actuarial services beyond ratemaking.

2. Definitions have been significantly modified.

3. Guidance on application of the standard beyond natural catastrophes has been expanded.

4. Guidance for catastrophe models throughout the standard has been expanded.

5. Guidance has been expanded to include potential changes to the future risk environment, such as future climate change impacts, throughout the standard.

6. In section 3.5.1.3, guidance on adjustment of historical insurance data has been enhanced.

7. In section 3.11, guidance on reasonableness has been added.

8. In section 3.12, guidance on relying on another party has been added.

9. In section 3.13, guidance on documentation has been updated.

10. In section 4, disclosures have been updated to reflect the changes made in section 3.

Request for Comments

The ASB appreciates comments and suggestions on all areas of this proposed standard submitted through the Comments Template. Rationale and recommended wording for any suggested changes would be helpful.

The ASB voted in March 2026 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.

SECOND EXPOSURE DRAFT—March 2026

PROPOSED REVISION OF
ACTUARIAL STANDARD OF PRACTICE NO. 39

TREATMENT OF CATASTROPHE OR EXTREME EVENT LOSSES IN FUTURE COST ESTIMATES FOR PROPERTY/CASUALTY RISK TRANSFER AND RISK RETENTION

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 analyzing, determining, or reviewing future cost estimates for **catastrophe** losses and loss adjustment expenses for property/casualty risk transfer or risk retention.

1.2 Scope—This standard applies to actuaries when performing actuarial services with respect to analyzing, determining, or reviewing future cost estimates for **catastrophe** losses and loss adjustment expenses for property/casualty risk transfer or risk retention. For example, this standard applies when actuaries are developing future cost estimates underlying product prices for direct insurance and reinsurance; estimating funding requirements for self-insured programs and captives; reviewing financial reports for internal or external use; conducting analyses of capital requirements, capital adequacy, and stress testing; and estimating various risk metrics, such as average annual losses, risk loads, and return period loss estimates.

If the actuary is performing actuarial services that involve reviewing future cost estimates for **catastrophe** losses and loss adjustment expenses for property/casualty risk transfer or risk retention, the actuary should use the guidance in this ASOP to the extent practicable within the scope of the actuary's assignment.

If the actuary determines that the guidance in this standard conflicts with an ASOP that applies to all practice areas, this standard governs.

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

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

1.4 Effective Date—This standard is effective for actuarial services 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 standard and appear in bold throughout the ASOP. The actuary should also refer to ASOP No. 1, *Introductory Actuarial Standard of Practice*, for definitions and discussions of common terms, which do not appear in bold in this standard.

2.1 Catastrophe—A low-frequency event with high-severity or widespread potential effects. **Catastrophes** may cause unusually large aggregate losses and distort historical experience. **Catastrophes** include property and casualty events such as hurricanes, earthquakes, wildfires, cyber attacks, and pandemics. **Catastrophes** may be referred to as "extreme events."

2.2 Catastrophe Model—A model of low-frequency events with high-severity or widespread potential effects. **Catastrophe models** may be used to explain a system, study effects of different components, or derive estimates. For example, stochastic models and deterministic **scenario analyses** can be used for **catastrophe** modeling.

2.3 Scenario Analysis—A process for assessing the impact of one possible event or several simultaneously or sequentially occurring possible events. **Scenario analysis** is often used when historical data are insufficient or other tools are unavailable. **Scenario analysis** may include a narrative description or numerical calculations.

Section 3. Analysis of Issues and Recommended Practices

3.1 Overview—The actuary should develop future cost estimates for **catastrophes** using appropriate methods that utilize historical data or output from one or more **catastrophe models**.

3.2 Identification of Potential Catastrophes—The actuary should take reasonable steps to identify the perils or events that may produce **catastrophe** losses.

Thresholds for "catastrophe" and "extreme event" may differ depending on the context and may be dictated or imposed by an outside entity. The actuary should use terms and meanings that are appropriate for the actuary's assignment.

3.3 Identification and Attribution of Historical Catastrophe Losses—The actuary should identify, where practicable, the **catastrophe** losses in historical data. When doing so, the actuary should take into account how accurately these losses can be identified and the extent to which they may have a material impact on the results of the analysis.

When attributing losses to a **catastrophe**, the actuary should do the following:

a. use criteria tailored to and consistently applied to the coverage and type of event, risk classifications, and historical periods; and

b. make appropriate adjustments when the criteria result in a material inconsistency in how **catastrophe** losses are identified in the historical data.

3.4 Incorporation of Loss Adjustment Expenses—The actuary should develop a reasonable estimate of prospective loss adjustment expense for **catastrophe** losses. When doing so, the actuary should take into account that the relationship of loss adjustment expense to loss can be significantly different for **catastrophe** losses than for other losses.

3.5 Use of Data and Models—The actuary may use insurance data, non-insurance data, or **catastrophe models** as described in the sections below. The actuary should refer to ASOP No. 13, *Trending Procedures*, and ASOP No. 23, *Data Quality*.

3.5.1 Use of Historical Insurance Data—Sources of historical insurance data include self-insureds, insurance companies, reinsurers, advisory organizations, and governmental entities such as a state fund. When using historical insurance data, the actuary should follow the guidance below.

3.5.1.1 Applicability of Historical Insurance Data—The actuary should assess the extent to which the exposures that generated the historical data are applicable to the future period, taking into account changes in coverages and provisions, applicable law, building codes, geographic representation, concentration, and other relevant factors.

3.5.1.2 Evaluating Credibility of Historical Insurance Data—The actuary should consider comparing historical insurance data to non-insurance data and **catastrophe model** output to evaluate the extent to which the available historical insurance data fully represent the long-term frequency and severity of the perils or events identified in section 3.2 that may produce the **catastrophe** losses. The actuary should also refer to ASOP No. 25, *Credibility Procedures.*

3.5.1.3 Adjustment of Historical Insurance Data to Reflect Future Conditions—The actuary should consider adjusting the historical insurance data to reflect the environment expected to exist in the period for which the actuary is estimating the future costs, taking into account the following:

a. exposure to loss (including coverage differences, the underlying portfolio of insured risks and the associated values, insured limits, and deductibles);

b. population shifts;

c. claim cost inflation;

d. wealth effect (the changes over time in the amount or value of amenities typically included in, and the average size of, a home or other building);

e. economic distortions occurring when past data were collected, such as supply chain constraints;

f. noneconomic distortions such as claimant behavior, changes in applicable law, building codes and the enforcement of these codes, and building practices that would impact coverage or claim settlement;

g. emerging technology; and

h. other relevant factors.

The actuary should also refer to ASOP No. 53, *Estimating Future Costs for Prospective Property/Casualty Risk Transfer and Risk Retention*, regarding additional changes that may suggest the need for adjustments.

3.5.1.4 Stability vs. Responsiveness of Outcomes Based on Historical Insurance Data—The actuary should use professional judgment to select historical insurance data that represent the actuary's assessment of the risk of **catastrophe** losses for the applicable future period. When doing so, the actuary should take into account the sensitivity of future cost estimates to the inclusion or exclusion of historical **catastrophe** losses and to the selection of experience periods.

3.5.1.5 Differing Trends in Loss Data—Historical insurance data used to estimate future **catastrophe** losses will often extend over much longer time periods than data used in other applications; therefore, the effect of small differences in annual trend rates will be magnified. The actuary should take into account the potential for **catastrophe** losses to trend at a rate materially different from other losses and reflect such differences in trend assumptions and methods as appropriate.

When trending prior years to current levels, the actuary may consider relevant indices from non-insurance sources, such as the U.S. Bureau of Economic Analysis, U.S. Bureau of Labor Statistics, and U.S. Census Bureau.

3.5.1.6 Differing Development in Loss Data—Traditional actuarial loss development techniques may not be appropriate for **catastrophe** losses. The actuary should take into account the potential for **catastrophe** losses to emerge differently from other losses and reflect such differences in development assumptions and methods as appropriate.

3.5.2 Use of Non-Insurance Data—Various organizations publish data relevant to **catastrophes**. For example, the federal government publishes census and other data related to inflation, changes in exposure, population shifts, and other data relevant to assessing changes in exposure to **catastrophe** losses. Other organizations collect data on economic losses from **catastrophes** and historical patterns of cyber data breaches. When using non-insurance data, the actuary should follow the guidance for historical insurance data in section 3.5.1, as applicable.

3.5.3 Use of Catastrophe Model Output—If, after considering the items contained in section 3.5.1 and 3.5.2, the actuary believes that the available historical data do not sufficiently represent the exposure to **catastrophe** losses, the actuary should consider using **catastrophe model** output to develop future cost estimates for **catastrophes**. The actuary should also refer to ASOP No. 38, *Catastrophe Modeling (for All Practice Areas)*.

When using **catastrophe model** output, the actuary should consider whether the **catastrophe model** output needs to be adjusted, taking into account the factors in 3.5.1.3(a)-(h), as applicable.

3.5.4 Blending of Historical Data and Catastrophe Model Output—The actuary may blend historical experience with **catastrophe model** output when, in the actuary's judgment, it is appropriate to do so. For example, the actuary may use historical experience that has been capped to reduce volatility from extreme losses to derive the basic portion of the future cost estimates and a **catastrophe model** to derive an excess expected loss load for losses above the level chosen for capping the experience.

3.6 Considerations When Selecting Catastrophe Models—When selecting a **catastrophe model**, the actuary should refer to ASOP No. 38 and ASOP No. 56, *Modeling*. The actuary should take into account the following, if applicable:

a. whether the model's output is relevant for all or a subset of the portfolio, coverages, perils, or events;

b. the extent to which models and experience are relevant if a peril or type of event is rapidly changing (such as cyber risk, climate change, or terrorism); and

c. the impact of emerging technology, data, and methods.

The actuary may review and discuss the issues, scenarios, and results of blending various approaches with experienced professionals in other relevant areas to gain additional insight.

The actuary should consider reviewing the results of more than one model to develop the future cost estimates.

3.7 Additional Considerations When Selecting Catastrophe Models— The actuary should consider using a stochastic **catastrophe model** when available, appropriate, and practicable. Situations in which a stochastic model may not be appropriate include the following:

a. when industry data may exclude relevant losses not covered by insurance in the historical periods;

b. when future losses are likely to depend on changing legal interpretation and legislative issues;

c. when relevant stochastic **catastrophe models** are in early stages of development and therefore may not provide reliable estimates;

d. when the exposure may involve long latency periods; and

e. when unanticipated risks may emerge after a coverage commitment.

Such situations are common for casualty **catastrophe** exposures and may apply to property **catastrophe** exposures as well.

When a stochastic **catastrophe model** is not available, not appropriate, or not practicable, the actuary should consider using deterministic **scenario analysis** or another reasonable alternative.

3.8 Multiple Events—The actuary should consider adjusting the future cost estimate for the possibility that two or more events may interact to yield outcomes different from what would be expected otherwise. For example, a second hurricane may hit an area, resulting in higher losses due to impacts from the first hurricane. The actuary should also consider adjusting the future cost estimate for the possibility of two or more correlated events, such as mudslide following a wildfire or disease spread after a flood.

3.9 Post-Event Economic Forces—The actuary should take into account whether future **catastrophe** losses might be affected by broader economic forces such as demand surge causing temporary supply and demand imbalances or by other post-event loss amplifications triggered by a **catastrophe**.

3.10 Costs Not Considered in Catastrophe Models—When using a **catastrophe model** to develop the future cost estimates, the actuary should assess whether the model output fully

reflects the costs included in the coverage associated with the future cost estimates. If the actuary identifies costs that are not reflected in model output, the actuary should consider separately estimating such costs.

3.11 Reasonableness—The actuary should be satisfied that the future cost estimates reasonably reflect the anticipated distribution of **catastrophe** losses.

3.12 Reliance on Another Party—When relying on another party and thereby disclaiming responsibility for

a. data and other information relevant to the use of data, the actuary should refer to ASOP No. 23.

b. a model, the actuary should refer to ASOP No. 56.

c. a **catastrophe model**, the actuary should refer to ASOP No. 38.

d. assumptions or methods prescribed by another party, the actuary should review the assumptions or methods for reasonableness and consistency with other assumptions or methods to the extent practicable and appropriate within the scope of the actuary's assignment.

e. any other item not addressed above (including assumptions or methods provided, but not prescribed, by another party), the actuary should review the items for reasonableness and consistency to the extent practicable and appropriate within the scope of the actuary's assignment. In addition, the actuary should be reasonably satisfied that the reliance is appropriate, taking into account the following, as applicable:

1. when the other party is an actuary, whether the actuary knows that the other party is appropriately qualified and has followed applicable ASOPs;

2. whether the actuary knows that the other party has expertise in the applicable field;

3. whether the actuary knows the other party's stated purpose for the item and the extent to which it is consistent with the actuary's intended purpose; and

4. whether the actuary knows of differences of opinion within the other party's field of expertise that are material to the actuary's use of the item.

3.13 Documentation—The actuary should prepare and retain documentation to support compliance with the requirements of section 3 and the disclosure requirements of section 4. The actuary should prepare documentation in a form such that another actuary qualified in the same practice area could assess the reasonableness of the actuary's work. The amount, form, and detail of the 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, *Actuarial Communications*, 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, the actuary should refer to ASOP Nos. 13, 23, 25, 38, 41, 53, and 56. In addition, the actuary should disclose the following:

a. any perils or events identified by the actuary that may produce **catastrophe** losses (section 3.2);

b. the criteria used to identify which events are considered **catastrophes** for the purposes of applying this standard (see section 3.3);

c. a description of the data, methods, assumptions, and rationale used to

i. incorporate historical insurance data, non-insurance data, and **catastrophe model** output in the future cost estimate (see sections 3.3 and 3.5);

ii. incorporate loss adjustment expenses in the future cost estimate (see section 3.4);

iii. select a **catastrophe model(s)** (see sections 3.6 and 3.7);

iv. make any adjustment(s) for multiple events (see section 3.8);

d. any impact of post-event economic forces considered (see section 3.9);

e. assumptions and methods used to estimate any costs not reflected in **catastrophe models** being used (see section 3.10); and

f. the extent of any reliance on information provided by another party (section 3.12).

4.2 Additional Disclosures in an Actuarial Report—The actuary also should include disclosures in an actuarial report in accordance with ASOP No. 41 for any of the following circumstances:

a. if any material assumption or method was prescribed by applicable law;

b. 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; or

c. if in the actuary's professional judgment, the actuary has deviated materially from the guidance of this standard.

4.3 Confidential Information—Nothing in this standard is intended to require the actuary to disclose confidential information.

Appendix 1

Background and Current Practices

Historical Procedures

Prior to Hurricanes Hugo (1989) and Andrew (1992), the predominant ratemaking procedures used by primary property insurers to determine a catastrophe provision involved calculating the long-term ratio of such losses to non-catastrophe losses over a twenty- to thirty-year span. Property catastrophes were identified by an industry-dollar or loss-ratio threshold and were typically restricted to weather-related perils such as hurricanes, tornadoes, or snowstorms. Other property catastrophes such as floods and earthquakes were usually covered by optional coverages or separate policies.

Provisions for casualty-related catastrophes were typically included implicitly in primary insurers' rates, possibly using a contingency provision.

Primary insurers used ceded reinsurance to manage various exposures beyond the insurer's risk tolerance. Reinsurers used a combination of methods to price property catastrophe reinsurance or casualty excess-of-loss reinsurance, including historical data, expert judgment, learnings from similar events in the past, and experience and exposure rating techniques. Final prices were often expressed as ratios to a cedant's primary exposure or premium within the subject business of a treaty or facultative placement.

Regulatory and rating agency surplus requirements for U.S. insurers were a function of written premium, with no explicit recognition that catastrophe-exposed insurers required more capital compared to others with minimal catastrophe exposure. Furthermore, a catastrophe-exposed insurer with inadequate rates or underestimated unpaid claims reserves had the potential to appear to be more adequately capitalized than a similar insurer with sufficient rates or reasonable carried reserves.

Emerging Issues and Evolution of Current Practices

Property—In the late 1980s and early 1990s, property catastrophes produced aggregate losses exceeding previously expected possibilities, leading to several insurer and reinsurer insolvencies. Events such as hurricanes Hugo and Andrew, California earthquakes near San Francisco and Northridge, the Oakland Hills wildfire, and a major flood in the Midwest caused unanticipated levels of loss and prompted recognition of rate inadequacy. In addition, population movements, increasing exposure concentration, and variations in adherence to building codes produced changes in exposure that had not been taken into account by historical procedures. The resulting higher historical losses led to rapid rate increases, capacity shortages, and other market disruptions.

This situation triggered a drive to improve risk assessment tools and sources of capital in the early 1990s, giving rise to the development of property catastrophe models. Property catastrophe

models became more mature after enhancements, validation efforts, reinsurers' insistence on the quality of cedants' exposure data, and some state-level regulatory or legislative scrutiny. The use of catastrophe models to support rates for catastrophic property perils or events instead of relying solely on historical insurance data has become more widely accepted. Many U.S. regulators now expect property/casualty insurers to use property catastrophe model output when monitoring their exposure accumulations compared to their desired risk profiles and when evaluating their capital adequacy.

Casualty—In the mid-1980s, recognition of accumulated asbestos and environmental liabilities exacerbated a sharp turn from soft to hard U.S. casualty market conditions. Recognition of asbestos and environmental unpaid claims liabilities produced insolvencies and prompted reinsurers (and primary insurers) to implement new exclusions or change occurrence coverage to claims-made coverage in the most affected commercial lines segments. This shifted the balance of incentives for large accounts in those markets toward risk mitigation or loss prevention and limited risk transfer using non-admitted excess and surplus lines markets. Casualty catastrophes are manifested in legal, socio-economic, and environmental factors rather than physical properties. Liability may be incurred long before claims are reported, and loss development may span years or decades. Liability often does not occur in well-defined geographic areas and tends to be non-recurring, unlike losses for natural catastrophes.

Emerging Risks—Other issues such as terrorism exemplified by the 9/11 World Trade Center attack and wildfires, both of which highlight emerging property and casualty catastrophe exposure, have emerged that make assessment of catastrophe exposure more difficult. Technological advances in the 21st century have led to risks not previously contemplated, such as cyber risk. Likewise, the recent advances in artificial intelligence may introduce additional sources of emerging liability catastrophe risk.

Climate change has been a source of increased focus in the 21st century and is believed to have increased the variability in frequency and severity of natural catastrophes, as was found in the review of long-term historical data underlying the Actuary's Climate Index. Climate change also presents potential emerging liability risk. Climate change impacts may require reliance on additional or new types of data, climate studies, scenario analysis, or climate models from global organizations (such as the Intergovernmental Panel on Climate Change), academic institutions, catastrophe modeling organizations, or climate scientists.

Evolution of Tools—In response to the need for better tools to understand exposure to catastrophe or extreme event losses, the quality and granularity of data have significantly improved. This, combined with rapid advances in computational power, has resulted in catastrophe simulation models being widely used by actuaries in many practice areas for risk management, ratemaking, and pricing analyses. The use of catastrophe models in the United States, which initially focused on the hurricane and earthquake perils, has steadily expanded to other key perils and events, such as severe convective storm, winter storm, wildfire, flood, terrorism, and initial versions of cyber catastrophe models.

The growth of catastrophe models has not obviated the need to perform actuarial analyses of loss experience. The review of historical insurance and non-insurance data continues to be important,

given the varying levels of model maturity, and in some cases, model results that are unreliable or not fit-for-purpose. For example, catastrophe loss experience can be used for a variety of purposes, including validating catastrophe model assumptions, comparing model output to indications based on adjusted historical data, adjusting model assumptions or output metrics, or blending with model output to improve expected loss estimates. Using long-term historical data requires adjusting historical data to reflect expected conditions including exposure changes, population shifts, claim cost inflation, economic and noneconomic distortions, changes in applicable law, and changing climate conditions.

One goal of the revision to ASOP No. 39 was to modernize its terminology to better fit the current state of practice and anticipate future evolution of practice involving treatment of catastrophe losses in future cost estimates. The objective was to recognize the rapid evolution of this field in recent years, particularly as it has moved from its historical roots in ratemaking for natural disasters to a wider range of applications.

Historically, the main challenge was to use actuarial techniques to deal with making a provision for the infrequent occurrence of large natural disasters in long-term pricing and associated applications in risk management, capital requirements, and reinsurance. As such, the focus was on insurance statistics on disasters collected by organizations such as Property Claims Services and on how to incorporate reasonable provisions for such infrequent large events in long-term loss costs that formed the basis for property insurance prices. The emphasis was on events defined as "catastrophes," usually based on some monetary threshold for an event large enough to distort the statistics used for ratemaking. Techniques such as the excess wind procedure and later tools such as catastrophe models were designed to estimate these large catastrophes and help actuaries place them into a proper provision to reflect their long-term expected cost.

These catastrophe views were based on the monetary effect of disasters on insurance losses. While understanding monetary effects is still of central importance to many applications, as actuarial practice has evolved it has become apparent that the consideration of catastrophes should expand to include events that may or may not generate large dollar losses.

Examples of these types of events include the following:

- An entity with a large amount of personal customer data could be the target of a cyber-attack. If the attackers are unable to get past the security protecting the individuals' data and the system penetration is detected relatively early, the event may or may not fall into the traditional definition of a catastrophe. This is an example of an event that is not a classic catastrophe, but that needs to be considered by an actuary doing pricing or risk analysis work.

- In tropical cyclones, extreme events, such as the rapid intensification from a tropical storm to category 5 hurricane, can occur far offshore. Understanding these events is important to building a full hazard distribution, but some of these events may not trigger losses.

- Climate analysis requires consideration of scenarios that have extreme events, such as heatwaves or droughts, which could have different economic consequences from those associated with the traditional definition of a "catastrophe" (for example, an uptick in hospital admissions but not physical damage to structures or a huge dollar loss to the economy).

These examples illustrate why the standard has expanded the definition of catastrophe.

Appendix 2

Comments on the First Exposure Draft and Responses

The first exposure draft of the proposed revision of ASOP No. 39, *Treatment of Catastrophe or Extreme Event Losses in Future Cost Estimates for Property/Casualty Risk Transfer and Risk Retention*, was issued in February 2025 with a comment deadline of June 1, 2025. Ten comment letters were received, some of which were submitted on behalf of multiple commentators, such as by firms or committees. For purposes of this appendix, the term "commentator" may refer to more than one person associated with a particular comment letter. The ASOP No. 39 Task Force and Casualty Committee of the Actuarial Standards Board (ASB) carefully considered all comments received, and the ASB reviewed (and modified, where appropriate) the changes proposed by the ASOP No. 39 Task Force and ASB Casualty Committee.

Summarized below are the significant issues and questions contained in the comment letters and the responses. Suggestions for minor wording or punctuation changes are not reflected in the appendix, although they may have been adopted.

The term "reviewers" in appendix 2 includes the ASOP No. 39 Task Force, the ASB Casualty Committee, and the ASB. The section numbers and titles used in appendix 2 refer to those in the exposure draft, which are then cross referenced with those in the final standard.

GENERAL	
Comment	One commentator suggested moving discussion of casualty extreme events to a separate standard.
Response	The reviewers disagree and made no change in response to this comment.
TRANSMITTAL MEMO	
Q1: Does this exposure draft overlook any significant approaches to estimating future costs of catastrophes or extreme events? If so, please explain.	
Comment	Five commentators said that the exposure draft does not overlook any significant approaches to estimating future costs of catastrophes or extreme events.
Q2. Is the guidance regarding scenario analysis clear and sufficient? If not, please explain.	
Comment	Several commentators said the guidance regarding scenario analysis is clear.
Q3: Is the guidance regarding reasonableness clear and sufficient? If not, please explain.	
Comment	Several commentators said that guidance on reasonableness was redundant with other ASOPs and could be deleted.
Response	The reviewers retained guidance on reasonableness.
Comment	One commentator said the guidance was clear and sufficient.

SECTION 1. PURPOSE, SCOPE, CROSS REFERENCES, AND EFFECTIVE DATE	
Section 1.2, Scope	
Comment	One commentator suggested deleting risk load from the list of risk metrics.
Response	The reviewers disagree and made no change.
SECTION 2. DEFINITIONS	
Section 2.1, Catastrophe	
Comment	One commentator suggested using "incurred" instead of "commencing" if referring to the losses.
Response	The reviewers modified the definition in response to another comment.
Comment	One commentator suggested using the definition of "extreme event" for "catastrophe" and eliminating "extreme event" in the standard.
Response	The reviewers agree and made changes consistent with the suggestion.
Comment	One commentator suggested that catastrophes may be defined by periods of time other than hours, suggested deleting the example of an industry organization, and suggested that a catastrophe may be associated with an extreme event or a series of related extraordinary events and may include compound events.
Response	The reviewers agree and made changes consistent with the suggestions.
Section 2.2, Catastrophe Model	
Comment	One commentator suggested using the term "Catastrophe or Extreme Event Model."
Response	The reviewers disagree but note that the definition of "catastrophe" now includes "extreme events."
Section 2.3, Compound Events (now deleted)	
Comment	Several commentators asked for examples.
Response	The reviewers deleted the definition but added examples in section 3.8.
Comment	One commentator suggested that a compound event may result from contagion.
Response	The reviewers deleted the definition.
Section 2.4, Extreme Event (now deleted)	
Comment	Several commentators suggested revisions to the definition of "extreme event."
Response	The reviewers deleted the definition.
Comment	One commentator suggested deleting or changing the definition.
Response	The reviewers deleted the definition.
Comment	One commentator suggested pointing out that an extreme event may involve compound events.
Response	The reviewers deleted the definition and provided guidance on multiple events in section 3.8.

Section 2.5, Scenario Analysis (now section 2.3)	
Comment	One commentator suggested revising the definition of scenario analysis.
Response	The reviewers believe the language is appropriate and made no change in response to this comment.
Comment	One commentator suggested clarifying that scenario analysis could be a model.
Response	The reviewers agree and modified the language accordingly.
Comment	One commentator suggested adding an example of scenario analysis.
Response	The reviewers disagree and made no change in response to this comment.
Comment	One commentator said the definition is too broad.
Response	The reviewers disagree and made no change in response to this comment.
Comment	One commentator asked for additional guidance on the appropriate use and development of scenario analysis.
Response	The reviewers believe that the current language covers this issue at the appropriate level of detail and therefore made no change in response to this comment.
Proposed new definition, Demand Surge	
Comment	One commentator suggested retaining the definition of demand surge from the existing standard.
Response	The reviewers disagree with adding a definition but added "or other post-event loss amplification" to what is now section 3.9.
Proposed new definition, Extreme Event Model	
Comment	One commentator suggested adding a definition of extreme event model.
Response	The reviewers note that other changes address this issue and did not add a definition.
Proposed new definition, Actuarial Report	
Comment	One commentator suggested adding the definition of "actuarial report" from ASOP No. 41, *Actuarial Communications*.
Response	The reviewers note that the ASOP refers the actuary to ASOP No. 41 and made no change.
Proposed new definition, Contagion	
Comment	One commentator suggested adding a definition of contagion.
Response	The reviewers disagree and made no change.
SECTION 3. ANALYSIS OF ISSUES AND RECOMMENDED PRACTICES	
Section 3.2, Identification of Potential Catastrophes or Extreme Events (now Identification of Potential Catastrophes)	
Comment	One commentator suggested including characteristics indicative of catastrophe or extreme event losses, such as those contained in the current version of the ASOP, as examples to consider.
Response	The reviewers believe the guidance is sufficient and made no change.

Comment	One commentator suggested deleting "extreme events" and adding part of the definition of catastrophe.
Response	The reviewers modified the language.
Section 3.3, Identification and Attribution of Historical Catastrophe or Extreme Event Losses (now Identification and Attribution of Historical Catastrophe Losses)	
Comment	Two commentators suggested adding illustrative examples.
Response	The reviewers believe the language is appropriate and made no change in response to these comments.
Section 3.4, Use of Data and Models (now section 3.5)	
Comment	One commentator suggested moving the references to ASOP Nos. 13, *Trending Procedures in Property/Casualty Insurance*, and 23, *Data Quality*, to the end of section 3.4.1.
Response	The reviewers believe the reminder in this section is sufficient and made no change.
Comment	One commentator suggested changing the title to Use of Data, Models, and Scenario Analysis.
Response	The reviewers note that scenario analyses are a type of catastrophe model and made no change.
Section 3.4.1, Use of Historical Insurance Data (now section 3.5.1)	
Comment	One commentator suggested adding "advisory organizations" to the list of data sources.
Response	The reviewers agree and made the change.
Section 3.4.1.1., Applicability of Historical Insurance Data (now section 3.5.1.1)	
Comment	One commentator suggested adding, "In addition, the actuary should consider if the historical data is a reasonable expectation of the future long-term average for perils seeing rapid changes (such as cyber, perils affected by climate change, or terrorism.)"
Response	The reviewers believe language added to section 3.5.1.4 addresses this issue.
Section 3.4.1.2, Evaluating Credibility of Historical Insurance Data (now section 3.5.1.2)	
Comment	One commentator suggested adding "in the subject future period."
Response	The reviewers believe the language is clear and made no change in response to this comment.
Section 3.4.1.3, Adjustment of Historical Insurance Data to Reflect Future Conditions (now section 3.5.1.3)	
Comment	One commentator suggested moving (d) into (a).
Response	The reviewers disagree and made no change in response to this comment.
Section 3.4.1.3(d) (now section 3.5.1.3[d])	
Comment	One commentator suggested explaining "wealth effect."
Response	The reviewers clarified the language.
Sections 3.4.1.3 & 3.4.1.5, Differing Trends in Loss Data (now sections 3.5.1.3 and 3.5.1.5)	
Comment	One commentator suggested moving language in 3.4.1.5 on non-insurance sources of data into section 3.4.1.3(h).
Response	The reviewers made no change in response to this comment.

Section 3.4.1.4, Stability vs. Responsiveness of Outcomes Based on Historical Insurance Data (now section 3.5.1.4)	
Comment	One commentator suggested alternative language.
Response	The reviewers modified the guidance.
Section 3.4.1.6, Differing Development in Loss Data (now section 3.5.1.6)	
Comment	One commentator suggested adding that extreme event losses may be reported, handled, and settled differently.
Response	The reviewers believe the language is appropriate and made no change in response to this comment.
Section 3.4.2, Use of Non-Insurance Data (now section 3.5.2)	
Comment	One commentator suggested deleting the reference to federal government data.
Response	The reviewers believe the language is appropriate and made no change in response to this comment.
Section 3.4.3, Use of Catastrophe Model Output (now section 3.5.3)	
Comment	One commentator suggested adding, "When using catastrophe model output, the actuary should consider adjusting the catastrophe model output to reflect the environment expected to exist in the period for which the actuary is estimating costs taking into account the considerations in 3.4.1.3 (a)-(h), as applicable."
Response	The reviewers agree and added similar language.
Section 3.4.3, 3.4.4, 3.8, and elsewhere (now sections 3.5.3, 3.5.4, 3.9, and elsewhere)	
Comment	One commentator suggested using the term "Catastrophe or Extreme Event Model."
Response	The reviewers disagree and made no change in response to this comment.
Section 3.4.4, Blending of Historical Data and Catastrophe Model Output (now section 3.5.4)	
Comment	One commentator said the example was confusing and suggested an alternative.
Response	The reviewers modified the language.
Comment	One commentator suggested moving this section to later in the document and allowing for blending of any of historical insurance data, catastrophe model output, and scenario analysis.
Response	The reviewers disagree with moving the language but believe other changes made address the commentator's concerns.
Comment	One commentator suggested adding scenario analysis, deleting the basic and excess example, and clarifying what was meant by reasonable.
Response	The reviewers believe changes made address the commentator's concerns.
Section 3.6, Additional Considerations for Casualty Coverages (now section 3.7, Additional Considerations When Selecting Catastrophe Models)	
Comment	Two commentators suggested combining the guidance in sections 3.6 and 3.7.
Response	The reviewers disagree and made no change in response to this comment.

Comment	One commentator suggested providing an example of "unanticipated risks."
Response	The reviewers disagree and made no change in response to this comment.
Comment	Several commentators suggested the guidance in this section could apply to both property and casualty coverages.
Response	The reviewers agree and modified the language.
Comment	One commentator recommended switching sections 3.6 and 3.7.
Response	The reviewers agree and changed the order.
Section 3.7, Considerations when Evaluating Models (now section 3.6, Considerations When Selecting Catastrophe Models)	
Comment	One commentator recommended adding additional guidance on "scenario analysis" and changing "should consider" to "may" with respect to reviewing results of more than one model.
Response	The reviewers disagree and made no change in response to this comment, but moved the related guidance to the end of the section.
Section 3.7(c) (now section 3.6[c])	
Comment	One commentator suggested adding "emerging available data, and emerging methods."
Response	The reviewers agree and added data and methods.
Section 3.8, Costs Not Considered in Catastrophe Models (now section 3.10)	
Comment	One commentator suggested adding scenario analysis.
Response	The reviewers disagree, made no change in response to this comment, but note that other changes clarify that catastrophe models can include scenario analyses.
Comment	One commentator suggested changing "should assess" to "should consider whether."
Response	The reviewers disagree and made no change in response to this comment.
Comment	One commentator suggested adding "significant" before "costs."
Response	The reviewers disagree and made no change.
Section 3.10, Impact of Broader Economic Forces (now section 3.9, Post-Event Economic Forces)	
Comment	One commentator suggested adding "social" forces.
Response	The reviewers disagree and made no change in response to this comment.
Comment	One commentator suggested changing "should take into account" to "should consider."
Response	The reviewers believe the language is appropriate and consistent with ASOP No. 1, *Introductory Standard of Practice,* and made no change in response to this comment.
Comment	One commentator suggested expanding the example to include things other than demand surge to provide additional clarification.
Response	The reviewers believe the example is sufficient but added "other post-event loss amplifications."

Section 3.11, Reasonableness	
Comment	Two commentators said it might be difficult to specify frequency and severity in some cases.
Response	The reviewers agree and modified the language.
Comment	One commentator suggested deleting the section or referring to ASOP No. 1.
Response	The reviewers disagree and made no change in response to this comment.
Section 3.12, Reliance on Another Party	
Comment	One commentator suggested providing guidance to disclose the "extent of reliance" on another party, rather than "disclaiming responsibility."
Response	The reviewers note that this disclosure is included in section 4 and made no change.
Proposed new section, Use of Scenario Analysis	
Comment	One commentator suggested adding a section that explicitly permits scenario analysis.
Response	The reviewers modified the definition of catastrophe model to include scenario analysis in response to this comment.
SECTION 4. COMMUNICATIONS AND DISCLOSURES	
Section 4.1, Required Disclosures in an Actuarial Report	
Comment	One commentator suggested adding a reference to ASOP No. 30, *Treatment of Profit and Contingency Provisions and the Cost of Capital in Property/Casualty Insurance Ratemaking*.
Response	The reviewers believe a reference to ASOP No. 30 is unnecessary and made no change.
Section 4.1(d) (now 4.1[c])	
Comment	One commentator suggested adding a reference to extreme events in d(i).
Response	The reviewers disagree with the suggestions for (d) and made no change in response to this comment.
Section 4.1(e)	
Comment	Several commentators suggested making (e) more general.
Response	The reviewers believe this disclosure is covered by what is now 4.1(c).
APPENDIX 1	
Comment	One commentator suggested modifying the language in the last paragraph of the Historical Procedures section.
Response	The reviewers agree and made the change.
Comment	One commentator suggested reinstating the current practices section.
Response	The reviewers changed the title of the subsection "Issues" to "Emerging Issues and Evolution of Current Practices," since it already contained a discussion of current practices.