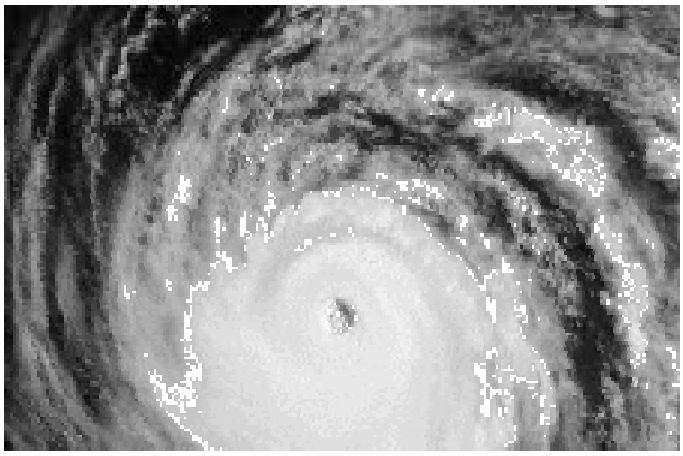
Florida Commission on Hurricane Loss Projection Methodology



Professional Team Audit Report

E. W. Blanch Company (EWB)

On-Site Review May 1, 2001

On May 1, 2001, the Professional Team visited on-site at E. W. Blanch Co. (EWB) in San Jose, California. The following people participated in the review:

EWB

Masoud Zadeh, Ph.D., P.E., Senior Vice President
Ajay Singhal, Ph.D., Project Manager
Kai Pan, Ph.D., Project Engineer
Nesrin Basoz, Ph.D, Project Manager
Charles S. White, Senior Vice President and Actuary
Jeremy Blanchard, Project Manager
Eric A. Enslin, Technical Account Manager
Bronislava Sigal, Ph.D., Senior Statistician
Pasan, Seneviratna, Ph.D., P.E., Senior Staff Engineer
Josef Sukonick, Ph.D., Senior Staff Software Engineer

Professional Team

Mark Johnson, Ph.D., Statistician, Team Leader
Fred Stolaski, P.E., Structural Engineer
Tom Schroeder, Ph.D., Meteorologist
Marty Simons, ACAS, Actuary
Paul Fishwick, Ph.D., Computer Scientist
Donna Sirmons, Staff

The review began with introductions and an overview of the audit process. Changes from 1999 were discussed and then the audit proceeded with General Standards, Statistical Standards, Actuarial Standards, Vulnerability Standards, Meteorological Standards and finally Computer Standards. Requests for additional materials were made and responded to throughout the day.

Florida Commission on Hurricane Loss Projection Methodology

2000 Standards

5. 1 General Standards – ***Mark Johnson, Leader***

5.1.1 Scope of the Computer Model and Its Implementation

The computer model shall project loss costs for personal lines residential property from hurricane events, excluding flood and storm surge, except as flood and storm surge apply to Additional Living Expense (ALE). References to the model throughout the Standards shall include its implementation.

Proprietary: **Yes**
Verified: **Yes**

Pro Team Comments:

No change from the previous year.

5.1.2 Qualifications of Modeler Personnel and Independent Experts

Model construction, testing, and evaluation shall be performed by modeler personnel or independent experts who possess the necessary skills, formal education, or experience to develop hurricane loss projection methodologies.

The model or any modifications to an accepted model shall be reviewed by modeler personnel or independent experts in the following professional disciplines, if relevant: structural/wind engineering (licensed Professional Engineer (PE)), statistics (advanced degree), actuarial science (Associate or Fellow of Casualty Actuarial Society or Member of the American Academy of Actuaries), meteorology (advanced degree), and computer science/engineering (advanced degree). Where applicable, these individuals shall abide by the standards of professional conduct adopted by their profession.

Reference: Module 2, Section I, #2-#3 (pages 73-77)
Reference: Module 2, Section I, #5 (pages 78-79)

Proprietary: Yes
Verified: Yes

Pro Team Comments:

Reviewed vitas of the following individuals:

- Pasan Seneviratna, Ph.D., P.E., Senior Staff Engineer involved in the development of risk assessment methodologies.
- Bronislava Sigal, Ph.D., Senior Statistician

5.1.3 Modelers Policy of Model Revision

The modeler shall have developed and implemented a clearly written policy for model revision with respect to methodologies and data. The modeler shall clearly identify the model version under review.

Reference: Module 1,Section I, A.1 (page 26)
Reference: Module 1, Section I, A.9 (page 47)

Proprietary: Yes
Verified: Yes

Pro Team Comments:

Reviewed Blanch's Catalyst 4.0 Policy of Model Revision Documentation revised December 2000.

5.1.4 Independence of Model Components

The meteorology, vulnerability, and actuarial components of the model shall each be demonstrated to be theoretically sound without compensation for potential bias from the other two components. Relationships within the model among the meteorological, vulnerability, and actuarial components shall be demonstrated to be reasonable.

Reference: Module 1, Section II, B.11 (page 63)
Reference: Module I, Section II, B.13-15 (pages 64-65)
Reference: 5.5.3 (page 20)

Proprietary: Yes
Verified: Yes

Pro Team Comments:

Components reviewed throughout the visit.

5.1.5 Geographic Location

Zip codes used in the model shall be updated at least every 24 months using information originating from the United States Postal Service.

Zip code centroids shall be derived by using either population or geography and shall be visually demonstrated to be reasonable.

If the model uses geographic location at a more refined level than zip code (e.g., latitude/longitude), such uses shall be visually demonstrated to be reasonable.

Reference: Module 3, Section VI, #1-#2 (page 115)
Reference: Module 3, Form A (page 118)

Proprietary: **Yes**
Verified: **Yes**

Pro Team Comments:

During the on-site review the Professional Team was shown maps of geographic centroids indicated within zip code boundaries including enlargements of specific areas. Blanch uses street level addresses where available.

5.1.6 Identification of Units of Measure of the Model

All units of measure for model inputs and outputs shall be clearly identified.

Reference: Module 1,Section I, C.2 (page 51)

Proprietary: **Some Proprietary material**
Verified: **Yes**

Pro Team Comments:

All materials examined during the on-site review were clearly defined with respect to model inputs and outputs.

5.1.7 Visual Presentation of Data

Visualizations shall be accompanied by legends and labels for all elements. Individual elements shall be clearly distinguishable, whether presented in original or copy form.

a. For data indexed by latitude and longitude, by county or by zip code, a color contour map and a continuous tone map with superimposed county and zip code boundaries shall be produced.

b. Florida Map Colors: Maps will use two colors, blue and red, along with shades of blue and red, with dark blue and dark red designating the lowest and highest quantities, respectively. The color legend and associated map shall be comprised of an appropriate number of intervals to provide readability.

Proprietary: **Yes**
Verified: **Yes**

Pro Team Comments:

Reviewed color-coded, contour maps conforming to the standard.

5.1.8 Disclosure of User Supplied Input

A modeler shall clearly disclose, in a model output report, the specific type of input which is required of insurers in order to use the model in a residential property insurance rate filing. Such input includes, but is not limited to, optional features of the model, type of data to be supplied by the insurer and needed to derive loss estimates from the model, and any variables which a licensed user is authorized to set in implementing the model.

Proprietary: **Yes**
Verified: **Yes**

Pro Team Comments:

Reviewed Blanch's Data Call Natural Peril Exposure Analysis request showing the specific type of input required from the users (from minimum requirements to a complete specification).

5.2 Meteorological Standards – ***Tom Schroeder, Leader***

5.2.1 Units of Measure for Model Output

All model outputs of length, wind speed, and pressure shall be in units of statute miles, statute miles per hour, and millibars, respectively.

Proprietary: **Some Proprietary**
Verified: **Yes**

Pro Team Comments:

In reviewing material throughout the day, they used all the appropriate measures.

5.2.2 Damage Function Wind Inputs

Wind inputs to the damage function shall be in units consistent with currently used wind measurement units and/or shall be converted using standard meteorological/ engineering conversion factors which are supported by literature and/or documented measurements available to the Commission.

Reference: Module 3, Section II, #2 (page 95)

Proprietary: **Yes**
Verified: **Yes**

Pro Team Comments:

Verified during the review of the vulnerability standards.

5.2.3 Official Hurricane Set or Suitable Approved Alternatives

Modelers shall include in their base storm set all hurricanes, including by-passing hurricanes, which produce hurricane force winds in Florida. The storm set shall be taken from the Tropical Prediction Center/National Hurricane Center (TPC/NHC) document *Tropical Cyclones of the North Atlantic Ocean, 1871-1998* updated through the 1999 hurricane season or later. All proposed alternatives to the characteristics of specific storms in the storm set shall be subject to the approval of the Commission.

Reference: Module 1, Section II, B.7-8 (pages 59-61)
Reference: Module 3, Section I (page 81)

Proprietary: **Yes**
Verified: **Yes**

Pro Team Comments:

Blanch provided evidence that their storm set matches that provided by the Commission. Blanch uses one source, but additional sources are used to verify the accuracy of the primary source.

5.2.4 Hurricane Characteristics

Methods for depicting all modeled hurricane characteristics (e.g., wind speed, minimum central pressure, radius of maximum winds, strike probabilities, and tracks) shall be based on information documented by scientific literature or modeler information accepted by the Commission.

Reference: Module 1,Section II, B.1-8 (pages 56-61)
Reference: Module 3, Section I (page 81)
Reference: Standard 5.6.1 (page 22)

Proprietary: **Yes**
Verified: **Yes**

Pro Team Comments:

Shown fitted distributions (cdf's) to empirical data. Discussed how 1985-1999 data are augmented to NWS-38 data.

5.2.5 Landfall Intensity

Models shall use maximum one-minute sustained 10-meter wind speed when defining hurricane landfall intensity. This applies both to the base storm set adopted in 5.2.3 used to develop landfall strike probabilities as a function of coastal location and to the modeled winds in each hurricane which causes damage. The associated maximum one-minute sustained 10-meter wind speed shall be within the range of wind speeds (in statute miles per hour) categorized by the Saffir-Simpson scale.

Saffir-Simpson Hurricane Scale:
A scale from 1 to 5 that measures hurricane intensity.

Category	Winds (mph)	Central Pressure (mb)	Damage
1	74 - 95	≥ 980	Minimal
2	96 - 110	965 – 979	Moderate
3	111 - 130	945 – 964	Extensive
4	131 - 155	920 – 944	Extreme
5	Over 155	< 920	Catastrophic

Reference: Module 3, Section I,#1-#3 (pages 81-82)
Reference: Standards 5.6.1 and 5.6.2 (page 22)

Proprietary: Yes
Verified: Yes

Pro Team Comments:

No change – Blanch has always used wind speeds.

5.2.6 Hurricane Probabilities

Modeled hurricane probabilities shall reasonably match the historical record through 1999 for category 1 to 5 hurricanes, shall be consistent with those observed for each geographical area of Florida, and shall be displayed in vertical bar graphs. "Consistent" means: (1) spatial distributions of modeled hurricane probabilities shall accurately depict vulnerable coastlines in Florida; and (2) probabilities are compared with observed hurricane frequency using methods documented in accepted scientific literature or proposed by the modeler and accepted by the Commission.

Reference: Module 1, Section I, B.2 (page 48)
Reference: Module 1, Section II, B.7 (pages 59-60)
Reference: Module 3, Section I (page 81)
Reference: Standards 5.6.1 and 5.6.2 (page 22)

Proprietary: Yes
Verified: Yes

Pro Team Comments:

Reviewed the new distributions. Shown vertical bar graph showing historical and modeled annual hurricane rate variations.

5.2.7 Hurricane Probability Distributions

Modeled probability distributions for hurricane intensity, eye diameter, forward speed, radii for maximum winds, and radii for hurricane force winds shall be consistent with historical hurricanes in the Atlantic basin as documented in accepted scientific literature available to the Commission.

Reference: Module 1, Section II, B.1 (page 56)
Reference: Module 1, Section II, B.7-8 (pages 59-61)
Reference: Module 3, Section 1, #2 (pages 81-82)
Reference: Module 3, Section 1, #8 (page 85)
Reference: Standards 5.6.1 and 5.6.2 (page 22)

Proprietary: **Yes**
Verified: **Yes**

Pro Team Comments:

Reviewed various maps showing wind speed and roughness factors by zip codes.

5.2.8 Land Friction

Land friction shall be used in the model to reduce wind speeds over land, shall be based on scientific methods, and shall provide realistic wind speed transitions between adjacent zip codes, counties, and territories. The magnitude of friction coefficients shall be consistent with accepted scientific literature, consistent with geographic surface roughness, and shall be implemented with appropriate geographic information system data.

Reference: Module 1, Section II, B.4-5 (pages 57-58)
Reference: Module 3, Section I (page 81)

Proprietary: **Yes**
Verified: **Yes**

Pro Team Comments:

Reviewed land friction maps showing the roughness factor by zip codes.

5.2.9 Hurricane Overland Weakening Rate

The hurricane overland weakening rate used by the model shall be bounded by the observed extremes in historical records for Florida. The mean wind speed shall be within twenty percent (20%) of the Kaplan/DeMaria decay value or an alternative acceptable to the Commission.

Reference: Module 1, Section II, B.3 (page 57)
Reference: Module 3, Section I (page 81)

Proprietary: **Yes**
Verified: **Yes**

Pro Team Comments:

Blanch demonstrated their compliance within 20% of the Kaplan/Demaria filling rate model. No change from the previous year.

5.3 Vulnerability Standards – ***Fred Stolaski, Leader***

5.3.1 Derivation of Vulnerability Functions

The method of derivation of the vulnerability functions shall be described and demonstrated to be theoretically sound.

Development of the vulnerability functions is to be based on one or more of the following: (1) historical data; (2) tests; (3) structural calculations; (4) expert opinion. Any development of the vulnerability functions based on structural calculations and/or expert opinion shall be supported by tests and historical data to the extent such data are available.

Reference: Module 1, Section I, A.8 (page 46)
Reference: Module 3, Section III (page 97)
Reference: Standard 5.6.1 (page 22)

Proprietary: **Yes**
Verified: **Yes**

Pro Team Comments:

Discussed the different damage functions. Saw original proprietary model data, verification of data, and addendums to the above. Entered data and developed vulnerability curves.

5.3.2 Required Vulnerability Functions

Vulnerability functions shall separately compute damages for building structures, mobile homes, appurtenant structures, contents, and additional living expense.

Reference: Module 3, Section III (page 97)

Proprietary: **Yes**
Verified: **Yes**

Pro Team Comments:

Reviewed different classifications of buildings and shown vulnerability curves for various types.

5.3.3 Wind Speeds Causing Damage

Damage associated with a declared hurricane event shall include damage incurred for wind speeds above and below the hurricane threshold of 74 mph. The minimum wind speed that generates damage shall be specified.

Reference: Module 3, Section III (page 97)

Proprietary: **Yes**
Verified: **Yes**

Pro Team Comments:

No change from previous year. Shown data at low wind speeds.

5.3.4 Construction Characteristics

In the derivation and application of vulnerability functions, assumptions concerning construction type and construction characteristics shall be demonstrated to be reasonable and appropriate.

Reference: Module 1, Section I, A.7 (page 46)
Reference: Module 3, Section III (page 97)

Proprietary: **Yes**
Verified: **Yes**

Pro Team Comments:

Discussed the damage functions and reviewed the different construction classifications.

5.3.5 Modification Factors

Modification factors to the vulnerability functions or structural characteristics and their corresponding effects shall be disclosed and shall be clearly defined and their theoretical soundness demonstrated.

Reference: Module 3, Section III,#3 (page 97)
Reference: Module 3, Section III, #6 (pages 98-99)

Proprietary: **Yes**
Verified: **Yes**

Pro Team Comments:

Discussed the different damage functions and reviewed curves for various structural characteristics.

5.3.6 Additional Living Expenses

In the estimation of Additional Living Expenses (ALE), the model shall consider hurricane damage including storm surge damage to the infrastructure.

The Additional Living Expense vulnerability function shall consider the time it will take to repair/reconstruct the home.

Reference: Module 3, Section IV, #5-#6 (pages 102-103)

Proprietary: **Yes**
Verified: **Yes**

Pro Team Comments:

Reviewed details on storm surge damage to infrastructure. Time factors are provided by an outside consultant.

Further details on submission revealed.

5.3.7 Mitigation Measures

Modeling of mitigation measures to improve a building's wind resistance and the corresponding effects on vulnerability shall be disclosed and demonstrated to be theoretically sound.

Proprietary: **Yes**
Verified: **Yes**

Pro Team Comments:

Straps and shutters are the two mitigation factors incorporated in the Catalyst model.

Pro Team was shown the following literature:

- Building Wind Damage Prediction and Mitigation Using Damage Bands by Christian O. Unanwa and James R. McDonald
- Technical publication entitled The Effectiveness of Hurricane Shutters in Mitigating Storm Damage by Prof. Jose D. Mitrani, P.E. and Prof. Wilson C. Barnes, AIA at Florida International University and Mr. Jerry Jarrell, Acting Director National Hurricane Center

5.4 Actuarial Standards – ***Marty Simons, Leader***

5.4.1 Underwriting Assumptions

When used in the modeling process or for verification purposes, adjustments, edits, inclusions, or deletions to insurance company input data used by the modeler shall be based upon accepted actuarial, underwriting, and statistical procedures. The methods used shall be documented in writing.

For damage estimates derived from historical insured hurricane losses, the assumptions in the derivations concerning (1) construction characteristics, (2) policy provisions, and (3) relevant underwriting practices underlying those losses shall be identified and demonstrated to be reasonable and appropriate.

Reference: Module 1, Section I, B.4 (page 49)
Reference: Module 1, Section II, A.3-5 (pages 54-56)
Reference: Module 3, Section IV (page 100)

Proprietary: **Yes**
Verified: **Yes**

Pro Team Comments:

The Professional Team was shown an assumption document from an individual insurer.

5.4.2 Actuarial Modifications

All modification factors to the actuarial functions or characteristics including but not limited to building code, quality, age, occupancy, stories, or condition of structure and their corresponding affects shall be disclosed and shall be clearly defined and their actuarial soundness demonstrated**.** The disclosure of modification shall include a description of the impact upon loss costs of the modification in accordance with the following:

A: < -50%.
B: -50% to -25%
C: -25% to 0
D: 0 to 25%
E: 25% to 50%
F: > 50%

Reference: Module 1, Section I, A.6 (page 45)
Reference: Module 1, Section I, A.10 (page 47)
Reference: Module 1, Section I, C.1.c (pages 50-51)
Reference: Module 3, Section III, #3 (page 97)

Proprietary: Yes
Verified: Yes

Pro Team Comments:

Discussed the building characteristics used by the CATALYST model. Reviewed comparison results with and without mitigation measures (roof hurricane straps, shutters).

5.4.3 Loss Cost Projections

Loss cost projections produced by hurricane loss projection models shall not include expenses, risk load, investment income, premium reserves, taxes, assessments, or profit margin. Hurricane loss projection models shall not make a prospective provision for economic inflation.

Reference: Module 1, Section I, B.4 (page 49)
Reference: Module 1, Section I, C.1.a (page 50)
Reference: Module 3, Section III, #2 (page 97)
Reference: Module 3, Section V (page 109)
Reference: Module 3, Section VII (page 117)

Proprietary: Yes
Verified: Yes

Pro Team Comments:

No change.

5.4.4 Insurer Inputs

The modeler shall disclose any assumptions, fixed and variable, that relate to insurer input. Such assumptions shall be demonstrated to be actuarially sound. Assumptions that can vary by specific insurer shall be disclosed in a model output report. Fixed assumptions, that do not vary, need to be disclosed to the Commission.

Reference: Module 1, Section I, A.10 (page 47)
Reference: Module 1, Section I, B.4 (page 49)
Reference: Module 1, Section II, A.3-4 (pages 54-55)
Reference: Module 3, Section IV (page 100)

Proprietary: Yes
Verified: Yes

Pro Team Comments:

Discussed interactions between Blanch and insurance companies and reviewed e-mail correspondence.

5.4.5 Demand Surge

Loss cost projections shall not explicitly include demand surge. Any adjustment to the model or historical data to remove implicit demand surge shall be disclosed.

Reference: Module 1, Section I, C.1.a (page 50)
Reference: Module 3, Section III, #2 (page 97)
Reference: Module 3, Section VII (page 117)

Proprietary: **Yes**
Verified: **Yes**

Pro Team Comments:

Verified the exclusion of demand surge in loss cost projections.

5.4.6 Loss Costs - Meaning of "Damage"

In calculating loss costs, damage shall be expressed as insurable losses.

Reference: Module 1, Section II, A.5 (pages 55-56)

Proprietary: **Yes**
Verified: **Yes**

Pro Team Comments:

Loss costs are expressed as insured losses.

5.4.7 Logical Relation to Risk

Loss costs shall not exhibit an illogical relation to risk, nor shall loss costs exhibit a significant change when the underlying risk does not change significantly.

1. Loss costs produced by the model shall be positive and non-zero for all zip codes.

2. Modelers shall produce color-coded maps for the purpose of comparing loss costs by five-digit zip code within each county and on a statewide basis.

3. Loss costs cannot increase as friction or roughness increase, all other factors held constant.

4. Loss costs cannot increase as the quality of construction type, materials, and workmanship increases, all other factors held constant.

5. If the model considers the presence of fixtures or construction techniques designed for hazard mitigation, then the loss costs cannot increase above those in the absence of such measures, all other factors held constant.

6. Loss costs shall decrease as deductibles increase, all other factors held constant.

7. If the model considers the quality of building codes and enforcement, then loss costs cannot increase as the quality increases, all other factors held constant.

The above tests are intended to apply in general. There may be certain anomalies that are insignificant or are explainable by special circumstances. This standard applies separately to each coverage.

Reference: Module 1, Section I, C.1.b (page 50)
Reference: Module 3, Section V, #2 (page 109)
Reference: Module 3, Section V, #5 (page 124)
Reference: Module 3, Section VII (page 117)

Proprietary: Yes
Verified: Yes

Pro Team Comments:

Nothing changed from last year and we reviewed the effect of hazard mitigation modifications.

5.4.8 Deductibles

The model shall provide a mathematical representation of the distribution of losses to reflect the effects of deductibles and coinsurance, and the modeler shall demonstrate its actuarial soundness.

Reference: Module 1, Section I, B.3 (pages 48-49)
Reference: Module 3, Section IV, #1-#2 (pages 100-101)
Reference: Standard 5.6.1 (page 22)

Proprietary: Yes
Verified: Yes

Pro Team Comments:

Discussed details in support of the truncated lognormal distribution.

5.4.9 Contents

The model shall provide a separate mathematical representation of contents loss costs, and the modeler shall demonstrate its actuarial soundness.

Reference: Module 3, Section IV, #5 (page 102)
Reference: Module 3, Section IV, #7 (page 104)
Reference: Standard 5.6.1 (page 22)

Proprietary: Yes
Verified: Yes

Pro Team Comments:

No change.

5.4.10 Additional Living Expenses (ALE)

The model shall provide a separate mathematical representation of Additional Living Expense (ALE) loss costs, and the modeler shall demonstrate its actuarial soundness.

Reference: Module 3, Section IV, #6 (page 103)
Reference: Standard 5.6.1 (page 22)

Proprietary: Yes
Verified: Yes

Pro Team Comments:

Used insurance company historical data as a basis.

5.4.11 Building Codes

Information upon which building code quality and enforcement is assessed, if incorporated in the model, shall be objective and reasonably accurate and reliable.

Reference: Module 1, Section I, C.1.b (page 50)
Reference: Module 3, Section III, #3 (page 97)
Reference: Standard 5.6.1 (page 22)

Proprietary: **Yes**
Verified: **Yes**

Pro Team Comments:

No change from last year.

5.4.12 Hazard Mitigation

Data or information upon which differences in loss costs due to fixtures, design features, or construction techniques designed for hazard mitigation are derived, if incorporated in the model, shall be objective and actuarially reasonable.

Proprietary: **Yes**
Verified: **Yes**

Pro Team Comments:

Reviewed the effects of hurricane straps and shutters. Scientific literature reviewed listed under 5.3.7.

5.4.13 Replication of Known Hurricane Losses

The model shall be shown to reasonably replicate incurred losses on a sufficient body of past hurricane events, including the most current data available to the modeler. This standard applies separately to personal residential and mobile homes to the extent data are available. Personal residential experience may be used to replicate building-only and contents-only losses. The modeler shall demonstrate that the replications were produced on an objective body of loss data by county or an appropriate level of geographic detail.

Reference: Module 3, Section IV, #9 (pages 104-108)
Reference: Module 3, Section V, #2 (page 109)
Reference: Standard 5.6.2 (page 22)

Proprietary: **Yes**
Verified: **Yes**

Pro Team Comments:

Discussed in relation to 5.6.2.

5.4.14 Comparison of Estimated Hurricane Loss Costs

The model shall provide the annual average statewide loss costs produced using the list of hurricanes in standard 5.2.3 historical hurricanes in Florida based on the 1998 Florida Hurricane Catastrophe Funds (FHCF) aggregate exposure data, as of November 1, 1999. These will be compared to the statewide loss costs produced by the model on an average industry basis. The difference, due to uncertainty, between historical and modeled annual average statewide loss costs shall be demonstrated to be statistically reasonable.

Reference: Module 3, Section I, #7 (page 84)
Reference: Module 3, Section I, #10 (pages 88-90)
Reference: Module 3, Section V, #2 (page 109)
Reference: Module 3, Section V, #4 (page 124)
Reference: Standard 5.6.2 (page 22)

Proprietary: Yes
Verified: Yes

Pro Team Comments:

Reviewed derivation of Variability of the Average Annual Loss Estimate.

5.4.15 Output Ranges

Any model previously found acceptable by the Commission shall provide an explanation suitable to the Commission concerning the updated output ranges. Differences between the prior year submission and the current submission shall be explained in the submission.

Reference: Module 3, Section V, #4-#5 (pages 114 & 124)

Proprietary: Yes
Verified: Yes

Pro Team Comments:

Reviewed and discussed changes from previous year.

5.4.16 County Level Aggregation

At the county level of aggregation, the contribution to the error in loss costs estimates induced by the sampling process shall be demonstrated to be negligible.

Reference: Module 1, Section II, C.2 (page 66)
Reference: Standard 5.6.2 (page 22)

Proprietary: **Yes**
Verified: **Yes**

Pro Team Comments:

Same approach as last year.

5.5 Computer Standards – ***Paul Fishwick, Leader***

5.5.1 Primary Document Binder

A primary document binder shall be created and shall contain fully documented sections for each subsequent Computer Standard. Development of each section shall be indicative of accepted software engineering practices.

Reference: Module 1, Section I (page 26)
Reference: Module 1, Section II (page 51)

Proprietary: **Yes**
Verified: **Yes**

Pro Team Comments:

Shown an online primary document binder.

5.5.2 Requirements

The modeler shall document all requirements specifications of the software, such as interface, human factors, functionality, documentation, data, human and material resources, security, and quality assurance.

Reference: Module 1, Section I (page 26)
Reference: Module 1, Section II (page 51)
Reference: Module 3, Section VI, #3 (page 116)

Proprietary: **Yes**
Verified: **Yes**

Pro Team Comments:

Reviewed requirements documentation for Catalyst software and its user interface.

5.5.3 Component Design

The modeler shall document detailed computer-printed diagrams for control and data flow, and a schema for all data files along with field type definitions. Each network diagram shall contain components, arcs, and labels. At the topmost design level, detailed input and output interface specifications, including data types, shall be specified for each of the model's components.

Reference: Module 1, Section I (page 26)
Reference: Module 1, Section II (page 51)

Proprietary: **Yes**
Verified: **Yes**

Pro Team Comments:

The Professional Team was shown:

- Catalyst Analyses Server Dual Loop Peril Model
- Hurricane Peril Design

5.5.4 Implementation

The software shall be traceable from the flow diagrams and their components down to the code level. All documentation, including document binder identification, shall be indicated in the relevant component. The highest design level components shall incrementally be translated into a larger number of components until the code level is reached.

Reference: Module 1, Section I (page 26)
Reference: Module 1, Section II (page 51)

Proprietary: **Yes**
Verified: **Yes**

Pro Team Comments:

Reviewed traceable diagrams and sample code.

5.5.5 Software Verification

The modeler shall employ verification procedures, such as code inspections, reviews, and walkthroughs, sufficient to demonstrate code correctness. The code shall contain sufficient logical assertions or flag-triggered output statements to test the correct values for key variables as they are modified.

Reference: Module 1, Section I (page 26)
Reference: Module 1, Section II (page 51)

Proprietary: Yes
Verified: Yes

Pro Team Comments:

Reviewed examples of exception handling mechanisms.

5.5.6 Testing

Tests shall be documented for each software component, independent of all other components, to ensure that each component provides the correct response to inputs. All components when interfaced shall function correctly.

Reference: Module 1, Section I (page 26)
Reference: Module 1, Section II (page 51)
Reference: Standards 5.6.3 and 5.6.4 (page 23)

Proprietary: Yes
Verified: Yes

Pro Team Comments:

Reviewed test documentation for two sample components.

5.5.7 Software Maintenance and Revision

The modeler shall specify all policies and procedures used to maintain the software. The modeler shall use source revision software to track code modifications.

Reference: Module 1, Section I (page 26)
Reference: Module 1, Section II (page 51)

Proprietary: **Yes**
Verified: **Yes**

Pro Team Comments:

Reviewed source control and change request tracking software.

5.5.8 User Documentation

The modeler shall have complete user documentation including all recent updates.

Reference: Module 1, Section I (page 26)
Reference: Module 1, Section II (page 51)

Proprietary: **Yes**
Verified: **Yes**

Pro Team Comments:

Reviewed the Catalyst User's Manual.

5.6 STATISTICAL STANDARDS – ***Mark Johnson, Leader***

5.6.1 Comparison of Historical and Modeled Results

In situations where a modeler uses historical data to develop a modeled counterpart, the modeler shall demonstrate the goodness-of-fit of the modeled results to the historical data using accepted scientific and statistical methods.

Proprietary: **Yes**
Verified: **Yes**

Pro Team Comments:

The Professional Team reviewed the bootstrapping method applied to rates and statistical goodness-of-fit tests used to assess the adequacy of the fitted distributions. Empirical fits were updated using 1985-1999 data. Looked at plots of fitted vs. empirical distributions for Central Pressure Differences, Translational Speed, and Heading at various mileage post segments.

5.6.2 Characterizing Uncertainty

In cases where a statistical estimate is given, the modeler shall also provide an assessment of the attendant uncertainty.

Proprietary: **Yes**
Verified: **Yes**

Pro Team Comments:

The Professional Team reviewed numerous instances of estimates with uncertainties computed.

5.6.3 Sensitivity Analysis for Model Output

The modeler shall demonstrate that the model has been assessed with respect to sensitivity of temporal and spatial outputs to the simultaneous variation of input parameters. Statistical techniques used to perform sensitivity analysis shall be explicitly stated and results demonstrated in graphical format.

Reference: Module 1, Section II, B.13-15 (pages 64-65)

Proprietary: **Yes**
Verified: **Yes**

Pro Team Comments:

Reviewed a sensitivity analysis involving the five variables of Rate, Central Pressure, Filling Rate, Rmax, and Roughness Factor.

Reviewed graphical plots showing the sensitivity of portfolio loss cost while varying all parameters simultaneously. Examined main effects and interaction plots.

5.6.4 Uncertainty Analysis for Model Output

The modeler shall demonstrate that the temporal and spatial outputs of the model have been subjected to an uncertainty analysis. Such an analysis will identify and quantify the input parameters that impact the uncertainty in model output when the input parameters are simultaneously varied. Statistical techniques used to perform uncertainty analysis shall be explicitly stated and results demonstrated in graphical format.

Reference: Module 1, Section II, B.13-15 (pages 64-65)

Proprietary: **Yes**
Verified: **Yes**

Pro Team Comments:

Reviewed histograms showing the distributions of average annual loss cost across the state varying different hurricane parameters.