Florida Commission on Hurricane Loss Projection Methodology

Professional Team Report
2005 Standards

EQECAT, Inc.

On-Site Review
May 4 & 5, 2006

On May 4&5, 2006 the Professional Team visited on-site at EQECAT, Inc. (EQE) in Oakland, California. The following individuals participated in the review.

EQECAT

Shawna S. Ackerman, FCAS, MAAA, Principal and Consulting Actuary – Pinnacle Actuarial Resources, Inc.
James R. (Bob) Bailey, Ph.D., P.E., Technical Manager, Wind Engineering Services (via telephone)
Branimir Betov, M.S., Senior Software Engineer
Richard Clinton, CPCU, President
Jun-Rong Huo, Ph.D., Structural Engineer
Petros G. Keshishian, Ph.D., Principal Engineer
Mahmoud M. Khater, Ph.D., P.E., Senior Vice President, Chief Science and Technology Officer
Omar Khemici, Ph.D., P.E., Director (Structural Engineering)
Thomas I. Larsen, Senior Vice President
Krishnaraj Santhanam, Ph.D., Atmospheric Scientist
Nilesh Shome, Ph.D., Senior Project Engineer (Statistics)
David F. Smith, Director (Meteorologist)
Qing Xia, Ph.D., Meteorologist

Professional Team

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

The review began with introductions and an overview of the audit process.

Discussed and reviewed the following corrections to be made in the submission that will be provided to the Commission prior to the May 16-18, 2006 meetings.

- Pages 7-9, Table of Contents, updated for missing Standard entries
- Pages 20-21, G-1.4, reference list updated to include Powell, Franklin, and Houston references provided under Standard M-4, Storm Data reference provided under V-1, and to be grouped by Standards
- Pages 35-39, Forms G-1 through G-5, with updated signatures after revisions have been made to the original February 28, 2006 submission and reviewed by modeler personnel.
- Page 42, M-2, to clarify EQECAT analyses of scientific information.
- Pages 42-43, M-2.1, to clarify information under 1) landfall location on use of HURDAT or other data sources, 2) central pressure or one-minute sustained wind speeds, and 3) Rmax to include all sources used for updating data.
- Pages 44-45, M-2.3, to clarify conversion from upper level wind to surface level winds.
- Page 46, M-2.9, to clarify changes in treatment of hurricane characteristics.
- Page 48, M-3.3, updated to use correct units of measurement.
- Page 49, M-4.1, to clarify assumptions used in creating hurricane characteristics databases.

- Page 56, M-5.5, Figures 6a and 6b updated to use correct units of measurement and Figure 6b changed to use results from Hurricane Charley.
- Page 56, M-5.6, to clarify treatment of stochastic storms.
- Pages 59-61, Form M-1 and Figure 8 to correct occurrence rates.
- Page 66, Form M-3, Figure 11 to reflect updated Rmax distribution and lower density of points.
- Page 70, V-1.4, to identify the storms used in the development of vulnerability functions.
- Page 72, V-1.7, to clarify how duration of wind speeds is considered in the model.
- Page 73, V-2.A, to address the fixtures or construction techniques included in the model.
- Page 80, Form V-2, to revise values for masonry structure vertical reinforcing.
- Page 86, A-3.1, to clarify "Estimation of Loss" paragraph.
- Pages 89, 91 and 92, A-4.2, output forms updated with current version number of model.
- Pages 93-94, A-4.3, input form updated to include model name and version number.
- Page 105, A-6.2, formula corrected for misalignment of numbers with integral signs.
- Page 179, S-1.1 and S-1.2, to clarify source of data set and correct a typographical error.
- Page 181, S-1.6, updated to correct test statistic values.
- Page 182, S-1.6, Figures 24a and 24b updated to use correct units of measurement and corrected plot in Figure 24b.
- Page 183, S-1.6, updated to correct test statistic values.
- Page 201, Form S-4, revised to correct value for previous year's historical hurricanes.

Reviewed and discussed additional information EQECAT anticipates including in their presentation to the Commission at the May model review meetings including the Trade Secret List information.

Report on Deficiencies

The Professional Team reviewed the following deficiencies cited by the Commission at the March 16, 2006 meeting. All deficiencies were corrected by the established time frame and have been verified.

1. Form V-1, One Hypothetical Event (pages 76-77)
   The results are identical from last year's submission although the basis for the form was changed by the Commission.

   Revised Form V-1 submitted and verified.

2. Form A-7, Output Ranges (pages 135-174)
   Modeler did not provide output ranges in the format shown in the file named ***"2005FormA7.xls"*** as instructed in the *Report of Activities* on page 121 (Saint Johns and Saint Lucie counties).

   Revised Form A-7 submitted and verified.

Discussed the automated process EQECAT uses to produce the output ranges from the model, the reason for the counties starting with s being out of order, and steps taken to eliminate this problem from reoccurring.

GENERAL STANDARDS – Mark Johnson, Leader

G-1 Scope of the Computer Model and Its Implementation

The computer model shall project loss costs for personal lines residential property from hurricane events.

Audit

1. The main intent of the audit is to determine the capabilities of the model and to assess its implementation for purposes of Florida projected loss costs. Copies of all representative or primary technical papers that describe the underlying model theory shall be made available.

2. Software located within the model, used to compile data used by the model, used to validate the model, and used to project model loss costs will be reviewed interactively.

3. Databases or data files relevant to the modeler's submission will be reviewed.

Pre-Visit Letter

2. Table of Contents, page 7 – Line entries for Standards G-4 and A-4 are missing.

3. G-1, Disclosure 2, page 11 – Be prepared to explain why even though the hurricane set has been regenerated to update the rates and distributions to radius to maximum winds and forward speed, the total number of storms (511,500) has not been changed to achieve necessary convergence on loss costs.

4. G-1, Disclosure 2, page 14 – Provide goodness-of-fit tests and sensitivity and uncertainty analyses referenced to be shown to the Professional Team.
    - The goodness-of-fit tests used to compare modeled distributions of various parameters with the underlying historical data will be presented to the professional team during the on-site review. The sensitivity and uncertainty analyses EQECAT has performed will be presented to the professional team during the on-site review.

5. G-1, Disclosure 4, page 20 – The list of references should be provided by Standard grouping.

Verified: **YES, ~~Contingent upon additional documentation provided to the Commission~~ Additional documentation received**

Professional Team Comments:

Revised responses to be provided to the Commission:

- Pages 7-9, Table of Contents, updated for missing Standard entries

- G-1.4, pages 20-21, reference list updated to include Powell, Franklin, and Houston references provided under Standard M-4, Storm Data reference under V-1, and to be grouped by Standards.

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Revised Table of Contents and response to G-1.4 received and reviewed by the Professional Team.

G-2 Qualifications of Modeler Personnel and Consultants

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

B. The model or any modifications to an accepted model shall be reviewed by either modeler personnel or consultants in the following professional disciplines: structural/wind engineering (licensed Professional Engineer), statistics (advanced degree), actuarial science (Associate or Fellow of Casualty Actuarial Society), meteorology (advanced degree), and computer/information science (advanced degree). These individuals shall be signatories on Forms G-1 through G-6 as applicable and shall abide by the standards of professional conduct if adopted by their profession.

Audit

1. The professional vitae of modeler personnel and consultants responsible for the current model and information on their predecessors if different than current personnel will be reviewed. Background information on individuals providing testimonial letters in the submission shall be provided.

2. Forms G-1, G-2, G-3, G-4, G-5, G-6, and all independent peer reviews of the model will be reviewed.

3. Discuss any known incidents where modeler personnel or consultants have been found to have failed to abide by the standards of professional conduct adopted by their profession.

Pre-Visit Letter

6. G-2, Disclosure 2.C, page 27 – Specify the process required in Standard C-5 with Figure 4.

7. G-2, Disclosure 3.B, page 29 – The documentation provided in the Appendix is not pertinent to *the modeler's responses to the current Standards, Disclosures, or Forms.* Clarify response provided.

8. G-2, Disclosure 4, page 30 – The response lacks a description of the reviews.

Verified: **YES, ~~Contingent upon additional documentation provided to the Commission~~ Additional documentation received**

Professional Team Comments:

Discussed personnel no longer with company and the change in status of Dr. Bob Bailey to a consultant.

Discussed the independent peer reviews performed on the model and their relevance to the current submission.

Discussed the aspects of the reviews performed by the rating agencies Standard and Poor's, Moody's, and Fitch.

Revised responses to be provided to the Commission:

- Forms G-1 through G-5, pages 35-39, with updated signatures after revisions have been made to the original February 28, 2006 submission and reviewed by modeler personnel.

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Revised Forms G-1 through G-5 received and reviewed by the Professional Team.

G-3 Risk Location

A. ZIP Codes used in the model shall be updated at least every 24 months using information originating from the United States Postal Service. The United States Postal Service issue date of the updated information shall be reasonable.

B. ZIP Code centroids, when used in the model, shall be based on population data.

C. ZIP Code information purchased by the modeler shall be verified by the modeler for accuracy and appropriateness.

Audit

1. Provide geographic displays for all ZIP Codes. The location of specific centroids will be reviewed.

2. Provide the third party vendor, if applicable, and a complete description of the process used to validate ZIP Code information.

Pre-Visit Letter

9. G-3, page 31 – Be prepared to review the entire process of ZIP Code updating, testing, verification, and how this updating might affect other ZIP Code-based databases.

Verified: YES

Professional Team Comments:

Reviewed the ZIP Code vendor and the updates to the ZIP Code centroids.

Reviewed examples of ZIP Code movements showing how the centroids moved in response to the changes in the actual physical boundaries of the ZIP Codes.

Reviewed ZIP Code boundary maps showing the changes in boundaries and centroids.

G-4 Submission Specifications*

*(*Significant Revision)*

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

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

C. Unless otherwise specified, wind fields generated by the model shall be used for completing relevant Forms and Tables in the submission.

Audit

1. The appropriateness of the units of measurement will be reviewed.

2. The information used in completing Forms and Tables in the submission will be reviewed.

Verified: YES, ~~Contingent upon additional documentation provided to the Commission~~ Additional documentation received

Professional Team Comments:

Reviewed units of measurement throughout the review process for use of appropriate units.

Revisions using appropriate units to be provided to the Commission:

- Page 48, M-3.3
- Page 56, M-5.5, Figures 6a and 6b
- Page 182, S-1.6, Figures 24a and 24b

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Revised responses for M-3.3, M-5.5, Figures 6a and 6b, and S-1.6, Figures 24a and 24b received and reviewed by the Professional Team.

G-5 Independence of Model Components

The meteorological, vulnerability, and actuarial components of the model shall each 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 reasonable.

Audit

1. Demonstrate that the model components adequately portray hurricane phenomena and effects (damage and loss costs). Attention will be paid to an assessment of (1) the theoretical soundness of each component and (2) the basis of their integration. For example, a model would not meet this Standard if an artificial calibration adjustment had been made to improve the match of historical and model results for a specific hurricane.

2. Describe all changes in the model since the previous submission that might impact the independence of the model components.

Verified: YES

Professional Team Comments:

The independence of the meteorology, vulnerability, and actuarial components and their theoretical soundness was verified in the course of the review.

METEOROLOGICAL STANDARDS – Jenni Evans, Leader

M-1 Base Hurricane Storm Set*

*(*Significant Revision)*

For validation of landfall and by-passing storm frequency in the stochastic storm set, the modeler shall use the latest updated Official Hurricane Set or the National Hurricane Center HURDAT as of June 1, 2005 or later. Complete additional season increments based on updates to HURDAT approved by the Tropical Prediction Center/National Hurricane Center are acceptable modifications to these storm sets. Peer reviewed atmospheric science literature can be used to justify modifications to the Base Hurricane Storm Set.

Audit

1. The modeler's Base Hurricane Storm Set will be reviewed.

Pre-Visit Letter

1. Cover Letter – Be prepared to explain why the hurricane rates and distributions of radius to maximum winds and translation speed have been updated, but not central pressure.

10. Be prepared to describe how multiple event years are treated in the model. Is there any feedback to surface roughness?

Verified: YES

Professional Team Comments:

Verified that there is no feedback to surface roughness for multiple events.

Discussed how multiple events in a year are handled in the model.

Reviewed plots of tracks and modeled wind fields for all new storms included in the modeler's base hurricane storm set.

M-2 Hurricane Characteristics

Methods for depicting all modeled hurricane characteristics, including but not limited to wind speed, radial distributions of wind and pressure, minimum central pressure, radius of maximum winds, strike probabilities, tracks, the spatial and time variant wind fields, and conversion factors, shall be based on information documented by currently accepted scientific literature.

Audit

1. All hurricane characteristics used in the model will be reviewed.

2. Prepare graphical depictions of hurricane characteristics as used in the model. Describe and justify:
   - the data set basis for the fitted distributions,
   - the modeled dependencies among correlated characteristics in the wind field component and how they are represented,
   - the asymmetric nature of hurricanes,
   - the fitting methods used and any smoothing techniques employed.

3. The goodness-of-fit of distributions to historical data will be reviewed.

4. The modeler will present time-based contour animations (capable of being paused) of wind and pressure fields to demonstrate scientifically reasonable wind field characteristics.

5. The treatment of uncertainties associated with the conversion of gradient winds to surface winds will be compared with currently accepted literature. Variation of the conversion factor with storm intensity will be reviewed.

6. All modeler-specific scientific literature provided in Standard G-1 will be reviewed to determine acceptability.

7. Identify all external data sources that affect model generated wind fields.

Pre-Visit Letter

11. M-2, page 42 – What are the meteorological parameters in your model that are most critical in terms of loss sensitivity? What is their relative importance and how is this assessed? Show example calculations of such an assessment.

12. M-2, page 42 – The analysis of far field pressure, P_{env}, in a recent report "suggests a value of 1011 or 1012 rather than the commonly used 1013 mb value." However, when the analysis is further restricted to storms affected Florida, this conclusion is modified to be, "A case can be made that if a single value is to be used for P_{env}, *1010 mb or 1011 mb is more reasonable than 1013 mb*." What is the value of this parameter in the model and how does it vary? If this

parameter does not vary, its effects will be wrapped into a shape or profile parameter. How is the variation of this profile parameter determined?

13. M-2, Disclosure 3, page 44 – "Gradient winds are considered in the model only in terms of a gradient-level force balance that determines the relationship between central pressure and wind speed. This force balance includes the maximum rotational gradient level 10-minute sustained wind speed. This is the only gradient-level wind speed in the model, so spatial variation of the relationship between gradient level and surface (10-meter) level wind speed is not relevant." In this quote, it appears that "*gradient winds*" are being used as a synonym for "*10-minute 10-meter winds*." This is not a correct use of the term and is misleading. Gradient winds are winds unaffected by friction and so is gradient wind balance. Thus, such winds occur only above the planetary boundary layer and it is necessary for the modeler to convert these winds for height and friction, as well as averaging time (since gradient balance is taken as infinite averaging time) to produce a 10-meter peak gust wind of relevance to this model.

14. M-2, Disclosure 3, page 45 – "USWIND converts 10-minute sustained 10-meter wind speeds to one-minute sustained 10-meter wind speeds by dividing by 0.863, according to Simiu and Scanlan (1996), Figure 2.3.10." Does Simiu and Scanlan (1996) endorse use of this figure in this way? What are the caveats on this figure in the text?

15. M-2, Disclosure 9, page 46 – The abrupt change in gradient wind speed evident in Figures 6a and 6b (page 56) appears inconsistent with this answer and results in a poor result for near-coastal wind speeds for Hurricane Floyd (1987). Be prepared to review agreement between the observed and modeled weakening rate for a range (weak through intense) of historical storms. Be prepared to discuss the treatment of hurricane intensity at and immediately after landfall.

Verified: **YES, ~~Contingent upon additional documentation provided to the Commission~~ Additional documentation received**

Professional Team Comments:

Reviewed the meteorological parameters in the model that are most critical to the characterization of hurricanes.

Reviewed how gradient winds are considered in the model only in terms of a gradient-level force balance between central pressure, latitude, and maximum wind speed.

Discussed the use of Simiu and Scanlan (1996) Figure 2.3.10 to convert 10-minute sustained 10-meter wind speeds to one-minute sustained 10-meter winds speeds by dividing by a factor of 0.863.

Reviewed the process for updating the distributions to Rmax and translation speed.

Reviewed computer code for calculating wind speeds over land implementing the filling rate parameter and the friction.

Revised responses to be provided to the Commission:

- M-2, page 42, to clarify EQECAT analyses of scientific information.

- M-2.1, page 42, clarify in hurricane parameter #1, landfall location, extent to which HURDAT or other data sources are used.
- M-2.1, page 43, clarify in hurricane parameter #3, central pressure or 1-minute sustained wind speeds.
- M-2.1, page 43, hurricane parameter #4, Rmax, provide all sources used for updating Rmax data.
- M-2.3, pages 44-45, provide conversion from upper level winds to surface level winds.
- M-2.9, page 46, to reflect model treatment of hurricane characteristics, including discrete changes.

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Revised responses to M-2.1, M-2.3, and M-2.9 received and reviewed by the Professional Team.

M-3 Landfall Intensity

Models shall use maximum one-minute sustained 10-meter wind speed when defining hurricane landfall intensity. This applies both to the Base Hurricane Storm Set 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:

Category	Winds (mph)	Damage
1	74 - 95	Minimal
2	96 - 110	Moderate
3	111 - 130	Extensive
4	131 - 155	Extreme
5	Over 155	Catastrophic

Audit

Demonstrate that the hurricane intensity at landfall is consistent with the Saffir-Simpson wind range for the stochastic storm set.

Verified: **YES, ~~Contingent upon additional documentation provided to the Commission~~ Additional documentation received**

Professional Team Comments:

Verified no change to the shape parameter.

Verified that landfall intensity is evaluated using 10-meter one-minute winds.

Revised response to be provided to the Commission:

- M-3.3, page 48, updated to use correct units of measurement.

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Revised response to M-3.3 received and reviewed by the Professional Team.

M-4 Hurricane Probabilities

A. Modeled probability distributions for hurricane intensity, forward speed, radii for maximum winds, and storm heading shall be consistent with historical hurricanes in the Atlantic basin.

B. Modeled hurricane probabilities shall reasonably reflect the Base Hurricane Storm Set used for category 1 to 5 hurricanes and shall be consistent with those observed for each coastal segment of Florida and neighboring states (Alabama, Georgia, and Mississippi).

Audit

1. Modeled probabilities are compared with observed hurricane frequency using methods documented in currently accepted scientific literature. The goodness-of-fit of modeled to historical hurricane frequencies for the four regions of Florida and overall as provided in Form M-1 will be reviewed.

2. Demonstrate that the quality of fit extends beyond the Florida border by showing results for appropriate coastal segments in Alabama, Georgia, and Mississippi.

3. Describe and support the method of selecting stochastic storm tracks.

4. Describe and support the method of selecting storm track strike intervals. If strike locations are on a discrete set, show the landfall points for major metropolitan areas in Florida.

5. Provide any modeler specific research performed to develop the functions used for simulating model variables or to develop databases.

Pre-Visit Letter

18. Form M-1, page 59 – Be prepared to discuss no change in the occurrence rates from previous year's submission.

Verified: **YES, ~~Contingent upon additional documentation provided to the Commission~~ Additional documentation received**

Professional Team Comments:

Reviewed results provided in Form M-1.

Revised responses to be provided to the Commission:

- M-4.1, page 49, clarification on assumptions used in creating the hurricane characteristic databases.
- Form M-1 and Figure 8, pages 59-61, with corrected occurrence rates

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Revised responses to M-4.1, Form M-1, and Figure 8 received and reviewed by the Professional Team.

M-5 Land Friction and Weakening*

*(*Significant Revision due to Disclosures)*

A. The magnitude of land friction coefficients shall be consistent with currently accepted scientific literature relevant to current geographic surface roughness distributions and shall be implemented with appropriate geographic information system data.

B. The hurricane overland weakening rate methodology used by the model shall be reasonable in comparison to historical records.

Audit

1. Identify other variables in the model that affect over land wind speed estimation.

2. Maps depicting land friction effects are required. Describe the representation of land friction effects in the model. Describe the variation in decay rate over land used in the model.

3. Comparisons of the model's weakening rates to weakening rates for historical Florida hurricanes will be reviewed.

4. Transition of winds from over water to over land (i.e. landfall) will be reviewed.

5. Form M-2 will be reviewed.

Pre-Visit Letter

16. M-5, Disclosure 5, page 54 – Be prepared to show comparisons of modeled decay rates with observed wind fields from other historical storms. Be prepared to show agreement between observations and wind fields *generated with your standard model* for historical storm cases over land. It is acceptable to adjust the observed winds to the same averaging time assumed by the

model, provided the same method of adjustment is used for all comparisons. It is not acceptable to refer to the Kaplan DeMaria decay rate without observed winds for the storms in question. The spatial distribution of winds should be compared for individual storms. Be prepared to explain any instances of poor agreement with reference to the meteorology of the case being considered.

17. M-5, Disclosure 6, page 56 – "The treatment of decay rates for stochastic and historical hurricanes in the EQECAT model is the same, except that for historical hurricanes the storm intensity is specified every six hours". Why is there a difference in the temporal resolution between stochastic and historical storms? Do stochastic storms have higher or lower resolution? The temporal resolution for the two historical storms in Figure 6 is evidently higher than 6 hours for over-land intensity, at least initially.

Verified: **YES, ~~Contingent upon additional documentation provided to the Commission~~ Additional documentation received**

Professional Team Comments:

Reviewed the decay rates used in the model to produce Figures 6a and 6b on page 56.

Discussed use of a terrain feature multiplier for decay rates and reviewed map of Florida terrain features.

Reviewed the computer code implementing the terrain feature multiplier.

Discussed the land use and land cover data source. Reviewed the timeliness of these data and the justification for use.

Reviewed comparison of observed versus modeled wind speeds over land for Hurricane Jeanne.

Reviewed results provided in Form M-2.

Revised response to be provided to the Commission:

- M-5.5, page 56, Figures 6a and 6b updated with correct units of measurement.
- M-5.5, page 56, Figure 6b updated with Hurricane Charley rather than Hurricane Floyd.
- M-5.6, page 56, clarification relative to the treatment of stochastic storms.

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Revised responses to M-5.5 and M-5.6 received and reviewed by the Professional Team.

M-6 Logical Relationships of Hurricane Characteristics

A. The magnitude of asymmetry shall increase as the translation speed increases, all other factors held constant.

B. The wind speed shall decrease with increasing surface roughness (friction), all other factors held constant.

Audit

1. Form M-3 and the modeler's sensitivity analyses provide the information used in auditing this Standard.

2. Justify the relationship between central pressure and radius of maximum winds.

Pre-Visit Letter

19. Form M-3.C, page 66 – Figure 11 implies that there is an equal likelihood of any Rmax within range for a given P_{min}. Is this correct?

Verified: **YES, ~~Contingent upon additional documentation provided to the Commission~~ Additional documentation received**

Professional Team Comments:

Discussed the relationship between central pressure and Rmax and verified that the methodology for applying the relationship has not changed.

Discussed the variables that impact the Rmax distribution. Verified that the limits on Rmax are unchanged.

Reviewed results provided in Form M-3.

Revised response to be provided to the Commission:

- Form M-3, Figure 11, page 66 to reflect updated Rmax distribution and lower density points.

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Revised Form M-3, Figure 11 received and reviewed by the Professional Team.

VULNERABILITY STANDARDS – Fred Stolaski, Leader

V-1 Derivation of Vulnerability Functions

A. Development of the vulnerability functions is to be based on a combination of the following: (1) historical data, (2) tests, (3) structural calculations, (4) expert opinion, or (5) site inspections. Any development of the vulnerability functions based on structural calculations or expert opinion shall be supported by tests, site inspections, or historical data.

B. The method of derivation of the vulnerability functions shall be theoretically sound.

C. Any modification factors/functions to the vulnerability functions or structural characteristics and their corresponding effects shall be clearly defined and be theoretically sound.

D. Construction type and construction characteristics shall be used in the derivation and application of vulnerability functions.

E. In the derivation and application of vulnerability functions, assumptions concerning building code revisions and building code enforcement shall be reasonable and be theoretically sound.

F. Vulnerability functions shall be separately derived for building structures, mobile homes, appurtenant structures, contents, and additional living expense.

G. The minimum wind speed that generates damage shall be reasonable.

Audit

1. Historical data should be available in the original form with explanations for any changes made and descriptions of how missing or incorrect data were handled. To the extent that historical data are used to develop vulnerability functions, demonstrate the goodness-of-fit of the data to fitted models. Complete reports detailing loading conditions and damage suffered are required for any test data used. Complete structural calculations shall be presented so that a variety of different structure types and construction characteristics may be selected for review. The basis for expert opinion and original site inspection reports should be available for review.

2. Copies of any papers, reports, and studies used in the development of the vulnerability functions should be available for review. Copies of all public record documents used may be requested for review.

3. Multiple samples of vulnerability functions for building structures, mobile homes, appurtenant structures, contents, and additional living expense should be available. The magnitude of logical changes among these items for a given wind speed shall be explained and validation materials should be available.

4. Justify the construction types and characteristics used, and provide validation of the range and direction of the variations in damage.

5. Document and justify all modifications to the vulnerability functions due to building codes and their enforcement.

6. Provide validation material for the disclosed minimum wind speed. Provide the computer code showing the inclusion of the minimum wind speed at which damage occurs.

7. Describe how the duration of wind speeds at a particular location over the life of a hurricane is considered.

8. Form V-1 will be reviewed.

Pre-Visit Letter

20. V-1, page 67 – Be prepared to describe any changes made to the vulnerability functions in the past five years based upon engineering site inspections, insurance company claim data, etc.

21. V-1.A, page 67 – Provide claims data and documentation from field surveys for 2004 storms.

22. V-1, Disclosure 1, page 69 – Be prepared to describe the process and software used in the procedures provided in Figure 12.

23. V-1, Disclosure 6, page 72 – The reference (Storm Data, Sept. 1992, Vol 24, 9, page 27) is not provided in the reference list on page 20.

25. Form V-1, page 76 – The results are identical from last year's submission although the basis for the form was changed by the Commission. Verify that the correct exposure supplied in ***FormV1Input05.xls*** was used to complete Form V-1.

Verified: **YES, ~~Contingent upon additional documentation provided to the Commission~~ Additional documentation received**

Professional Team Comments:

Reviewed 2004 field survey guidelines. Discussed basis for selection of areas to be covered for field site inspections and the information collected. Reviewed actual field notes and photos from several site inspections. Reviewed aerial photos of damaged areas from Hurricanes Charley, Frances, and Jeanne in 2004 and Hurricane Katrina in 2005.

Discussed process used for updating secondary structural modifiers if needed in the model after site inspections.

Reviewed map of damage ratios from Hurricane Charley.

Verified no modifications were made to the vulnerability functions.

Reviewed mapping of construction types and use of cladding characteristics to describe individual structures.

Discussed current analyses of the 2004 claims data from the 4 storms.

Reviewed comparison of modeled estimated losses from the 2004 storms versus actual losses reported by Property Claims Services.

Reviewed computer code for minimum wind speed for calculating damage.

Documentation reviewed:

- Hurricane Charley Field Report An Overview
- Secondary Structural Modifiers: Features and Model Description, July 28, 2003
- 2004 Hurricane Damage
- Vulnerability Functions for Estimating Wind Damage to Buildings, McDonald Mehta, May 28, 1992.

Reviewed the process for developing the vulnerability functions. Discussed the software programs utilized.

Discussed the process and guidelines applied to ensure the accuracy of the claims data used to validate the vulnerability functions.

Revised responses to be provided to the Commission:

- V-1.4, page 70, to identify the storms used in the development of vulnerability functions.
- V-1.7, page 72, to clarify how duration of wind speeds is considered in the model.

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Revised responses to V-1.4 and V-1.7 received and reviewed by the Professional Team.

V-2 Mitigation Measures*

*(*Significant Revision due to Form V-2)*

A. Modeling of mitigation measures to improve a structure's wind resistance and the corresponding effects on vulnerability shall be theoretically sound. These measures shall include fixtures or construction techniques that enhance:

- ***Roof strength***
- ***Roof covering performance***
- ***Roof-to-wall strength***
- ***Wall-to-floor-to-foundation strength***
- ***Opening protection***
- ***Window, door, and skylight strength.***

B. Application of mitigation measures shall be reasonable both individually and in combination.

Audit

1. Form V-2 provides the information used in auditing this Standard.

2. Total effect on damage due to use of multiple mitigation measures will be reviewed and shown to be reasonable. Any variation in the change over the range of wind speeds for individual and multiple mitigation measures will be reviewed and shown to be reasonable.

3. Mitigation measures used by the model that are not listed as required in this Standard will be disclosed and shown to be theoretically sound and reasonable.

Pre-Visit Letter

24. V-2.A, page 73 – The response does not state the model specifically addresses the fixtures listed in the Standard.

26. Form V-2, page 80 – Be prepared to discuss and show documentation on methods used to complete the form. Explain the values provided for Mitigated Structure at various wind speeds in relation to the sum of the individual Mitigation Measures added to the Base Structure. Explain in detail the low values given for all wind speeds, especially the Mitigated Structure and why 150 mph has the highest value. Be prepared to discuss Membrane values, Ties or Clips and Straps values, Plywood and Steel Shutter values, and Laminated and Impact Glass values.

Verified: **YES, ~~Contingent upon additional documentation provided to the Commission~~ Additional documentation received**

Professional Team Comments:

Discussed values of zero difference in Form V-2 and the process for completing the Form.

Discussed concept of weakest link as to location and wind speed at which damage occurs and how this affects the efficiency of individual mitigation measures. Discussed the independence of the individual mitigation measures. Reviewed the variation of values in Form V-2 for a single mitigation measure used for a frame structure and a masonry structure.

Revised response to be provided to the Commission:

- V-2.A, page 73, to address fixtures or construction techniques included in the model.
- Form V-2.A, page 80, to revise values for masonry structure vertical reinforcing.

****

Revised response to V-2.A and Form V-2.A received and reviewed by the Professional Team.

ACTUARIAL STANDARDS – Marty Simons, Leader

A-1 Modeled Loss Costs*

*(*Significant Revision)*

Modeled loss costs shall reflect all damages from storms that reach hurricane strength and produce minimum damaging wind speeds or greater on land in Florida.

Audit

1. The model will be reviewed to determine that the definition of an event in the model is consistent with Standard A-1.

2. The model will be reviewed to determine that by-passing storms and their effects are considered in a manner that is consistent with Standard A-1.

Pre-Visit Letter

27. A-1, Disclosure 1, page 81 – Define the term "close bypass."

Verified: YES

Professional Team Comments:

Discussed Shawna Ackerman's review of how damage from modeled storms is excluded or included in the calculation of loss costs.

Reviewed EQECAT's definition of an event, including "close bypass" for inclusion in damage calculations.

A-2 Underwriting Assumptions

A. 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.

B. For loss cost estimates derived from or validated with historical insured hurricane losses, the assumptions in the derivations concerning (1) construction characteristics, (2) policy provisions, (3) claim payment practices, and (4) relevant underwriting practices underlying those losses, as well as any actuarial modifications, shall be reasonable and appropriate.

Audit

Demonstrate how the claim practices of insurance companies are accounted for when claims data for those insurance companies are used to develop or to verify model calculations. For example, the level of damage the insurer considers a loss to be a "total loss." Provide the methods used to delineate among the insurer claim practices in the use of historical claims data to verify model outputs.

Pre-Visit Letter

28. A-2.A, page 82 – Provide analyses of insurance data from 2004 storms.

Verified: YES

Professional Team Comments:

Discussed Shawna Ackerman's review of the claims data dataset, the edits used on the claims data, data that is not used, and methods to ensure claims data is properly reflected in the model.

Discussed EQECAT's process for reviewing the claims data for consistency, the process used to correct any errors in the data, and the process for ensuring consistency between insurers.

Discussed EQECAT's review and preliminary analyses of the 2004 claims data and verified no changes were made to the wind field function or vulnerability functions in the model as a result of these analyses. Discussed reasons why no changes were made as a result of these analyses.

A-3 Loss Cost Projections

A. Loss cost projections produced by hurricane loss projection models shall not include expenses, risk load, investment income, premium reserves, taxes, assessments, or profit margin.

B. Loss cost projections shall not make a prospective provision for economic inflation.

C. Loss cost projections shall not explicitly include demand surge.

Audit

1. Demonstrate how the presence of demand surge has been considered in any analysis where Hurricane Andrew losses are used for development or verification of the model or its output. Demonstrate how demand surge is considered in any other data used in the development or verification of the model.

2. Describe how the model handles expenses, risk load, investment income, premium reserves, taxes, assessments, profit margin, and economic inflation.

Verified: YES

Professional Team Comments:

Discussed EQECAT's process for incorporating claims data into new or existing vulnerability functions, the removal of demand surge, and validation of the damage functions using loss experience.

Discussed current status on the development of 2004 claims data and the analyses on the 2004 claims data supporting EQECAT's opinion no change would be made to the vulnerability functions until after the 2004 claims data has been closed and analyzed.

Discussed Shawna Ackerman's review of how insurer claims payment practices are handled in the model.

A-4 User Inputs

All modifications, adjustments, assumptions, and defaults necessary to use the inputs in the model shall be actuarially sound and included with the model output. Treatment of missing values for user inputs required to run the model shall be actuarially sound and described with the model output.

Audit

1. Quality assurance procedures should include methods to assure accuracy of insurance data. Compliance with this Standard will be readily demonstrated through documented rules and procedures.

2. All insurer inputs and assumptions will be reviewed.

Verified: **YES, ~~Contingent upon additional documentation provided to the Commission~~ Additional documentation received**

Professional Team Comments:

Reviewed process for analyzing and verifying insurance claims data.

Discussed Shawna Ackerman's review of assumptions made regarding inputs in the model.

Revised response to be provided to the Commission:

- A-4.2, pages 89, 91, and 92, model output reports to include current model version number.
- A-4.3, pages 93-94, input form updated to include model name and version number.

****

Revised responses to A-4.2 and A-4.3 received and reviewed by the Professional Team.

A-5 Logical Relationship to Risk

A. 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.

B. Loss costs produced by the model shall be positive and non-zero for all valid Florida ZIP Codes.

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

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

E. Loss costs cannot increase as the presence of fixtures or construction techniques designed for hazard mitigation increases, all other factors held constant.

F. Loss costs cannot increase as the quality of building codes and enforcement increases, all other factors held constant.

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

H. The relationship of loss costs for individual coverages, (e.g., structures and appurtenant structures, contents, and loss of use/additional living expense) shall be consistent with the coverages provided.

Audit

1. Graphical representations of loss costs by ZIP Code and county will be reviewed.

2. Color-coded maps depicting the effects of land friction on loss costs by ZIP Code will be reviewed.

3. Individual loss cost relationships will be reviewed. Forms A-1, A-2, A-3, A-4, A-5 and A-6 will be used to assess coverage relationships.

Pre-Visit Letter

34. Form A-1, page 115 – Explain minimal changes to all losses.

Verified: YES

Professional Team Comments:

Reviewed plots of loss costs for owners frame, masonry, and mobile home.

Discussed changes in losses provided in Form A-1 due to ZIP Code update.

A-6 Deductibles and Policy Limits*

*(*Significant Revision)*

A. The methods used in the development of mathematical distributions to reflect the effects of deductibles and policy limits shall be actuarially sound.

B. The relationship among the modeled deductible loss costs shall be reasonable.

C. Deductible loss costs shall be calculated in accordance with s. 627.701(5)(a), F.S.

Audit

The actuary for the modeler may be asked to attest to the actuarial soundness of the procedure for handling deductibles and policy limits. To the extent that historical data are used to develop mathematical depictions of deductibles and policy limit functions, demonstrate the goodness-of-fit of the data to fitted models. Justify changes from the prior submission in the relativities among corresponding deductible amounts for the same coverage.

Pre-Visit Letter

29. A-6.C, page 103 – Provide a detailed description of the process used to ensure that deductibles are calculated in accordance with s. 627.701(5)(a), Florida Statutes.

Verified: **YES, ~~Contingent upon additional documentation provided to the Commission~~ Additional documentation received**

Professional Team Comments:

Discussed Shawna Ackerman's review of the process and the computer programming for modeling annual deductible.

Reviewed the process and calculations for applying occurrence deductibles and annual deductibles.

Reviewed the code in the software where the annual or occurrence deductible is calculated and applied.

Reviewed plots comparing the average annual loss assuming annual deductibles versus occurrence deductibles for masonry and frame loss costs.

Reviewed graph showing the percentage change in loss costs after application of the annual deductible using various deductible ranges for masonry, frame, and mobile home.

Reviewed process for verification of the annual deductible calculations. Reviewed Perl script utilized to verify calculations.

Revised response to be provided to the Commission:

- A-6.2, page 105, correct formula for misalignment of numbers with integral signs.

****

Revised response to A-6.2 received and reviewed by the Professional Team.

A-7 Contents

A. The methods used in the development of contents loss costs shall be actuarially sound.

B. The relationship between the modeled structure and contents loss costs shall be reasonable, based on the relationship between historical structure and contents losses.

Audit

The actuary for the modeler may be asked to attest to the actuarial soundness of the procedure for calculating loss costs for contents coverage. To the extent that historical data are used to develop mathematical depictions of contents functions, demonstrate the goodness-of-fit of the data to fitted models. Justify changes from the prior submission in the relativities between loss costs for structures and the corresponding loss costs for contents.

Verified: YES

Professional Team Comments:

Reviewed process for calculating damage to contents and verified no changes were made in the methodology for handling contents losses.

Reviewed plot of Form A-1 results showing the relationship between building losses and contents losses.

Discussed Shawna Ackerman's review of contents loss costs.

A-8 Additional Living Expense (ALE)*

*(*Significant Revision)*

A. The methods used in the development of Additional Living Expense (ALE) loss costs shall be actuarially sound.

B. ALE loss cost derivations shall consider the estimated time required to repair or replace the property.

C. The relationship between the modeled structure and ALE loss costs shall be reasonable, based on the relationship between historical structure and ALE losses.

D. ALE loss costs produced by the model shall appropriately consider ALE claims arising from damage to the infrastructure.

Audit

1. The actuary for the modeler may be asked to attest to the actuarial soundness of the procedure for calculating loss costs for ALE coverage. Documentation and justification of the following will be reviewed:
    a. The method of derivation and data on which the ALE vulnerability function is based;
    b. Validation data specifically applicable to ALE;
    c. Assumptions regarding the coding of ALE losses by insurers;
    d. The effects of demand surge on ALE for Hurricane Andrew;
    e. Assumptions regarding the variability of ALE by size of property;
    f. Statewide application of ALE assumptions;
    g. Assumptions regarding ALE for mobile homes, tenants, and condo unit owners exposure;
    h. The methods used to incorporate the estimated time required to repair or replace the property;
    i. The methodology and available validation for determining the extent of infrastructure damage and its effect on ALE costs.

2. To the extent that historical data are used to develop mathematical depictions of ALE functions, demonstrate the goodness-of-fit of the data to fitted models.

3. Justify the differences in the relationship of structure and ALE loss costs from those previously found acceptable.

Verified: YES

Professional Team Comments:

Discussed Shawna Ackerman's review of ALE loss costs, and verified no change in the methodology for handling ALE.

Reviewed goodness-of-fit plot of the maximum building or contents damage in percentage versus the ALE percentage loss.

Reviewed plot of the maximum building or contents damage in percentage versus the ALE percentage loss for historical data.

Discussed communications with insurance companies regarding their handling of ALE in the claims data.

Reviewed the process and calculations for removing demand surge from Hurricane Andrew claims data.

A-9 Output Ranges

A. Output Ranges shall be logical and any deviations supported.

B. All other factors held constant:

1. Output ranges produced by the model shall reflect lower loss costs for masonry construction versus frame construction.

2. Output ranges produced by the model shall reflect lower loss costs for residential risk exposure versus mobile home risk exposure.

3. Output ranges produced by the model shall reflect lower loss costs, in general, for inland counties versus coastal counties.

4. Output ranges produced by the model shall reflect lower loss costs, in general, for northern counties versus southern counties.

Audit

1. Forms A-7, A-8, and A-9 will be reviewed.

2. The modeler will be required to justify the following:
   a. Changes from the prior submission of greater than five percent in weighted average loss costs for any county.
   b. Changes from the prior submission of five percent or less in weighted average loss costs for any county.

3. Output Ranges will be reviewed to ensure appropriate differentials among deductibles, coverage, and construction types.

4. Anomalies in the output range data will be reviewed and shall be justified.

Pre-Visit Letter

30. A-9, Disclosure 1, page 111 – Be prepared to discuss response to this disclosure as to "Statewide weighted average loss costs for masonry."

31. A-9, Disclosure 2, page 112 – Be prepared to describe how each change contributes to the percentages listed in Form A-8.

32. A-9, Disclosures 3 & 4, page 112 – Be prepared to discuss responses provided to these disclosures.

33. A-9, Disclosure 3, page 112 – Be prepared to review the updating of the Rmax and translational speed distributions. Elaborate on cited counties and their adjoining counties. Provide details relative to all changes greater than 15%, including estimates of each specific contributor to changes.

35. Form A-7, page 135 – Be prepared to discuss in detail the massive increases in Loss Costs. Many counties have changes in the 30, 40, 50% or more range.

36. Form A-8, page 177 – Explain large increases in detail.

37. Form A-9, page 178 – Provide detailed description of the underlying causes of reductions in Panhandle counties.

Verified: YES

Professional Team Comments:

Reviewed reason for inconsistencies between original submitted Output Ranges and the template provided by the Commission. Discussed methods to prevent problem reoccurrence in the future.

Discussed Shawna Ackerman's review of the loss costs provided in the Output Ranges.

Reviewed reasons for anomalies in the statewide weighted average loss costs for masonry due to the masonry exposures being more heavily weighted than the frame exposures in areas having higher levels of hazard.

Reviewed changes in the output range loss costs due to the following changes to the model:

- Probabilistic hurricane database updated with the November 1, 2005 Official Hurricane Set
- ZIP Code database updated to August 2005.
- Distributions for Rmax and Translation Speed updated.

Discussed in detail how implementation of the above model updates impacted the loss costs.

Reviewed plots showing the changes in loss cost by county for each individual update in the model and in total.

Reviewed wind speed tracks for Hurricanes Charley, Frances, Ivan and Jeanne.

Reviewed plot of historical landfalls in the Gulf of Mexico for maximum sustained winds validating the frequency update and the resulting high impact on loss costs.

Reviewed historical map of maximum wind speed before and after Hurricanes Charley, Frances, Ivan and Jeanne justifying the frequency update and the change in loss costs.

STATISTICAL STANDARDS – Mark Johnson, Leader

S-1 Modeled Results and Goodness-of-Fit

A. The use of historical data in developing the model shall be supported by rigorous methods published in currently accepted scientific literature.

B. Modeled and historical results shall reflect agreement using currently accepted scientific and statistical methods.

Audit

1. Forms S-1 and S-2 will be reviewed.

2. The modeler's characterization of uncertainty for wind speed, damage estimates, annual loss, and loss costs will be reviewed.

Pre-Visit Letter

38. S-1, Disclosure 6, pages 181-182 – Provide test statistics for Ft. Myers. Be prepared to discuss results for Ft. Myers and Daytona Beach.

Verified: **YES, ~~Contingent upon additional documentation provided to the Commission~~ Additional documentation received**

Professional Team Comments:

Reviewed the updating procedure for Rmax and translation speed including revisions to the methodology itself and the selection of underlying data. Verified that the EQECAT model distributions were consistent with the Professional Team's analysis of historical data.

Discussed the process for calculating the mean and standard deviation for the updated model distributions.

Reviewed K-S test results for the Rmax and translation speed distributions for both the Fort Myers and Daytona Beach mileposts.

Reviewed the smoothing function used for producing goodness-of-fit tests.

Reviewed scatter plot of Rmax for historical land falling and by-passing storms.

Revised response to be provided to the Commission:

- S-1.1, page 179, correct spelling of Kolmogorov-Smirnov
- S-1.2, page 179, to clarify data sources for later storms, 1985-2004.
- S-1.6, page 181, to correct test statistic values.
- S-1.6, page 182, Figures 24a and 24b, updated to use correct units of measurement and corrected plot in Figure 24b.

****

Revised responses to S-1.1, S-1.2, S-1.6, and Figures 24a and 24b received and reviewed by the Professional Team.

S-2 Sensitivity Analysis for Model Output

The modeler shall have assessed the sensitivity of temporal and spatial outputs with respect to the simultaneous variation of input variables using currently accepted scientific and statistical methods and have taken appropriate action.

Audit

1. The modeler's sensitivity analysis will be reviewed in detail. Statistical techniques used to perform sensitivity analysis shall be explicitly stated. The results of the sensitivity analysis displayed in graphical format (e.g., contour plots with temporal animation) will be reviewed.

2. Form S-5 will be reviewed for new modeling companies which have not previously provided the Commission with this analysis.

Verified: YES

Professional Team Comments:

Reviewed sensitivity analyses for Rmax and translation speed relative to possible storm shifts.

S-3 Uncertainty Analysis for Model Output

The modeler shall have performed an uncertainty analysis on the temporal and spatial outputs of the model using currently accepted scientific and statistical methods and have taken appropriate action. The analysis shall identify and quantify the extent that input variables impact the uncertainty in model output as the input variables are simultaneously varied.

Audit

1. The modeler's uncertainty analysis will be reviewed in detail. Statistical techniques used to perform uncertainty analysis shall be explicitly stated. The results of the uncertainty analysis displayed in graphical format (e.g., contour plots with temporal animation) will be reviewed.

2. Form S-5 will be reviewed for new modeling companies which have not previously provided the Commission with this analysis.

Verified: YES

Professional Team Comments:

Reviewed uncertainty analyses for Rmax and translation speed relative to possible storm shifts.

S-4 County Level Aggregation

At the county level of aggregation, the contribution to the error in loss cost estimates attributable to the sampling process shall be negligible.

Audit

Provide a graph assessing the accuracy associated with a low impact area such as Nassau County. We would expect that if the contribution error in an area such as Nassau County is small, the error in the other areas would be small as well. Assess where appropriate, the contribution of simulation uncertainty via confidence intervals.

Verified: YES

Professional Team Comments:

Reviewed sample sizes used in calculating annual deductibles. Examined the relationship between annual deductible calculations and the average annual losses.

Reviewed convergence test for Broward and Nassau counties on 150,000 years compared to 511,500 event simulation.

S-5 Replication of Known Hurricane Losses

The model shall reasonably replicate incurred losses in an unbiased manner on a sufficient body of past hurricane events from more than one company, including the most current data available to the modeler. This Standard applies separately to personal residential and, to the extent data are available, to mobile homes. Personal residential experience may be used to replicate structure-only and contents-only losses. The replications shall be produced on an objective body of loss data by county or an appropriate level of geographic detail.

Audit

1. The following information for each insurer and hurricane will be reviewed:
   a. The validity of the model assessed by comparing expected losses produced by the model to actual observed losses incurred by insurers at both the state and county level,
   b. The version of the model used to calculate modeled losses for each hurricane provided,
   c. A general description of the data and its source,
   d. A disclosure of any material mismatch of exposure and loss data problems, or other material consideration,
   e. The date of the exposures used for modeling and the date of the hurricane,
   f. An explanation of differences in the actual and modeled hurricane parameters,
   g. A listing of the departures, if any, in the wind field applied to a particular hurricane for the purpose of validation and the wind field used in the model under consideration,
   h. The type of property used in each hurricane to address:
      a. Personal versus commercial
      b. Residential structures
      c. Mobile homes
      d. Condominiums
      e. Structures only
      f. Contents only,
   i. The inclusion of demand surge, storm surge, loss adjustment expenses, or law and ordinance coverage in the actual losses, or the modeled losses.

2. The following documentation will be reviewed:
   a. Publicly available documentation referenced in the submission,
   b. The data sources excluded from validation and the reasons for excluding the data from review by the Commission (if any),
   c. An analysis that identifies and explains anomalies observed in the validation data,
   d. User input sheets for each insurer and hurricane detailing specific assumptions made with regard to exposed property.

3. The confidence intervals used to gauge the comparison between historical and modeled losses will be reviewed.

4. Form S-3 will be reviewed.

5. The results of one hurricane event for more than one insurance company and the results from one insurance company for more than one hurricane event will be reviewed to the extent data are available.

Verified: YES

Professional Team Comments:

Reviewed examples of fits from the 2004 season. Data from the Florida storms are not ready for inclusion into Form S-3.

S-6 Comparison of Projected Hurricane Loss Costs

The difference, due to uncertainty, between historical and modeled annual average statewide loss costs shall be reasonable, given the body of data, by established statistical expectations and norms.

Audit

1. Form S-4 will be reviewed.

2. Justify the following:
   a. Meteorological parameters,
   b. The effect of by-passing storms,
   c. The effect of actual hurricanes that had two landfalls impacting Florida,
   d. The departures, if any, from the wind field, vulnerability functions, or insurance functions applied to the actual hurricanes for the purposes of this test and those used in the model under consideration, and
   e. Exposure assumptions.

Verified: YES, ~~Contingent upon additional documentation provided to the Commission~~ Additional documentation received

Professional Team Comments:

Reviewed results for Form S-4 and the changes from last year due to the updates in the model.

Revised response to be provided to the Commission:

- Form S-4, page 201, updated for correct value for previous year's historical hurricanes.

****

Revised Form S-4 received and reviewed by the Professional Team.

COMPUTER STANDARDS – Paul Fishwick, Leader

C-1 Documentation

A. The modeler shall maintain a primary document binder, containing a complete set of documents specifying the model structure, detailed software description, and functionality. Development of each section shall be indicative of accepted software engineering practices.

B. All computer software (i.e., user interface, scientific, engineering, actuarial, data preparation, and validation) relevant to the modeler's submission shall be consistently documented and dated.

C. Documentation shall be created separately from the source code.

Audit

1. The primary document binder, in either electronic or physical form, and its maintenance process will be reviewed. The binder shall contain fully documented sections for each Computer Standard.

2. All documentation shall be easily accessible from a central location.

3. Complete user documentation, including all recent updates, will be reviewed.

4. Modeler personnel, or their designated proxies, responsible for each aspect of the software (i.e. user interface, quality assurance, engineering, actuarial) shall be present when the Computer Standards are being audited. Internal users of the software will be interviewed.

5. Provide verification that documentation is created separately from the source code.

Pre-Visit Letter

39. Pages 203 – 211 – Provide all documents, binders, etc. referenced to be made available to the Professional Team.
    - Page 203, C-1.A,B,C – EQECAT maintains all such documentation, and will have it available to the professional team during the on-site visit.

Verified: YES

Professional Team Comments:

Reviewed the primary document binder and the master list of reference documents, December 1997 – May 2006.

C-2 Requirements

The modeler shall maintain a complete set of requirements for each software component as well as for each database or data file accessed by a component.

Audit

Provide confirmation that a complete set of requirements for each software component, as well as for each database or data file accessed by a component, has been maintained and documented.

Pre-Visit Letter

39. Pages 203 – 211 – Provide all documents, binders, etc. referenced to be made available to the Professional Team.
    - Page 204, C-2 – EQECAT maintains all such documentation, and will have it available to the professional team during the on-site visit.
    - Page 204, C-2.1 – The above documentation will be available to the professional team during the on-site visit.

Verified: YES

Professional Team Comments:

Reviewed software requirements included in WCe 3.7.01 and EQECAT 5.9.01 Product Enhancements Revision 1, as indicative of the requirements documentation process.

C-3 Model Architecture and Component Design

The modeler shall maintain and document (1) detailed control and data flow diagrams and interface specifications for each software component, and (2) schema definitions for each database and data file. Documentation shall be to the level of components that make significant contributions to the model output.

Audit

1. The following will be reviewed:

a. Detailed control and data flow diagrams, completely and sufficiently labeled for each component,
b. Interface specifications for all components in the model,
c. Documentation for schemas for all data files, along with field type definitions,
d. Each network diagram including components, sub-component diagrams, arcs, and labels.

2. A model component custodian, or designated proxy, should be available for the review of each component.

Pre-Visit Letter

39. Pages 203 – 211 – Provide all documents, binders, etc. referenced to be made available to the Professional Team.
    - Page 205, C-3 – This documentation will be available to the professional team during the on-site visit.

Verified: YES

Professional Team Comments:

Reviewed data flow diagram for application of the annual deductible.

Reviewed the data dictionary (i.e., schema) for the ZIP Code database.

C-4 Implementation

A. The modeler shall maintain a complete procedure of coding guidelines consistent with accepted software engineering practices.

B. The modeler shall maintain a complete procedure used in creating, deriving, or procuring and verifying databases or data files accessed by components.

C. All components shall be traceable, through explicit component identification in the flow diagrams, down to the code level.

D. The modeler shall maintain a table of all software components affecting loss costs, with the following table columns: (1) Component name, (2) Number of lines of code, minus blank and comment lines; and (3) Number of explanatory comment lines.

E. Each component shall be sufficiently and consistently commented so that a software engineer unfamiliar with the code shall be able to comprehend the component logic at a reasonable level of abstraction.

Audit

1. The interfaces and the coupling assumptions will be reviewed.

2. Provide the documented coding guidelines and confirm that these guidelines are uniformly implemented.

3. The procedure used in creating, deriving, or procuring and verifying databases or data files accessed by components will be reviewed.

4. The traceability among components at all levels of representation will be reviewed.

5. The following information shall be available and will be reviewed for each component, either in a header comment block, source control database, or the documentation: component name, date created, dates modified and by whom, purpose or function of the component, and input and output parameter definitions.

6. The table of all software components as specified in C-4.D will be reviewed.

7. Model components and the method of mapping to elements in the computer program will be reviewed.

8. Comments within components will be examined for sufficiency, consistency, and explanatory quality.

Pre-Visit Letter

39. Pages 203 – 211 – Provide all documents, binders, etc. referenced to be made available to the Professional Team.
    - Page 206, C-4.D – This table will be available for review by the professional team.
    - Page 206, C-4.E – The underlying model including algorithm implementation and technical assumptions along with the procedures used for updating the system data will be available for review by the professional team during the on-site visit.

Verified: YES

Professional Team Comments:

Reviewed software metrics table of all software components.

Reviewed revised Coding Standards for handling of comment lines in the software code.

Reviewed the annual deductible implementation in C++ and Perl.

Reviewed code specifying the minimum wind speed at which damage occurs.

Reviewed the filling rate model implementation.

Reviewed code containing the terrain feature modification of winds due to friction.

C-5 Verification

A. General

For each component, the modeler shall maintain procedures for verification, such as code inspections, reviews, calculation crosschecks, and walkthroughs, sufficient to demonstrate code correctness.

B. Component Testing

1. The modeler shall use testing software to assist in documenting and analyzing all components.

2. Unit tests shall be performed and documented for each component.

3. Regression tests shall be performed and documented on incremental builds.

4. Aggregation tests shall be performed and documented to ensure the correctness of all model components. Sufficient testing shall be performed to ensure that all components have been executed at least once.

C. Data Testing

1. The modeler shall use testing software to assist in documenting and analyzing all databases and data files accessed by components.

2. The modeler shall perform and document integrity, consistency, and correctness checks on all databases and data files accessed by the components.

Audit

1. The components will be reviewed for containment of sufficient logical assertions, exception-handling mechanisms, and flag-triggered output statements to test the correct values for key variables that might be subject to modification.

2. The testing software used by the modeler will be reviewed.

3. The component (unit, regression, aggregation) and data test processes and documentation will be reviewed.

Pre-Visit Letter

40. C-5.B-4, page 208 – Demonstrate that sufficient testing has been performed to ensure that all components have been executed at least once.

Verified: YES

Professional Team Comments:

Reviewed unit testing procedures and verified unit level coverage testing. Reviewed the program used to ensure code coverage (i.e., all components executed at least once).

Reviewed the general approach to unit testing based on the CPPUnit program.

Reviewed a specific unit test of the revised annual deductible code. This test involves visual charts and manual checks.

Reviewed a verification check performed by comparing two implementations (one in Perl and the other in C++) of the annual deductible code.

Reviewed a software-based verification of the effects of the ZIP Code centroid update on loss costs.

Verified that the modeler uses ISO 9001 to assist in quality assurance for the steps used in the development of the vulnerability curves.

C-6 Model Maintenance and Revision

A. The modeler shall maintain a clearly written policy for model revision, including verification and validation of revised components, databases, and data files.

B. A revision to any portion of the model that results in a change in any Florida residential hurricane loss cost shall result in a new model version number.

C. The modeler shall use tracking software to identify all errors, as well as modifications to code, data, and documentation.

Audit

1. All policies and procedures used to maintain the code, data, and documentation will be reviewed. For each component in the system decomposition, the modeler should provide the installation date under configuration control, the current version number, and the date of the most recent change(s).

2. The policy for model revision will be reviewed.

3. The tracking software will be reviewed.

Pre-Visit Letter

39. Pages 203 – 211 – Provide all documents, binders, etc. referenced to be made available to the Professional Team.
    - Page 210, C-6.C – EQECAT's policies and procedures for model revision will be made available to the professional team during the on-site visit.
    - Page 210, C-6.1 – EQECAT has a series of ISO procedures regarding the maintenance of code, data, and documentation, and these will be made available to the professional team.

Verified: YES

Professional Team Comments:

Discussed the tracking software used to identify all errors and modifications to code, data, and documentation.

Reviewed EQECAT's policy for revisions to the model and for incremental builds.

C-7 Security

The modeler shall have implemented and fully documented security procedures for: (1) secure access to individual computers where the software components or data can be created or modified, (2) secure operation of the model by clients, if relevant, to ensure that the correct software operation cannot be compromised, (3) anti-virus software installation for all machines where all components and data are being accessed, and (4) secure access to documentation, software, and data in the event of a catastrophe.

Audit

1. The written policy for all procedures and methods used to ensure the security of code, data, and documentation will be reviewed. Specify all security procedures.

2. Documented security procedures for access, client model use, anti-virus software installation, and off-site procedures in the event of a catastrophe will be reviewed.

Pre-Visit Letter

39. Pages 203 – 211 – Provide all documents, binders, etc. referenced to be made available to the Professional Team.

- Page 211, C-7 – These procedures will be made available to the professional team during the on-site visit.

Verified: YES

Professional Team Comments:

Reviewed EQECAT's security policy.

Discussed the policy for user password maintenance.