

Draft: 10/3/25

**2026 Proposed Charges****CASUALTY ACTUARIAL AND STATISTICAL (C) TASK FORCE**

The mission of the Casualty Actuarial and Statistical (C) Task Force is to identify, investigate and develop solutions to actuarial problems and statistical issues in the property/casualty (P/C) insurance industry.

The Task Force's goals are to assist state insurance regulators with maintaining the financial health of P/C insurers; ensuring P/C insurance rates are not excessive, inadequate or unfairly discriminatory; and ensuring that appropriate data regarding P/C insurance markets are available.

**Ongoing Support of NAIC Programs, Products, or Services**

1. The **Casualty Actuarial and Statistical (C) Task Force** will:
  - A. Provide reserving, pricing, ratemaking, statistical, and other actuarial support to NAIC committees, task forces, and/or working groups. Propose changes to the appropriate work products, with the most common work products noted below, and present comments on proposals submitted by others relating to casualty actuarial and statistical matters. Monitor the activities regarding other group's activities related to casualty actuarial issues, including the development of financial services regulations and statistical reporting, including disaster.
    - i. Property and Casualty Insurance (C) Committee: Ratemaking, reserving, or data issues.
    - ii. Blanks (E) Working Group: Property/casualty (P/C) annual financial statement, including Schedule P; P/C quarterly financial statement; and P/C quarterly and annual financial statement instructions, including the Statement of Actuarial Opinion (SAO) and Actuarial Opinion Summary Supplement.
    - iii. Capital Adequacy (E) Task Force: P/C risk-based capital (RBC) report.
    - iv. Statutory Accounting Principles (E) Working Group: *Accounting Practices and Procedures Manual* (AP&P Manual), and specifically with any future review and provide comments on statutory accounting issues being considered under *Statement of Statutory Accounting Principles (SSAP) No. 65—Property and Casualty Contracts*.
    - v. Speed to Market (D) Working Group: P/C actuarial sections of the *Product Filing Review Handbook*.
  - B. Monitor national casualty actuarial developments and consider regulatory implications.
    - i. Casualty Actuarial Society (CAS) ~~and Society of Actuaries: Statements of Principles and~~ Syllabus of Basic Education.
    - ii. American Academy of Actuaries (Academy): Standards of Practices, Council on Professionalism and Education, and Casualty Practice Council.
    - ~~iii. Society of Actuaries (SOA): Anticipated changes to education pathways.~~
    - ~~iv. iii.~~ Federal legislation.
  - C. Facilitate discussion among state insurance regulators regarding rate filing issues of common interest across the states through the scheduling of regulator-to-regulator meetings.
  - D. Conduct the following predictive analytics work:
    - i. Facilitate training and the sharing of expertise through predictive analytics webinars (Book Club).
    - ii. Coordinate with the Innovation, Cybersecurity, and Technology (H) Committee and the Life Actuarial (A) Task Force on the tracking of new uses of artificial intelligence (AI), auditing algorithms, product development, and other emerging regulatory issues. Discuss regulatory oversight of AI and machine learning (ML) in insurers' ratemaking, reserving, and other activities with Big Data and AI (H) Working Group and Third-Party Data and Models (H) Working Group.
    - iii. With the NAIC Rate Model Review Team's assistance, discuss guidance for the regulatory review of models used in rate filings. Maintain the Model Review Manual.
  - E. Research-Monitor cyber liability insurance and discuss regulatory data needs.

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- Develop rate indices to track, over time and in detail, the cumulative magnitude of the rate changes that impact each state's P/C insurance markets. Collaborate with the SERFF modernization team to help guide the new platform in a direction that hopes to make these types of indices more granular, reliable, and useful.

2. The **Actuarial Opinion (C) Working Group** will:

- ~~A.~~ Propose revisions to the following as needed, especially to improve actuarial opinions, actuarial opinion summaries, and actuarial reports, as well as the regulatory analysis of these actuarial documents and loss and premium reserves:
- Financial Analysis Handbook.*
  - Financial Condition Examiners Handbook.*
  - Annual Statement Instructions—Property/Casualty.*
  - Regulatory guidance to appointed actuaries and companies.
  - Other financial blanks and instructions, as needed.

~~B. Assess the need for changes to the Property and Casualty Statement of Actuarial Opinion instructions upon release of the SOA's proposed changes to its education pathways.~~

3. The **Statistical Data (C) Working Group** will:

- Consider updates and changes to the *Statistical Handbook of Data Available to Insurance Regulators* to improve data quality and reporting standards.
- Consider updates and developments, provide technical assistance, and oversee the production of the following reports and databases. Periodically, evaluate the demand and utility versus the costs of production of each product.
  - Dwelling Fire, Homeowners Owner-Occupied, and Homeowners Tenant and Condominium/Cooperative Unit Owner's Insurance* (Homeowners Report).
  - Auto Insurance Database Report* (Auto Report).
  - Competition Database Report* (Competition Report).
  - Report on Profitability by Line by State Report* (Profitability Report).
  - Auto Insurance Average Premium Supplement*
- Enhance the expedited reporting and publication of average auto and average homeowners premium portions of the annual Auto Report and Homeowners Report.

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NAIC Support Staff: Kris DeFrain/Roberto Perez/Libby Crews

MemberMeetings/CCMTE/2025 Fall/CASTF/2026 CASTF Proposed Charges.Docx

*[Link to exposed NAIC Model Review Manual](#)*

(Can also be found on [Task Force Web page](#) under Documents.)

Attachment Two:

1. *NAIC Model Review Manual* **Exposure Comments Received**
2. Revised Appendix C (with tracked changes)

**From:** ZEMAN, ROBERT <Bob.ZEMAN@allstate.com>  
**Sent:** Friday, July 25, 2025 3:26 PM  
**To:** DeFrain, Kris <kdefrain@naic.org>  
**Cc:** ZEMAN, ROBERT <Bob.ZEMAN@allstate.com>  
**Subject:** FW: DRAFT NAIC CASTF Model Review Manual

Hi Kris, here are the comments from Allstate on the Draft Model Review Manual. Let me know if you have any questions. Thank you!

Allstate appreciates the opportunity to provide these comments on the NAIC Model Review Manual dated 6/5/25. Allstate recognizes the additional transparency that publication of this draft manual provides. We asked our company experts including but not limited to those involved in the filing process to review the manual and offer insights on the draft.

Our overriding comment is that we respectfully suggest the manual, and the process it is designed to reflect, allow additional opportunities earlier in the process for dialogue with the insurer making the model filing to answer questions and give context to the filing. This could further assist NAIC and state DOI staff in their review of the filing. Our staff indicated they of course would be willing to answer questions at any point throughout the review process.

Our staff understands that NAIC has indicated it will not share information as to which states have signed the agreement with the NAIC. While we respect that point of view, we suggest it could be useful for insurers to know which states participate in the review process and have access to prior NAIC reports. For example, for states that have signed the agreement, our filing memos could be tailored to identify existing model reports that could in turn help expedite another state's review.

It would also be helpful if the process would provide for notification to the filing company that the filing is being reviewed by the NAIC Model Review team. This could help the company respond to subsequent requests by other states for information relating to the filing. It would also help the company more efficiently plan for future filings.

Our staff indicated it would be helpful to receive, at some point in the process, a copy of the NAIC team's report relating to analysis of the company's filing. While we understand the report is prepared by the NAIC team to assist a given state in its review, the information

and feedback could help the company modify future filings and help shape responses to subsequent inquiries.

Similarly, our experts indicated it would be helpful to know if possible what information exists about review by the NAIC team of similar filings made by other insurers. This would be relevant in instances where we are considering a “me-too” filing consistent with law and procedure for such filings in a given state.

Our comments are given in the spirit of offering thoughts designed to help provide a more efficient process for the benefit of regulators, insurers and the consumers we serve.

Bob Zeman

Allstate

[Rzema@allstate.com](mailto:Rzema@allstate.com)

July 17, 2025

Kris DeFrain, MAAA, FCAS, CPCU  
Director of Research and Actuarial Services  
National Association of Insurance Commissioners (NAIC) Central Office  
(via email: kdefrain@naic.org)

RE: Draft Model Review Manual Comments

Dear Ms. DeFrain,

Thank you for this opportunity to provide feedback regarding the NAIC Model Review Manual.

APCIA<sup>1</sup> supports actions that assist in understanding and reviewing models. While most of the requirements are feasible, some seem unlikely to provide value. It is not clear what the intended use of some the information gathered may be. NAIC's actions on the data collected could lead to inappropriate regulation which would negatively impact our shared goal of assuring that premiums and reserves are aligned with risk.

Our members' concerns are outlined below.

## 1. Data Gathered Before Submission to the NAIC

*(Including High-level comments on Appendix C)*

- **General Concern:** Model Checklists are overly prescriptive and create the risk of limiting metrics that are more relevant than those addressed in the Checklists.
  - We recommend allowing greater adaptability in the selection of statistical metrics used to demonstrate appropriate model validation. The same metrics may not be suitable for all model types or use-case scenarios.
- **General Concern:** Model checklist requirements are excessively detailed.
  - We suggest refocusing the checklist on key areas such as model validation and usage, rather than emphasizing detailed technical aspects of model development.

## 2. Detailed Suggestions on the Model Checklists

- **General comments**

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<sup>1</sup> The American Property Casualty Insurance Association (APCIA) is the primary national trade association for home, auto, and business insurers. APCIA promotes and protects the viability of private competition for the benefit of consumers and insurers, with a legacy dating back 150 years. APCIA represents the broadest cross-section of home, auto, and business insurers of any national trade association. APCIA membership consists of over 1,200 member companies (or over 315 member groups). APCIA member companies P&C countrywide market share is 67% (total 75% commercial lines, 57% personal lines).

We recommend a less prescriptive approach. Regulators should identify critical validation concepts but allow companies flexibility in demonstrating validation. Prescriptive mandates impose undue burdens, especially when companies use comparable yet differing validation methods.

Specific examples include:

- P-values and confidence intervals do not always provide meaningful validation for parameter estimates, since their usefulness varies with the size of the dataset and other considerations. Flexibility to utilize alternative methods should be permitted.
  - Companies should have the flexibility to choose various suitable metrics to assess model performance. For instance, Lorentz curves can be used to effectively validate overall model performance.
  - Shapley values may provide more meaningful views of variable importance as opposed to Variable Importance Plots in certain contexts. Flexibility in selecting appropriate methods should be allowed.
  - The number of categories used in quantile plots should reflect data specifics, model application, and dataset size. A fixed number (e.g. 20 categories) does not always provide the optimal validation information.
- **Essential Information Sections**
    - Clarification is needed on the term "target consumer," as its meaning is unclear and potentially ambiguous across multiple checklists.
  - **Sometimes Needed Information Sections**
    - Requiring detailed individual credentials for modeling team members, especially in larger companies where staffing may rotate during the course of a multi-year modeling project, creates excessive administrative burden. If individual credentials, as opposed to model information, is considered relevant from a regulatory perspective, it would be more practical to request qualifications only from the lead modeler accountable for the model's overall development.

### 3. Focus on Nationally Significant Companies and Licensed Third Parties

- **General Concern:** Company size alone is not a reliable indicator of model risk and should not be the criterion for achieving impactful regulatory oversight.
  - Larger companies may often have more resources to hire skilled modelers, develop proprietary models, or tailor third-party models to have a better fit to their books of business.
  - Relying solely on size may inadvertently confer an unfair competitive advantage to some firms, potentially stifling innovation while not addressing the risk of inadequately resourced models use by other firms.

- **Recommendation:** We suggest that the NAIC consider incorporating additional or alternative criteria beyond company size.
  - Possible criteria include:
    - The ratio of market conduct complaints to policies in force.
    - A qualitative evaluation of an insurance group's Model Risk Management framework or other relevant governance framework, as assessed by the group's lead regulator. For example, if a qualitative scale of A (highest rated), B (medium rated), or C (lowest rated) were used to rank model risk governance frameworks, prioritizing a C rated company over an A rated company may result in more impactful regulatory oversight. Such a qualitative rating could be applied alone or in conjunction with company size.

#### 4. Factors of Tree-Based Model

A simple decision tree will have a limited number of "factors," which can easily be expressed by a series of if/then statements ("if A, B, ~C, D, E, ~F, G, then \$2,300"). Such a tree would lead to dozens, perhaps hundreds of factors at most. In practice, companies generally don't use such a simple tree in a regulatory process, and may use methods such as Random Forests or Gradient Boosting Machines. In those cases, the model would be based on hundreds or thousands of underlying trees, each potentially with its own set of factors. The ensembled trees with different sets of features could lead to additional challenges with compliance:

- Column C (current factor): There is no sense in which any tree in the proposed model corresponds to a specific tree in a current model. It is not feasible to present a set of proposed and current factors in this manner.
- Column D, E, F (indicated factor): It is neither efficient nor practical for data scientists and companies to adjust factors in these models as they might in GLMs. It is reasonable to assume that these columns will always be equivalent. Submitting them for regulation would be practical but meaningless.
- Presentation: While it is possible to show every single tree, the weights applied to each tree, and the if/then statements that represent which leaf of each tree would get activated, it is not clear how the NAIC intends to use the lengthy documentation which may have no added value and insight. We request that the intended process for using this data is shared before the close of the review period.
- Table of every possible combination: This is no more feasible for decision trees (or neural nets) than it is for GLMs. We request that the usage of such information for GLM regulation in the past is shared before the close of the review period.

#### Additional comments for neural nets

We are confused by the thrust of this section which implies that neural nets are synonymous with classification. It is neither the case that neural nets can only be used for classification, nor that classification can only rely on neural nets. Due to their layered structure and nonlinear transformations, the "factors" in neural networks may be even less meaningful to regulators than they are for decision trees. We believe that this serves to illustrate the concerns expressed above in the comments in the decision tree section.

Please do not hesitate to contact me with questions.



Thank you,



Norman Miami, FCAS, MAAA, Affiliate IFoA

Vice President, Actuary, Policy, Research and International

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July 25, 2025

Commissioner Bettencourt (NH), Chair  
NAIC Casualty Actuarial and Statistical (C) Task Force  
c/o Kris DeFrain, Director, Research and Actuarial Department  
Via email [kdefrain@naic.org](mailto:kdefrain@naic.org)

**Re: NAMIC Comments on the Casualty Actuarial and Statistical (C) Task Force's NAIC Model Review Manual**

Dear Commissioner Bettencourt and Members of the Committee:

On behalf of the National Association of Mutual Insurance Companies (NAMIC)<sup>1</sup>, we would like to thank the NAIC Casualty Actuarial and Statistical (C) Task Force for requesting and accepting comments on its recent NAIC Model Review Manual exposure. NAMIC appreciates the Task Force's attention to transparency in how the rate model reviews are conducted on behalf of states, as well as the effort to streamline the review process across states to achieve efficient speed-to-market. That said, we do wish to emphasize the importance of adhering to proper procedure and state specific laws for contracting directly with states.

NAMIC has substantive comments on the draft exposure below, and we are looking forward to continuing robust dialogue as the Task Force continues its review process.

**SUBSTANTIVE COMMENTS BY DOCUMENT**

**[1] NAIC Model Review Manual**

The original concept of contracting with the NAIC and using its staff for rate model reviews was rooted in the intent to provide a streamlined and technically consistent process, particularly as state Departments of Insurance work to develop their own internal expertise and staffing capacity. Given the principles and intent behind the process itself, transparency behind the need for, and genesis of, any changes to the process are of utmost importance. In an effort to more fully understand the changes being proposed, NAMIC requests greater clarity in the areas of the manual outlined below.

The comments we outline below are provided notwithstanding the fact that we strongly encourage Departments to prioritize rebuilding and maintain suitable in-house staffing levels. Preserving these functions at the Departments, where the statutory and regulatory authority ultimately resides, will help

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<sup>1</sup> The National Association of Mutual Insurance Companies consists of nearly 1,500 member companies, including seven of the top 10 property/casualty insurers in the United States. The association supports local and regional mutual insurance companies on main streets across America as well as many of the country's largest national insurers. NAMIC member companies write \$391 billion in annual premiums and represent 68 percent of homeowners, 56 percent of automobile, and 31 percent of the business insurance markets. Through its advocacy programs NAMIC promotes public policy solutions that benefit member companies and the policyholders they serve and fosters greater understanding and recognition of the unique alignment of interests between management and policyholders of mutual companies.



ensure that oversight remains closely aligned with the needs and legal responsibilities of each individual state.

#### **[a] Introduction**

NAMIC recommends that the Model Review team apply and rely upon relevant Actuarial Standards of Practice, and other actuarial principles related to the ratemaking process, in addition to ensuring compliance with applicable state statutes and regulations.

Additionally, the manual does not provide definitions for “complex predictive models” nor for “predictive models;” to create consistency from an actuarial standpoint, NAMIC recommends replacing these terms with simply “model” and utilizing the definition adopted in 2019 with ASOP 56.<sup>2</sup>

#### **[b] Rate Review Support Services Agreement**

Confidentiality continues to be a high priority for members, particularly in the case of model reviews, which often contain highly sensitive trade secret information from an insurance company. In this vein, NAMIC recommends:

1. The manual should include a page that lists all participating states and each state’s specific authority for sharing information with the NAIC, along with mandating the NAIC’s confidential treatment of the information. As we expressed during the development and execution of the Property Casualty Market Intelligence data call, companies want to provide all required information but will only do so with the confidence in statutory confidentiality.
2. NAIC exposure of the master Information Sharing and Confidentiality Agreement referenced in the manual.
3. Articulating how confidentiality will be maintained on the information is uploaded into the database. For example, will access be audited and maintained to ensure only appropriate stakeholders can access confidential information?
4. Establishing and maintaining open communication with the filing insurance company and sharing of any written report created by the NAIC to the insurance company.

#### **[c] State, Insurer, and Model-Type Priorities**

We are concerned this area of the manual may introduce inefficiencies into the filing process, which contradicts the stated goal of providing faster speed-to-market. Focusing primarily on “nationally significant companies” raises issues of fairness, as all insurers- regardless of size- should be subject to consistent regulation by the states. Additionally, based on member feedback, it has generally been an insurer’s experience that the NAIC review process tends to be slower than current state reviews, notwithstanding the commitment to a 30-day turnaround. Finally, limits on the number of NAIC reviews allowed per state each month could cause delays in filings, hindering timely market access.

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<sup>2</sup> <https://www.actuarialstandardsboard.org/asops/modeling-3/>



## [2] The Rate Review Support Services Agreement

NAMIC appreciates the opportunity to review a currently in-force agreement between the NAIC and Maine. Providing this is an outstanding example of genuine transparency in the spirit of collaboration that can improve safety and confidence for all stakeholders. The agreement appears to be strong, primarily because of its reliance on Maine statutes. Not all states currently have similarly strong statutory protections, which may create gaps or weaknesses if they execute comparable agreements that lack explicit protection.

With this in mind, we have recommended amendments for the agreement that would enhance the confidentiality protection of companies:

- 8. **As between the parties**, the NAIC agrees that the Confidential Information disclosed by the BOI remains the property of the BOI and agrees that it will take no action the effect of which would be to limit, waive or jeopardize any privilege or claim of confidentiality **held by the BOI or any other third party** related to the Confidential Information.
- 10. With the exception of the Report described herein, **and any Confidential Information or any derivatives thereof**, the NAIC retains any and all rights, title and interest in any work papers, methodologies, models, standards, and any other type of material whatsoever ("Proprietary Materials"), which it may have developed or employed in the performance of the Support Services under this Agreement, and neither the BOI nor the State of Maine shall have any right, title or interest in or to the Proprietary Materials for any purpose. The BOI agrees to take no action adverse to the rights of the NAIC as owner of the Proprietary Materials.
- Suggested additional new paragraph **19. To the extent any of the Confidential Information shared by the BOI with the NAIC under this agreement originates from a third party, such third party is an intended beneficiary of the Confidential provisions set forth in this Agreement.**

## [3] Appendix C

### [a] Page 3- Generalized Linear Model (GLM) List

NAMIC requests the task force clarify, and make explicit in the manual, what is considered a "new model" vs a "state-specified version of a model" vs a "refresh." By way of example, because many areas of a model can be adjusted, it is unclear what would constitute the threshold for a "new model".

### [b] Page 4- GLM Data

Relative to the GLM data section, NAMIC provides the following feedback:

1. NAMIC has concerns around the point in the manual that requests a listing of the rational explanation for each modeled variable and why it would plausibly impact insurance risk. Variables are selected based on correlation with loss experience. A rational explanation can be interpreted differently and therefore could introduce subjectivity biases into the analytical process which is not supported by ratemaking practices.



2. The request for 100 anonymized sample modeling records is a very large number given the need to provide all possible values. For consistency and to reduce supply and review burden, we suggest reducing to 10 records as requested on page 7.
3. The request for SERFF filing numbers where the use of data was previously approved warrants more clarity. Not all states require a filing to be approved, or generally a rate filing may be approved not specifically data.

#### **SUMMARY**

In summary, thank you again to the Task Force for allowing NAMIC to submit comments in response to the exposure of the NAIC Model Review Manual and associated documents. We look forward to continued discussions with the Task Force through robust and transparent conversations on this matter. NAMIC and our members seek to achieve efficient and effective methods of review as well as processing of model reviews in order to maximize speed-to-market. Such results are inherently beneficial not only to the Departments of Insurance, but companies and consumers alike, and fosters competitive marketplaces.

Sincerely,

Erica Weyhenmeyer, CPCU, AIE, MCM  
Policy Vice President – Market Regulation & Workers' Compensation  
NAMIC

**From:** Herrington, Whitney <Whitney.Herrington@flor.com>

**Sent:** Monday, July 7, 2025 11:46 AM

**To:** DeFrain, Kris <kdefrain@naic.org>

**Subject:** RE: Updated FW: CASTF Exposure: NAIC Model Review Manual

Good morning Kris,

Our team has the following to submit for the exposure:

*CASTF may consider revising the section titled “SERFF Access” under “Rate Review Support Services Agreement” on page 4.*

*Here is the current language:*

#### **SERFF Access**

The System for Electronic Rate and Form Filing (SERFF) allows insurers, advisory organizations, and third-party filers to submit insurance product filings (typically rate, rule, and form filings) electronically to state insurance regulators. This is a multi-state electronic filing system (licensed in all jurisdictions), but SERFF access is limited to a regulator’s individual state. NAIC Staff will request access to every state with a signed Rate Review Support Services Agreement.

#### **Access to NAIC and State Reports**

Access to the Model Database and NAIC or state reports is restricted to regulators only.

### **REVIEW SUBMISSIONS AND DUE DATES**

Before submission of a review request, the regulator will check the model database to see if the model has already been reviewed. Upon receipt of a regulator’s request to review model support and/or objections (compliance issues), NAIC Staff will review the model complexity and the current state of the filing’s supporting documentation. NAIC Staff will reply within 2 business days to share their availability and a date of when they can complete a review. The regulator will respond whether that date is acceptable, or they wish to withdraw the model review request.

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*This does not account for states that do not use SERFF for rate filings. In these cases, would the NAIC team need direct access to the state’s filing system?*



**Whitney Herrington**

Research and Projects Coordinator

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Tallahassee, FL 32399

[www.FLOIR.com](http://www.FLOIR.com)

**From:** Meyer, Connor (COMM) <connor.meyer@state.mn.us>

**Sent:** Tuesday, July 1, 2025 6:02 PM

**To:** Kloese, Sam <skloese@naic.org>

**Cc:** DeFrain, Kris <kdefrain@naic.org>

**Subject:** RE: Updated FW: CASTF Exposure: NAIC Model Review Manual

Hi Sam,

I just wanted to follow up about this question I had regarding the 7-year retention for modeling datasets on the Model Review Team checklists, and also I had one additional question about the checklist for neural networks.

On the fourth page of the neural network checklist (Neural Network Model Validation), one of the items is:

- A confusion matrix arranged as follows:
  - Predicted Class in the row names
  - Actual Class in the column names
  - Test Dataset count in the table

I am wondering if this item should also include a confusion matrix for any holdout/validation datasets rather than just the testing dataset, since holdout/validation datasets are also often utilized. If you're looking for feedback on the checklists, and think it would be a good idea to have confusion matrices for holdout datasets as well, perhaps this item of the checklist could be revised to:

- A confusion matrix for the Test and/or Holdout Datasets arranged as follows:
  - Predicted Class in the row names
  - Actual Class in the column names
  - Test Dataset (and/or Holdout Dataset) count in the table

Please let me know your thoughts on this matter.

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On Jun 30, 2025, at 4:25 PM, Meyer, Connor (COMM) <[connor.meyer@state.mn.us](mailto:connor.meyer@state.mn.us)> wrote:



Hi Kris,

Phil Vigliaturo forwarded me the NAIC Model Review Manual that is being exposed for comments. I'm not sure if this is the kind of comment/question you were looking to get, but I was wondering about one of the items on the Model Checklists in Appendix C. All the checklists have a line about guaranteeing that the modeling dataset will be retained for at least 7 years. I was wondering what the reasoning behind this is, and why it is deemed as "Essential Information" on the checklists rather than "Sometimes Needed Information". Does it come from an academic paper or an ASOP?

Again, I'm not sure if this is the kind of comment you were looking to get since it's more to do with the checklists rather than the Manual. Could you perhaps pass this question along to the Model Review Team?

Thanks,

Connor Meyer

Actuarial Analyst

651-539-1759

[mn.gov/commerce](http://mn.gov/commerce)

Minnesota Department of Commerce

85 7th Place East, Suite 280 | Saint Paul, MN 55101

<image006.png>

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# Washington State Comments

## NAIC Model Review Manual

### BACKGROUND

The NAIC model review project officially began in April 2018 when the Executive Committee adopted the recommendation of the Big Data (EX) Working Group to direct NAIC management to “conduct research on the appropriate skills and potential number of resources for the organization to help NAIC members in coordinating their reviews of predictive models.” NAIC senior management conducted the research and recommended gradual build-up of expertise at the NAIC to aid regulators’ review of P/C rate models.

In 2019 with existing actuarial, legal, and IT staff, the NAIC did 3 things:

- 1) Drafted a contractual agreement called the Rate Review Support Services Agreement (Appendix A) to be used so a state can gain access to the model database and can request a rate model technical review from the NAIC.
- 2) The NAIC developed the initial NAIC rate model technical review process with a consulting Actuary, and
- 3) the NAIC created a model database for confidential regulatory communication.

The NAIC does not do the following actions:

- Assume any regulatory authority,
- Create objections (“compliance issues”) to be sent to the company,
- Recommend acceptance or rejection of the model or any specific rating variable and,
- Separate analysis to determine any correlation with unlawful characteristics or to assess disparate impact.

Model reviews conducted by NAIC Staff were initially guided by the NAIC white paper *Regulatory Review of Predictive Models* (Attachment 2). This includes the initial paper and Appendices for different types of models adopted by the Task Force over time.

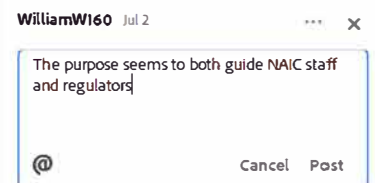
### INTRODUCTION

This *Manual* is intended to **guide NAIC Staff** to assist insurance regulators in the state’s review of predictive models. The aim is to provide a consistent and documented review of complex predictive models used in insurance products while providing appropriate speed to market. To the extent possible, the *Manual* is intended to add uniformity when NAIC Staff produce reports applicable to all states. Compliance with a state’s laws and regulations will be performed by the state insurance regulator.

### RATE REVIEW SUPPORT SERVICES AGREEMENT

This Rate Review Support Services Agreement (Agreement) identifies the NAIC services that can be requested and utilized:

- 1) Rate Model Reviews: Develop reports so state insurance regulators can review and decide if the insurer’s rate model support is in compliance with state law and regulations.



Review submissions should include any specific instructions. The Task Force can also request that specific policy questions be answered with each NAIC model review.


After a model is reviewed in one state, Comparison Reports were completed to compare an insurer's model in one state with the model reviewed in another state. At this time with limited NAIC resources, NAIC Staff will only create Comparison Reports if there are current resources available in the 30 days following the request. A Comparison Report template is maintained by NAIC staff.

## STATE, INSURER, AND MODEL-TYPE PRIORITIES

### 1. Data Gathered before Submission to the NAIC

- **Objective:** Ensure complete support documentation is received from the insurer prior to asking for an initial report from the NAIC. This should facilitate a smooth and more efficient review process. Insisting that companies provide complete information will reduce the review time of a model and will effectively reduce the number of NAIC reports per filing by one.
- **Process:**
  - States will be responsible for collecting and compiling relevant model support information prior to NAIC review.
  - The NAIC Model Checklist (Appendix C) provides information that must be submitted by regulators to the NAIC. The current Appendix C contains only GLM information. The Task Force will add the following to the GLM information in Appendix C: 1) checklists for non-GLM models, 2) modifications to support information when a model is a refresh to a previously filed model, and 3) guidance for any other special circumstances (e.g., specific components of a telematics filing to be reviewed).
  - States are encouraged to continually update their model filing requirements in SERFF upon adoption of new guidance from the Task Force.
  - Regularly review and adjust model support requirements to maintain efficiency and relevance.

### 2. Focus on Nationally Significant Companies and Licensed Third Parties

- **Objective:** Prioritize NAIC efforts on entities with the greatest impact.
- **Process:**
  - Limit NAIC review work to  top 20 insurance groups (by market size) and third-party vendors licensed or operating in 10 or more states.
  - Exceptions may arise; as in the case of an innovative modeling approach initiated by a smaller company or a new product.

### 3. Scheduling with Priorities -- Limiting the Number of Reports by State

WilliamW160 Jul 23

... X

I'm glad there can be exceptions to this since having to say no to a filer just because they are a smaller insurer would have some difficult political ramifications.

*Reply or use @ to invite others*

## NAIC STAFF RESOURCES

The Task Force will quarterly evaluate the queue of filings and the NAIC model review staff/resources. If the Task Force and/or Task Force leadership determine regulatory needs are not being met, the Task Force will first attempt to find efficiencies or suggest using other resources. If the Task Force wishes the needs to be met by NAIC Staff, the Task Force chair will discuss NAIC resources with the chair of the Property and Casualty Insurance (C) Committee.

## MANUAL REVISIONS

NAIC will evaluate the prioritization and utilization of NAIC resources to ensure that they are meeting the needs of those states participating in this process. Suggestions for improving or correcting information contained in the *Manual* may be made via written proposal to the Task Force. The Task Force will determine if changes should be made. Substantive changes made will be discussed in open session, while mechanical corrections (e.g., editorial or typographical changes) will be made without announcement or discussion.

## APPENDIX

- A. Rate Review Support Services Agreement Template
- B. The Task Force's white paper and all adopted appendices
- C. NAIC Model Checklists

WilliamW160 Jul 23 ... X

I'd prefer more active language than "discuss".  
Something like "advocate" or "encourage" or  
"partner with ... to develop a plan".

Reply or use @ to invite others

## Predictive Model Checklists Introduction

Regulators frequently using the NAIC rate model review service asked the NAIC rate model review team to create a list of rate filing documentation needed for the NAIC to complete a full-scope rate model review. The goals of such lists are to make the NAIC review process more efficient and expeditious. Regulators may evaluate these lists and determine the state's needs. Regulators can share this list with insurers, revise the state's rate filing checklists, or communicate with insurers through rate filing objections, when needed.

The lists below are divided by "Essential Information" and "Sometimes Needed Information." These terms are defined in this table:

Category	Description
Essential Information	Information that the NAIC rate model review team requests before writing a full-scope initial assessment of a model.
Sometimes Needed Information	Information that the NAIC model review team finds useful for model reviews but may only be needed if something appears non-standard about the modeling approach. Regulators may want to wait to request such information from insurers only when requested in the initial NAIC report.

This document is meant to address multiple model types. There are some differences in model documentation available for different model types. The sections below are divided by model type. Today, the majority of predictive models used in personal automobile and home insurance rating plans are GLMs. According to many in the insurance industry, GLMs introduce significant improvements over univariate-based rating plans by automatically adjusting for correlations among input variables. Tree-based models, including random forests and gradient boosting machines, can capture complex non-linear relationships between predictor variables and the target variable. Tree-based models can account for deep interactions between predictor variables. Penalized regression methods can mitigate the risk of overfitting and multi-collinearity in a multi-variate model. Some penalized regression methods (such as lasso regression) also offer automatic variable selection. This checklist document details the rate filing documentation requested by the NAIC Model Review Team for efficient review of standard GLMs, Tree-based models, and penalized regression models.

WilliamW160 Jul 23

Suggest there is a clear statement that regulators can edit this checklist. Just to make sure everyone knows this.

Reply or use @ to invite others

## Tree-based Model Data

## Essential Information

- A narrative providing the description of each data source including the following:
  - Informational materials or website links for each 3<sup>rd</sup> party
  - Commentary on how the company reviewed the veracity of the data source
  - Why the company believes the data source is useful for the model's intended purpose
  - Disclosure of known data errors
  - SERFF filing numbers where the use of the data was previously approved (if applicable)
- A description of the relevance of the data
  - The lines of business and companies included should be identified
  - Description of any considerations or adjustments made to make the data more applicable for its intended use
- A data dictionary provided as a table with the following columns:
  - Data Source (Vendor name or "Internal")
  - Variable name
  - Alternate names appearing in other filing documents
  - Data types (discrete, continuous, logical, categorical)
  - Treatment Type (Model, Control, Offset, Target)
  - Possible values (Empirical min and max for numerical variables, all categories for categorical variables)
- Tables showing summary metrics for each dataset by year (training, testing, holdout)
  - Year
  - Losses
  - Exposures (or Policy Count)
  - Claim Count (if applicable)
- A narrative on the candidate variable selection process prior to the model building.
- A narrative on the data accuracy and data reconciliation process
  - Description of the methods used to compile, filter, and/or merge data from different sources
  - How the data was reconciled to other sources
- A listing of the rational explanation for each modeled variable that discusses why it would plausibly impact insurance risk as discussed in the CASTF white paper.
- A guarantee that the modeling dataset will be retained for at least 7 years
- A description of any dimensionality reduction techniques (PCA, clustering, etc.) that were applied to the data.
- An Excel file with 100 anonymized sample modeling records including all predictor variables and target variables.

## Sometimes Needed Information

- A description of steps taken to meet state requirements regarding unfair discrimination (if applicable).
- A listing of variables which are subject to the fair credit reporting act (if applicable).
- A table showing the data volume distribution by state for each dataset (training, testing, holdout)
- A listing of variables initially considered but later removed from the model.

WilliamW160 Jul 23 ... X

Perhaps a more direct reference to page and location within the white paper

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Predictive Model Checklists Introduction

Regulators frequently using the NAIC rate model review service [have](#) asked the NAIC rate model review team to create a list of rate filing documentation needed for the NAIC to complete a full-scope rate model review. [The checklists below refer to “new model” vs. “model refresh.” A “model refresh” is a model where a prior iteration of the model was already filed with the department of insurance requesting review and the latest iteration uses the same data sources, variables, and modeling assumptions \(model type, error distribution assumptions, etc.\) as the prior iteration. A model which does not meet this definition of a model refresh is considered a new model.](#)

The goals of ~~such lists~~[the NAIC model checklists](#) are to make the NAIC review [of models](#) process more efficient and expeditious. Regulators may evaluate these lists and determine the state’s needs. Regulators can share this list with insurers, revise ~~insurers~~[the state’s rate filing checklists](#), ~~or communicate~~[or communicate](#) with insurers through rate filing objections, when needed.

The lists below are divided by “Essential Information” and “Sometimes Needed Information.” These terms are defined in this table:

Category	Description
Essential Information	Information that the NAIC rate model review team requests before writing a full-scope initial assessment of a model.
Sometimes Needed Information	Information that the NAIC model review team finds useful for model reviews but may only be needed if something appears non-standard about the modeling approach. Regulators may want to wait to request such information from insurers only when requested in the initial NAIC report.

This document is meant to address multiple model types. There are some differences in model documentation available for different model types. ~~The sections~~[The sections](#) below are ~~divided by~~[divided by](#) model type. Today, the majority of predictive models used in personal automobile and home insurance rating plans are GLMs. According to many in the insurance industry, GLMs introduce significant improvements over univariate-based rating plans by automatically adjusting for correlations among input variables. Tree-based models, including random forests and gradient boosting machines, can capture complex non-linear relationships between predictor variables and the target variable. Tree-based models can account for deep interactions between predictor variables. Penalized regression methods can mitigate the risk of overfitting and multi-collinearity in a multi-variate model. Some penalized regression methods (such as lasso regression) also offer automatic variable selection. This checklist document details the rate filing documentation requested by the NAIC Model Review Team for efficient review of standard GLMs, Tree-based models, and penalized regression models.



## Generalized Linear Model (GLM) List

### GLM Introduction

#### Essential Information

- A narrative discussing what the company is trying to accomplish with the model, including the following details:
  - Is this a new model or refresh? What is the prior model's SERFF number (if applicable)?
  - Does the filing impact existing renewals?
  - ~~Who is the target consumer?~~ What is the target market for the product?
  - What is the target variable of the model? (Frequency, Severity, Loss Ratios, Pure Premium, etc.) How is it defined?
  - What is being optimized? Does the model consider anything other than differences in loss cost?
- A narrative discussing the specifications and high-level assumptions of the model, including the following details:
  - Number of GLMs
  - Split of the data into models (by coverage, by peril, etc.)
  - Split of the data into datasets (training, test, holdout)
  - How models were combined to derive the final rating algorithm

#### Sometimes Needed Information

- A narrative discussing the credentials of the ~~modeling team~~ lead modeler and actuary reviewing the model (if applicable), including the following details:
  - Name of each individual
  - Relevant educational experience
  - Relevant credentials and designations
  - Years of experience building ~~predictive~~ models
  - Years of experience in the insurance industry
- Discuss how Actuarial Standards of Practice (ASOPs) 12, 23, 41, and 56 were considered in building the models.
- Describe the software (including packages and libraries if applicable) used to build the models.
- Provide copies of or links to academic references for their modeling techniques.
- A table listing the states where the model has been filed for review, the SERFF tracking number, and an indicator showing whether the filing has been approved.

## GLM Data

## Essential Information

- A narrative providing the description of each data source including the following:
  - Informational materials or website links for each 3<sup>rd</sup> party
  - Commentary on how the company reviewed the veracity of the data source
  - Why the company believes the data source is useful for the model's intended purpose
  - Disclosure of known data errors
  - The filing number representing the latest prior iteration of the model which contains the same proposed third-party data variables (if applicable).
  - ~~SERFF filing numbers where the use of the data was previously approved (if applicable)~~
- A description of the relevance of the data
  - The lines of business and companies included should be identified
  - Description of any considerations or adjustments made to make the data more applicable for its intended use
- A data dictionary provided as a table with the following columns:
  - Data Source (Vendor name or "Internal")
  - Variable name
  - Alternate names appearing in other filing documents
  - Data types (discrete, continuous, logical, categorical)
  - Treatment Type (Model, Control, Offset, Target)
  - Possible values (Empirical min and max for numerical variables, all categories for categorical variables)
- Tables showing summary metrics for each dataset (training, testing, holdout)
- by year, when applicable (training, testing, holdout)
  - Year
  - Losses
  - Exposures (or Policy Count)
  - Claim Count (if applicable)
- A narrative on how the company determined the variables to include in the final model
- A narrative on the data accuracy and data reconciliation process
  - Description of the methods used to compile, filter, and/or merge data from different sources
  - How the data was reconciled to other sources
- A listing of the rational explanation for each modeled variable that discusses why it would plausibly impact insurance risk as discussed in the CASTF white paper.
- A guarantee that the modeling dataset will be retained for at least 7 years.
- A description of any dimensionality reduction techniques (PCA, clustering, etc.) that were applied to the data.
- ~~An Excel file with 100 anonymized sample modeling records including all predictor variables and target variables.~~

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**Commented [SK1]:** NAMIC wants this removed as it introduces "subjectivity biases into the analytical process". I disagree, and the regulators want it based on the CASTF white paper.

**Commented [KB2R1]:** I disagree as well.

**Commented [PR3R1]:** I think we should keep as well

**Commented [YA4R1]:** I also think we should keep it.

**Commented [AD5R1]:** Ditto

**Commented [SK6R1]:** Add reference to where it is. (Look at APCIA)

## Sometimes Needed Information

- A description of steps taken to meet state requirements regarding unfair discrimination (if applicable).
- A listing of variables which are subject to the fair credit reporting act (if applicable).

## NAIC Predictive Model Review Checklists

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- A table showing the data volume distribution by state for each dataset (training, testing, holdout). The percentage of data coming from the state where the model is filed for each dataset (training, testing, holdout).
- A listing of variables initially considered but later removed from the model.
- An Excel file with 10 anonymized sample modeling records including all predictor variables and target variables.

## GLM Modeling

## Essential Information

- A narrative discussing the specifications and assumptions of the model, including the following details:
  - Form of the regression equation
  - Distribution assumed for the error term
  - The link function
  - Weights used in regression (if applicable)
- A description of how the model differs from prior versions of the model (if applicable).
- A narrative on the steps taken to eliminate the effects of other rating plan variables from the model (e.g. offsets).
- A description for each control or offset variable of why it was necessary to treat them as control/offset variables.
- A description of how the variables with null or missing values will be treated, including the following:
  - A table showing the rate of null or missing values for each variable
  - A description of the scenarios which generated null or missing values
  - A description of how each null or missing value is treated (might include imputation method or simply left in as a control)
  - A description of what happens to null and/or missing values when generated in production. (Is there a rating factor applied for null/missing or is the data populated before policy issuance?)
- A description of any large loss capping applicable to the dataset
  - Identify the size of the large loss cap
  - Identify the percentile of claim severity represented by large loss cap
- A description of adjustments and modifications to the data including trending, loss development, capping at minimums or maximums, and removal of outliers.
- A description of variable transformations applied to the data. The description should include the name of each transformation technique used, and an example transformation complete with a sample unadjusted value and a final transformed value.
- A description of each feature engineered variables. The description should include the rationale behind the feature engineered variable and a sample calculation including unadjusted original variable values and the final feature engineered variable value.
- A description of how binning was applied to numeric variables and how categorical variable values were grouped together.

## Sometimes Needed Information

- Deviance residual plots for each model demonstrating the appropriateness of the model assumptions.

## GLM Validation

## Essential Information

- A narrative on how the model was validated and assessed for model stability
- A narrative on how the model was assessed for improvement over the prior version of the model (if applicable)
- Provide a demonstration of each variable's statistical significance, via at least one of the following ways:
  - GLM output with beta coefficients and corresponding p-values
  - AIC analysis comparing the full model AIC versus each subset model excluding one variable at a time
  - F nested model tests comparing the full model to subset models excluding one variable at a time
  - Double lift charts comparing the full model versus each subset model excluding one variable at a time
  - Error analysis showing that the full model error is lower on a test dataset than each subset model excluding one variable at a time
- An Excel file containing model output in this format:
  - Each model is a separate worksheet
  - Column A is Variable Name
  - Column B is Variable Level Name
  - Column C is the coefficient
  - Column D is the p-value (if applicable)
  - Column E is the 95th confidence interval lower bound (if applicable)
  - Column F is the 95th confidence interval upper bound (if applicable)
- Ventile plots (quantile plots with at least 120 buckets) for both state specific data and countrywide data, built on data not used for model training. Each plot should include lines for both predicted averages and actual average.
- Lorenz curve for each model built on countrywide data. The plot should include the Lorenz curve and the equality reference line. The plot should also include the Gini value for the model.
- An Excel file containing correlation matrices in this format:
  - Each model's correlation matrix is a separate worksheet
  - Row 1 and Column 1 include variable names
  - The rest of the table displays the correlation metrics
- Commentary on which correlation metric (Pearson's, Cramer's V, etc.) was provided in the correlation matrix Excel file

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## Sometimes Needed Information

- A description of how often the model will be validated against new data in the future.
- A double lift chart comparing the newly proposed model and the current model (if applicable)
- Actual vs. Expected plots by model and variable (aka "Univariate Plots") which show the closeness between actual averages and predicted averages.
- Akaike Information Criterion (AIC) analysis showing AIC for the full model and each subset model excluding one variable at a time to demonstrate the potential impact on AIC of removing each variable.
- F nested model tests comparing the full model to subset models excluding one variable at a time to demonstrate the significance of each term. Each test should include the following:
  - F-statistic

## NAIC Predictive Model Review Checklists

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- ~~○ F-test critical values~~
- ~~○ Numerator degrees of freedom~~
- ~~○ Denominator degrees of freedom~~

- Variance Inflation Factors (VIFs) for each variable

## GLM Implementation

## Essential Information

- A description of how the models being filed are ultimately integrated into the company's final rating algorithm
- A narrative about all post modeling adjustments, such as smoothing, mapping to scores, and tempering of factors
- A narrative identifying the variables-risk classes where deviations from indicated were made and commentary on the reason for the deviations
- A dislocation analysis accounting for all rate changes within the filing, including the following:
  - Histograms showing percentage premium change on uncapped and capped basis (if applicable), using buckets of 5%
  - Descriptions of the scenarios with the highest increases
  - Descriptions of the scenarios with the biggest decreases
- Commentary on the differences between rating new and existing policyholders
- An Excel file which documents deviations between indicated and selected in this format:
  - Each model is a separate worksheet
  - Column A is Variable Name
  - Column B is Variable Level NameRisk Class
  - Column BE is the Current Factor (if applicable)
  - Column BC is the Indicated Factor
  - Column ED is the Proposed Factor
  - Column FE is the percentage difference between indicated and proposed. If the absolute value of the percentage difference is > 10%, the cell should be highlighted.
- Sample rating/scoring exhibits for 10 risks in Excel, which show risk characteristics, all intermediate adjustments, and the final algorithm output considering the company's final selections.

## Sometimes Needed Information

- None are listed at this time. Description of how the results of the model will be displayed or explained to policyholders.

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## Tree-based Model (Random Forest, GBM, etc.) Checklist

### Tree-based Model Introduction

#### Essential Information

- A narrative discussing what the company is trying to accomplish with the model, including the following details:
  - Is this a new model or refresh? What is the prior model's SERFF number (if applicable)?
  - Does the filing impact existing renewals?
  - ~~What is the target market for the product? Who is the target consumer?~~
  - What is the target variable of the model? (Frequency, Severity, Loss Ratios, Pure Premium, etc.) How is it defined?
  - ~~What is being optimized?~~ Does the model consider anything other than differences in loss cost?
- A narrative discussing the specifications and high-level assumptions of the model, including the following details:
  - Number and Type of models (GBM, Random Forest, etc.)
  - Split of the data into models (by coverage, by peril, etc.)
  - Split of the data into datasets (training, test, holdout)
  - How models were combined to derive the final rating algorithm

#### Sometimes Needed Information

- A narrative discussing the credentials of the lead modeler and actuary reviewing the model (if applicable), modeling team, including the following details:
  - Name of each individual
  - Relevant educational experience
  - Relevant credentials and designations
  - Years of experience building ~~predictive~~ models
  - Years of experience in the insurance industry
- Discuss how Actuarial Standards of Practice (ASOPs) 12, 23, 41, and 56 were considered in building the models.
- Describe the software (including packages and libraries if applicable) used to build the models.
- Provide copies of or links to academic references for their modeling techniques.
- A table listing the states where the model has been filed for review, the SERFF tracking number, and an indicator showing whether the filing has been approved.



## Tree-based Model Data

## Essential Information

- A narrative providing the description of each data source including the following:
  - Informational materials or website links for each 3<sup>rd</sup> party
  - Commentary on how the company reviewed the veracity of the data source
  - Why the company believes the data source is useful for the model's intended purpose
  - Disclosure of known data errors
  - The SERFF filing number representing the latest prior iteration of the model which contains the same proposed third-party data variables (if applicable).
  - ~~SERFF filing numbers where the use of the data was previously approved (if applicable)~~
- A description of the relevance of the data
  - The lines of business and companies included should be identified
  - Description of any considerations or adjustments made to make the data more applicable for its intended use
- A data dictionary provided as a table with the following columns:
  - Data Source (Vendor name or "Internal")
  - Variable name
  - Alternate names appearing in other filing documents
  - Data types (discrete, continuous, logical, categorical)
  - Treatment Type (Model, Control, Offset, Target)
  - Possible values (Empirical min and max for numerical variables, all categories for categorical variables)
- Tables showing summary metrics for each dataset by year (training, testing, holdout)
  - , when applicable (training, testing, holdout)
    - Year
    - Losses
    - Exposures (or Policy Count)
    - Claim Count (if applicable)
- A narrative on the candidate variable selection process prior to the model building.
- A narrative on the data accuracy and data reconciliation process
  - Description of the methods used to compile, filter, and/or merge data from different sources
  - How the data was reconciled to other sources
- A listing of the rational explanation for each modeled variable that discusses why it would plausibly impact insurance risk as discussed in the CASTF white paper.
- A guarantee that the modeling dataset will be retained for at least 7 years
- A description of any dimensionality reduction techniques (PCA, clustering, etc.) that were applied to the data.
- ~~An Excel file with 100 anonymized sample modeling records including all predictor variables and target variables.~~

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## Sometimes Needed Information

- A description of steps taken to meet state requirements regarding unfair discrimination (if applicable).
- A listing of variables which are subject to the fair credit reporting act (if applicable).

- ~~The percentage of data coming from the state where the model is filed for each dataset (training, testing, holdout). A table showing the data volume distribution by state for each dataset (training, testing, holdout).~~
- A listing of variables initially considered but later removed from the model.
- An Excel file with 10 anonymized sample modeling records including all predictor variables and target variables.

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**Commented [SK8R7]:** Will update later

## Tree-based Modeling

## Essential Information

- A narrative discussing the specifications and assumptions of the model, including the following details:
  - Form of the regression equation (if applicable)
  - Distribution assumed for the error term (if applicable)
  - The link function (if applicable)
  - Weights used in regression (if applicable)
  - Description of the tuning procedure for all hyperparameters
  - Description of how the component trees are combined to arrive at final predictions
- A description of all hyperparameters, including the following:
  - Number of component trees
  - Number of features considered at each split in the trees
  - Sampling size (number of rows)
  - Maximum tree depth
  - Minimum volume of data per node
  - “Shrinkage” or learning rate (applicable to GBMs)
- A description of how the model differs from prior versions of the model (if applicable).
- A narrative on the steps taken to eliminate the effects of other rating plan variables from the model (e.g. offsets).
  -
- A description for each control or offset variable of why it was necessary to treat them as control/offset variables.
- A description of how the variables with null or missing values will be treated, including the following:
  - A table showing the rate of null or missing values for each variable
  - A description of the scenarios which generated null or missing values
  - A description of how each null or missing value is treated (might include imputation method or simply left in as a control)
  - A description of what happens to null and/or missing values when generated in production. (Is there a rating factor applied for null/missing or is the data populated before policy issuance?)
  - A description of how the Tree-based model treats null or missing values.
- A description of any large loss capping applicable to the dataset
  - Identify the size of the large loss cap
  - Identify the percentile of claim severity represented by large loss cap
- A description of adjustments and modifications to the data including trending, loss development, capping at minimums or maximums, and removal of outliers.
- A description of variable transformations applied to the data. The description should include the name of each transformation technique used and an example transformation complete with a sample unadjusted value and a final transformed value.
- A description of each feature engineered variables. The description should include the rationale behind the feature engineered variable and a sample calculation including unadjusted original variable values and the final feature engineered variable value.
- A description of how binning was applied to numeric variables and how categorical variable values were grouped together (if binning or grouping were applied before running the Tree-based model).

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## Sometimes Needed Information

- Deviance residual plots for each model demonstrating the appropriateness of the model assumptions.

## Tree-based Model Validation

### Essential Information

- A narrative on how the model was validated and assessed for model stability
- A narrative on how the model was assessed for improvement over the prior version of the model (if applicable)
- Ventile plots (quantile plots with at least 120 buckets) for both state specific data and countrywide data, built on data not used for model training. Each plot should include lines for both predicted averages and actual average.
- Lorenz curve for each model built on countrywide data. The plot should include the Lorenz curve and the equality reference line. The plot should also include the Gini value for the model.
- Plots useful for understanding the model
  - Plots showing model performance by number of trees. The company should provide a plot showing that an error metric (deviance, negative log-likelihood, etc.) decreases after each iteration (each additional tree). If the company chooses an error metric other than deviance or log-likelihood, the company should describe why they chose a different metric and explain how it is calculated.
  - Variable Importance Plots highlighting which variables contributed most to the model. Provide commentary why variables with relatively lower importance are still included in the proposed model.
  - Interpretability plots visualizing the relationship between each predictor variable and the target variable such as partial dependence plots (PDPs), accumulated local effects (ALE) plots, or Shapley plots. There should be at least one plot for every variable used in the model. The plots should be accompanied by commentary on why the visualized relationships are reasonable.
- An Excel file containing correlation matrices in this format:
  - Each model's correlation matrix is a separate worksheet
  - Row 1 and Column 1 include variable names
  - The rest of the table displays the correlation metrics
- Commentary on which correlation metric (Pearson's, Cramer's V, etc.) was provided in the correlation matrix Excel file

## Sometimes Needed Information

- A description of how often the model will be validated against new data in the future
- A double lift chart comparing the newly proposed model and the current model (if applicable)
- Actual vs. Expected plots by model and variable (aka "Univariate Plots") which show the closeness between actual averages and predicted averages.

## Tree-based Model Implementation

### Essential Information

- A description of how the models being filed are ultimately integrated into the company's final rating algorithm
- A narrative about all post modeling adjustments, such as smoothing, mapping to scores, and tempering of factors
- A narrative identifying the variables where deviations from indicated were made and commentary on the reason for the deviations
- Tree diagrams for the first tree in each model, demonstrating how the splitting works.
- A dislocation analysis accounting for all rate changes within the filing, including the following:
  - Histograms showing percentage premium change on uncapped and capped basis (if applicable), using buckets of 5%
  - Descriptions of the scenarios with the highest increases
  - Descriptions of the scenarios with the biggest decreases
- Commentary on the differences between rating new and existing policyholders
- Documentation on deviations between indicated and selected factors, if applicable. For example, a tree-based model might assign policies to different tiers. Additional analysis after the tree model may derive indicated factors by tier. Any deviations from indicated should be disclosed.
- An Excel file which documents deviations between indicated and selected in this format:
  - Each model is a separate worksheet
  - Column A is Variable Name
  - Column B is Variable Level Name
  - Column C is the Current Factor (if applicable)
  - Column D is the Indicated Factor
  - Column E is the Proposed Factor
  - Column F is the percentage difference between indicated and proposed. If the absolute value of the percentage difference is > 10%, the cell should be highlighted.
- Sample rating/scoring exhibits for 10 risks in Excel, which show risk characteristics, all intermediate adjustments, and the final algorithm output considering the company's final selections.

### Sometimes Needed Information

- Description of how the results of the model will be displayed or explained to policyholders.
- Complete documentation that would allow future audits of model predictions. This could be satisfied by one of the following:
  - Comprehensive Tree diagrams for every tree
  - Comprehensive splitting rules that reproduce the tree logic
  - Tables showing every possible combination of risk characteristics and the final model prediction.

## Penalized Regression Model (GAM, Elastic Net, Lasso, Ridge, Derivative Lasso, Lasso Credibility, etc.) Checklist

### Penalized Regression Model Introduction

#### Essential Information

- A narrative discussing what the company is trying to accomplish with the model, including the following details:
  - Is this a new model or refresh? What is the prior model's SERFF number (if applicable)?
  - Does the filing impact existing renewals?
  - ~~What is the target market for the product? Who is the target consumer?~~
  - What is the target variable of the model? (Frequency, Severity, Loss Ratios, Pure Premium, etc.) How is it defined?
  - What is being optimized? Does the model consider anything other than differences in loss cost?
- A narrative discussing the specifications and high-level assumptions of the model, including the following details:
  - Number and Type of models (GAM, Elastic Net, Lasso, Ridge, Derivative Lasso, Lasso Credibility, etc.)
  - Split of the data into models (by coverage, by peril, etc.)
  - Split of the data into datasets (training, test, holdout)
  - How models were combined to derive the final rating algorithm

#### Sometimes Needed Information

- A narrative discussing the credentials of the lead modeler and actuary reviewing the model (if applicable), modeling team, including the following details:
  - Name of each individual
  - Relevant educational experience
  - Relevant credentials and designations
  - Years of experience building ~~predictive~~ models
  - Years of experience in the insurance industry
- Discuss how Actuarial Standards of Practice (ASOPs) 12, 23, 41, and 56 were considered in building the models.
- Describe the software (including packages and libraries if applicable) used to build the models.
- Provide copies of or links to academic references for their modeling techniques.
- A table listing the states where the model has been filed for review, the SERFF tracking number, and an indicator showing whether the filing has been approved.

## Penalized Regression Model Data

## Essential Information

- A narrative providing the description of each data source including the following:
  - Informational materials or website links for each 3<sup>rd</sup> party
  - Commentary on how the company reviewed the veracity of the data source
  - Why the company believes the data source is useful for the model's intended purpose
  - Disclosure of known data errors
  - The SERFF filing number representing the latest prior iteration of the model which contains the same proposed third-party data variables (if applicable).
  - ~~SERFF filing numbers where the use of the data was previously approved (if applicable)~~
- A description of the relevance of the data
  - The lines of business and companies included should be identified
  - Description of any considerations or adjustments made to make the data more applicable for its intended use
- A data dictionary provided as a table with the following columns:
  - Data Source (Vendor name or "Internal")
  - Variable name
  - Alternate names appearing in other filing documents
  - Data types (discrete, continuous, logical, categorical)
  - Treatment Type (Model, Control, Offset, Target)
  - Possible values (Empirical min and max for numerical variables, all categories for categorical variables)
- Tables showing summary metrics for each dataset (training, testing, holdout) by year, when applicable (~~training, testing, holdout~~)
  - Year
  - Losses
  - Exposures (or Policy Count)
  - Claim Count (if applicable)
- A narrative on how the company determined the variables to include in the final model
- A narrative on the data accuracy and data reconciliation process
  - Description of the methods used to compile, filter, and/or merge data from different sources
  - How the data was reconciled to other sources
- A listing of the rational explanation for each modeled variable that discusses why it would plausibly impact insurance risk as discussed in the CASTF white paper.
- A guarantee that the modeling dataset will be retained for at least 7 years
- A description of any dimensionality reduction techniques (PCA, clustering, etc.) that were applied to the data.
- ~~An Excel file with 100 anonymized sample modeling records including all predictor variables and target variables.~~

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## Sometimes Needed Information

- A description of steps taken to meet state requirements regarding unfair discrimination (if applicable).
- A listing of variables which are subject to the fair credit reporting act (if applicable).

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- The percentage of data coming from the state where the model is filed for each dataset (training, testing, holdout). A table showing the data volume distribution by state for each dataset (training, testing, holdout).
- A listing of variables initially considered but later removed from the model.
- An Excel file with 10 anonymized sample modeling records including all predictor variables and target variables.

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## Penalized Regression Modeling

### Essential Information

- A narrative discussing the specifications and assumptions of the model, including the following details:
  - Form of the regression equation
  - Description of the penalty term used in fitting the model
  - Distribution assumed for the error term
  - The link function (if applicable)
  - Weights used in regression (if applicable)
- A description of the following hyperparameters
  - The penalty parameter value and how it was chosen.
  - Any other hyperparameters used in model fitting (example: number of knots for a smoothed term in a GAM). Describe how they were chosen.
- A description of how the model differs from prior versions of the model (if applicable).
- A narrative on the steps taken to eliminate the effects of other rating plan variables from the model (e.g. offsets).
  -
- A description for each control or offset variable of why it was necessary to treat them as control/offset variables.
- A description of how the variables with null or missing values will be treated, including the following:
  - A table showing the rate of null or missing values for each variable
  - A description of the scenarios which generated null or missing values
  - A description of how each null or missing value is treated (might include imputation method or simply left in as a control)
  - A description of what happens to null and/or missing values when generated in production. (Is there a rating factor applied for null/missing or is the data populated before policy issuance?)
- A description of any large loss capping applicable to the dataset
  - Identify the size of the large loss cap
  - Identify the percentile of claim severity represented by large loss cap
- A description of adjustments and modifications to the data including trending, loss development, capping at minimums or maximums, and removal of outliers.
- A description of variable transformations applied to the data. The description should include the name of each transformation technique used and an example transformation complete with a sample unadjusted value and a final transformed value.
- A description of each feature engineered variables. The description should include the rationale behind the feature engineered variable and a sample calculation including unadjusted original variable values and the final feature engineered variable value.
- A description of how binning was applied to numeric variables and how categorical variable values were grouped together.

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### Sometimes Needed Information

- Deviance residual plots for each model demonstrating the appropriateness of the model assumptions.
- Demonstration of how the mode would differ if different hyperparameters were selected. This could take one of the following forms:

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- Sensitivity showing coefficient outputs side-by-side for higher and lower complexity hyperparameters
- Plots showing coefficients by penalty value

## Penalized Regression Model Validation

### Essential Information

- A narrative on how the model was validated and assessed for model stability
- A narrative on how the model was assessed for improvement over the prior version of the model (if applicable)
- An Excel file containing model output in this format:
  - Each model is a separate worksheet
  - Column A is Variable Name
  - Column B is Variable Level Name
  - Column C is the coefficient
- A demonstration of parameter stability via one of the following methods
  - Confidence intervals (5<sup>th</sup> to 95<sup>th</sup> percentile) of coefficients based on 100+ bootstrap samples
  - Range of coefficients from 10 or 20 cross validation folds
  - Range of coefficients across at least 5 different time periods
  - P-values from a reference GLM with the same selected variables
- Ventile plots (quantile plots with at least 120 buckets) for both state specific data and countrywide data, built on data not used for model training. Each plot should include lines for both predicted averages and actual average.
- Lorenz curve for each model built on countrywide data. The plot should include the Lorenz curve and the equality reference line. The plot should also include the Gini value for the model.
- Models with a complement of credibility (example: lasso credibility) should provide plots by variable that visualize the credibility complement and the model indicated as separate lines.
- ~~An Excel file containing correlation matrices in this format:~~
  - ~~○ Each model's correlation matrix is a separate worksheet~~
  - ~~○ Row 1 and Column 1 include variable names~~
  - ~~○ The rest of the table displays the correlation metrics~~
- Commentary on which correlation metric (Pearson's, Cramer's V, etc.) was provided in the correlation matrix Excel file
- Tables showing concavity metrics (applicable to GAMs)

### Sometimes Needed Information

- An Excel file containing correlation matrices in this format:
  - Each model's correlation matrix is a separate worksheet
  - Row 1 and Column 1 include variable names
  - The rest of the table displays the correlation metrics
- A description of how often the model will be validated against new data in the future
- A double lift chart comparing the newly proposed model and the current model (if applicable)
- Actual vs. Expected plots by model and variable (aka "Univariate Plots") which show the closeness between actual averages and predicted averages.

## Penalized Regression Model Implementation

### Essential Information

- A description of how the models being filed are ultimately integrated into the company's final rating algorithm
- A narrative about all post modeling adjustments, such as smoothing, mapping to scores, and tempering of factors
- A narrative identifying the variables-risk classes where deviations from indicated were made and commentary on the reason for the deviations
- A dislocation analysis accounting for all rate changes within the filing, including the following:
  - Histograms showing percentage premium change on uncapped and capped basis (if applicable), using buckets of 5%
  - Descriptions of the scenarios with the highest increases
  - Descriptions of the scenarios with the biggest decreases
- Commentary on the differences between rating new and existing policyholders
- An Excel file which documents deviations between indicated and selected in this format:
  - Each model is a separate worksheet
  - Column A is Variable Name
  - Column B is Variable Level NameRisk Class
  - Column BG is the Current Factor (if applicable)
  - Column CD is the Indicated Factor
  - Column DE is the Proposed Factor
  - Column EF is the percentage difference between indicated and proposed. If the absolute value of the percentage difference is > 10%, the cell should be highlighted.
- Sample rating/scoring exhibits for 10 risks in Excel, which show risk characteristics, all intermediate adjustments, and the final algorithm output considering the company's final selections.

### Sometimes Needed Information

~~None are listed at this time.~~

- Description of how the results of the model will be displayed or explained to policyholders.

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## Neural Network Checklist

### Neural Network Model Introduction

#### Essential Information

- A narrative discussing what the company is trying to accomplish with the model, including the following details:
  - Is this a new model or refresh? What is the prior model's SERFF number (if applicable)?
  - Does the filing impact existing renewals?
  - ~~What is the target market for the product? Who is the target consumer?~~
  - What is the target variable of the model? How is it defined?
  - What is being optimized? Does the model consider anything other than differences in loss cost?
- A narrative discussing the specifications and high-level assumptions of the model, including the following details:
  - Number and Type of models (Neural Network, etc.)
  - Split of the data into models (by coverage, by peril, etc.)
  - Split of the data into datasets (training, test, holdout)
  - How models were combined to derive the final rating algorithm

#### Sometimes Needed Information

- A narrative discussing the credentials of the lead modeler and actuary reviewing the model (if applicable), modeling team, including the following details:
  - Name of each individual
  - Relevant educational experience
  - Relevant credentials and designations
  - Years of experience building ~~predictive~~ models
  - Years of experience in the insurance industry
- Discuss how Actuarial Standards of Practice (ASOPs) 12, 23, 41, and 56 were considered in building the models.
- Describe the software (including packages and libraries if applicable) used to build the models.
- Provide copies of or links to academic references for their modeling techniques.
- A table listing the states where the model has been filed for review, the SERFF tracking number, and an indicator showing whether the filing has been approved.

## Neural Network Model Data

## Essential Information

- A narrative providing a description of each data source including the following:
  - Informational materials or website links for each 3<sup>rd</sup> party
  - Commentary on how the company reviewed the veracity of the data source
  - Why the company believes the data source is useful for the model's intended purpose
  - Disclosure of known data errors
  - The SERFF filing number representing the latest prior iteration of the model which contains the same proposed third-party data variables (if applicable).
  - ~~SERFF filing numbers where the use of the data was previously approved (if applicable)~~
- A description of the relevance of the data
  - The lines of business and companies included should be identified
  - Description of any considerations or adjustments made to make the data more applicable for its intended use
- Tables showing summary metrics for each dataset (training, testing, holdout) by year, when applicable (training, testing, holdout)
  - Year
  - Losses
  - Exposures (or Policy Count)
  - Claim Count (if applicable)
- A narrative on the data accuracy and data reconciliation process
  - Description of the methods used to compile, filter, and/or merge data from different sources
  - How the data was reconciled to other sources
- A guarantee that the modeling dataset will be retained for at least 7 years
- A description of any dimensionality reduction techniques (PCA, clustering, etc.) that were applied to the data.
- If the neural network is trained on image data
  - Describe the team creating the initial labels, how they determined the labels, the number of people labeling each image, and what their rate of consensus was (interrater reliability).
  - Explain what season(s) of the year the images are captured
  - Explain what percent of US properties have an image in the current database
  - Explain how the images are captured
  - Describe how frequently the images are refreshed
  - Describe what image quality criteria is placed on images
  - Provide a distribution of images by state for each dataset (training, testing, holdout).
  - Provide a histogram showing the age of the latest image for each dwelling in the database

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## Sometimes Needed Information

- A description of steps taken to meet state requirements regarding unfair discrimination (if applicable).
- A listing of variables which are subject to the fair credit reporting act (if applicable).

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- ◆ ~~The percentage of data coming from the state where the model is filed for each dataset (training, testing, holdout). A table showing the data volume distribution by state for each dataset (training, testing, holdout)~~

## Neural Network Modeling

### Essential Information

- A narrative discussing the specifications and assumptions of the model, including how the hyperparameters of the neural networks were tuned.
- Provide the hyperparameters selected for the neural network, including the following:
  - Learning Rate
  - Number of Epochs
  - Batch Size
  - Activation Function
  - Number of hidden layers and units
  - Weight initialization
- A description of how the model differs from prior versions of the model (if applicable).
- Commentary on how the risk of overfitting was mitigated including whether these common methods were applied:
  - Early Stopping
  - Regularization
  - Dropout
- Provide plots that help demonstrate how the models work
  - For Artificial Neural Networks (ANN), provide Shapley plots by variable
  - For Artificial Neural Networks (ANN), provide waterfall plots for:
    - 10 records with the worst score and commentary on what is driving the score
    - 10 records of false positives (if applicable) and commentary on what is driving misclassification
    - 10 records of false negatives (if applicable) and commentary on what is driving misclassification
  - For Convolutional Neural Networks (CNN), provide Grad-CAM images for:
    - 10 images with the worst score and commentary on what is driving the score
    - 10 images of false positives (if applicable) and commentary on what is driving misclassification
    - 10 images of false negatives (if applicable) and commentary on what is driving misclassification

### Sometimes Needed Information

- A description of any preprocessing (resizing, normalization, etc.) applied to the images before running the model.



## Neural Network Model Validation

## Essential Information

- A narrative on how the model was validated and assessed for model stability
- A narrative on how the model was assessed for improvement over the prior version of the model (if applicable)
- A confusion matrix for the Test and/or Holdout datasets arranged as follows:
  - Predicted Class in the row names
  - Actual Class in the column names
  - Test Dataset count in the table
- A summary of performance metrics (precision, recall, accuracy) on the test dataset.
- 10 sample images including model predictions and actual values.
- A description whether the model predictions were compared to an independent report (example: roof image classification versus findings from an actual roof inspection)

## Neural Network Model Implementation

### Essential Information

- A description of how the models being filed are ultimately utilized by the company
- An explanation regarding whether the data source used to train the model is the same data source that will be used in production. If not, what adjustments will be made to address differences between data sources.
- An explanation regarding whether the neural network prediction can be reproduced by a person using an objective criteria checklist
- A description regarding how consumers can appeal determinations made by the neural network
- A description of how often the data will be refreshed, whether scores will be updated automatically, and whether consumers can request an update to the score
- If the neural network is trained on image data
  - Explain whether an insured can personally submit an updated image if there have been updates to their property

### Sometimes Needed Information

- Description of how the results of the model will be displayed or explained to policyholders.

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