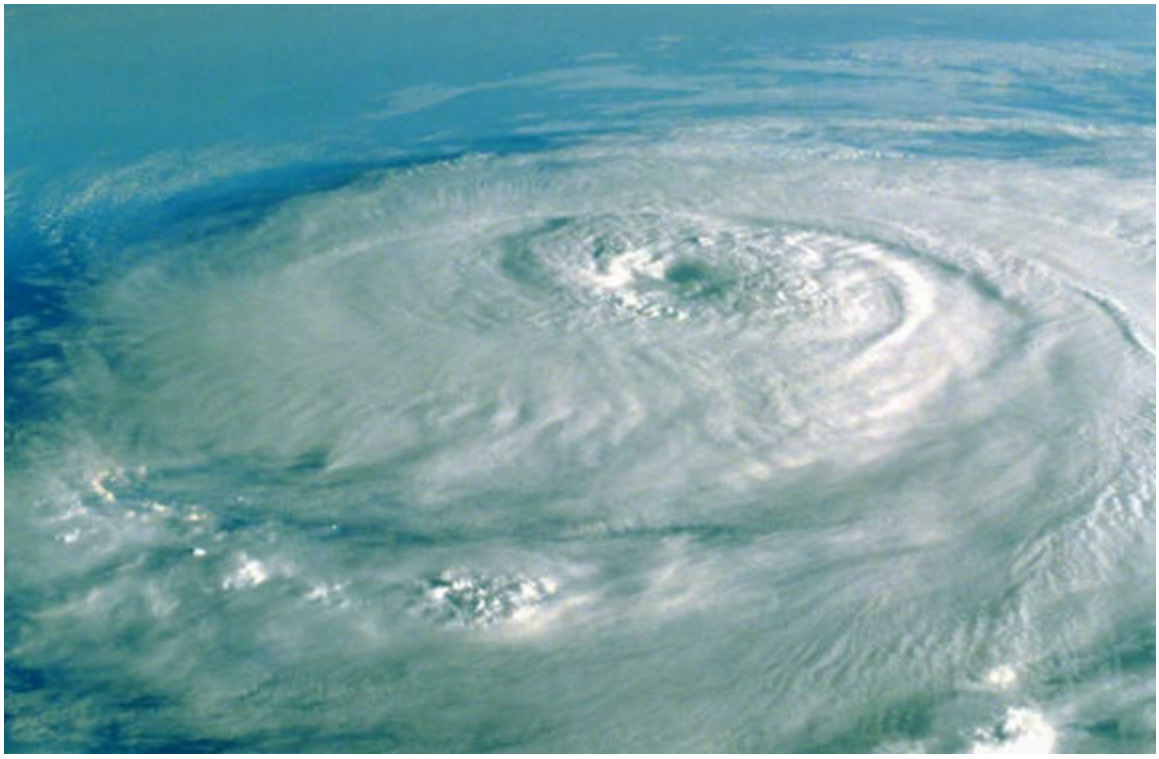
Florida Commission on Hurricane Loss Projection Methodology



Professional Team Audit Report
2001 Standards

EQECAT, Inc.

On-Site Review
April 23 & 24, 2002

On April 23 & 24, 2002, the Professional Team visited on-site at EQECAT, Inc. (EQE) in Oakland, California. The following people participated in the review.

EQECAT

Shawna S. Ackerman, FCAS, MAAA, Principal and Consulting Actuary – Miller, Herbers, Lehmann & Associates, Inc. and Paratus Consulting Limited
Robert Bailey, Ph.D., Wind and Structural Engineer (via phone)
Richard L. Clinton, CPCU, President
Craig Cole, Structural Engineer
Jun-Rong Huo, Principal Engineer
Anthony Hitchings, Structural Engineer
Mahmoud M. Khater, Ph.D., P.E., Senior Vice President, Chief Science and Technology Officer
Omar Khemici, Ph.D., P.E., Group Manager
Dennis E. Kuzak, Senior Vice President
Thomas I. Larsen, Structural Engineer, Senior Vice President
Richard Mensing, Ph.D., Statistical Consultant
Robert A. Philbrick, P.E., Regional Vice President
Keith Porter, P.E. (via phone)
Nilesh Shome, Senior Project Engineer
David F. Smith, Group Manager, Meteorologist
Qing Xia, Ph.D., Meteorologist

Professional Team

Mark Johnson, Ph.D., Statistician, Team Leader
Marty Simons, ACAS, Actuary
Ron Iman, Ph.D., Statistician
Paul Fishwick, Ph.D., Computer Scientist
John Pepper, P.E., Structural Engineer
Peter Ray, Ph.D., Meteorologist
Donna Sirmons, Staff

The review began with introductions and an overview of the audit process. EQE gave a presentation outlining the model changes since the February 2001 submission and the effect of those changes on loss costs statewide.

EQE provided a PowerPoint presentation of their compliance with each of the 2001 Standards. The presentation also included responses to the issues raised in the March 29th electronic correspondence and discussed during the April 8, 2002 conference call. Further supporting materials were presented upon request.

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: **No**
Verified: **Yes**

Professional Team Comments:

No change from last year; claims adjusters screen insurance company claims data to appropriately account for flood and storm surge damage that affects ALE.

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). These individuals shall abide by the standards of professional conduct adopted by their profession.

Reference: Module 2, Section I, #2-#3 (pages 44 – 47)
Reference: Module 2, Section I, #5 (pages 48 – 51)

Proprietary: **No**
Verified: **Yes**

Professional Team Comments:

Reviewed vitas for new EQECAT development team members:

- Qing Xia, Ph.D. from University of Chicago, Meteorologist, joined April 2002.

- Ashok Ramnirmal, Masters Degree in Computer Applications from India, Configuration Manager, joined August 2001.

Dick Mensing, previously full time, retired and is now a consultant to EQECAT.

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. Any revision to any portion of the model that results in a change in any Florida residential hurricane loss cost must be accompanied by a new model version number.

Reference: Module 1,Section I, A.1 (page 11)
Reference: Module 1, Section I, A.9 (page 26)

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

Professional Team Comments:

Reviewed EQECAT's documentation for model revision in regards to methodologies and data. Updates checked with code.

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 38)
Reference: Module I, Section II, B.13-15 (pages 38 – 39)
Reference: Standard 5.5.3 (page 174)

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

Professional Team Comments:

In the course of the review, verified the independence of the meteorology, vulnerability, and actuarial components of the model and found them to be theoretically sound and unbiased. (We detected no dependence.)

5.1.5 Risk Location

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

Zip code centroids, when used in the model, shall be based upon population data and shall be visually demonstrated to be reasonable.

Zip code information purchased by the modeler shall be verified by the modeler for accuracy and appropriateness.

Reference: Module 3, Section VI, #1 (pages 97 – 98)
Reference: Module 3, Form A (page 102)

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

Professional Team Comments:

Reviewed maps of population weighted Zip Code centroids highlighting the changes generated from updating to the October 2001 Zip code database. EQE uses visual reviews and automated procedural checks for verifying the accuracy of the Zip Code database.

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 30)

Proprietary: **No**
Verified: **Yes**

Professional Team Comments:

Reviewed examples of USWIND® storm editor that clearly specified units of measurement for all of the storm parameters. All wind speed maps shown were clearly labeled as mph gust.

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.

Reference: Module 3, Section V, #3 (pages 87 – 90)

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

Professional Team Comments:

Verified that all visualizations to be presented to the Commission will have the required characteristics. Reviewed numerous color-coded maps.

5.2 Meteorological Standards – *Peter Ray, 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: **No**
Verified: **Yes**

Professional Team Comments:

Shown illustration outlining units.

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 68)

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

Professional Team Comments:

Reviewed details on the gust factor expressions and the following documentation:

- *Gust Factors Applied to Hurricane Winds*, William R. Krayer and Richard D. Marshall, Structures Division, Building and Fire Research Laboratory, National Institute of Standards and Technology, Gaithersburg, Maryland

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, derived from the Tropical Prediction Center/National Hurricane Center (TPC/NHC) document *Tropical Cyclones of the North Atlantic Ocean, 1871-1998,* updated through the 2000 hurricane season and/or the HURDAT (HURricane DATa) data set, is found in the *Report of Activities as of November 1, 2001* under Section VII, Compliance With Standards and Related Information, #4. 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 (page 35)
Reference: Module 3, Section I (pages 52 – 67)

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

Professional Team Comments:

Verified EQE's storm set matches that provided by the Commission.

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 32 – 35)
Reference: Module 3, Section I (pages 52 – 67)
Reference: Standard 5.6.2 (page 177)

Proprietary: Yes
Verified: Yes

Professional Team Comments:

Reviewed details on the following:

- Landfall Location Milepost
- Maximum Wind Speed at Landfall
- Landfall Track Direction
- Rmax, Translation Speed
- Filling Rate

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	$\geq$ 980	Minimal

Category	Winds (mph)	Central Pressure (MB)	Damage
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 52 – 53)
Reference: Module 3, Form B
Reference: Standards 5.6.2 and 5.6.3 (page 177)

Proprietary: Yes
Verified: Yes

Professional Team Comments:

Verified that USWIND® uses the maximum sustained wind speeds provided by the Commission to define each hurricane's landfall intensity. Verified the USWIND® pressure-wind speed relationship generates wind speeds in agreement with the Saffir-Simpson Hurricane Scale.

5.2.6 Hurricane Probabilities

Modeled hurricane probabilities shall reasonably match the historical record through 2000 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 27)
Reference: Module 1,Section II, B.7 (page 35)
Reference: Module 3, Section I (pages 52 – 67)
Reference: Standards 5.6.2 and 5.6.3 (page 177)

Proprietary: Yes
Verified: Yes

Professional Team Comments:

Reviewed details on modeled landfall probabilities and the use of smoothed distributions. Comparison between historical landfall accounts and modeled shows the modeled results are a smooth version of history.

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 32)
Reference: Module 1, Section II, B.7-8 (page 35)
Reference: Module 3, Section 1, #2 (pages 52 – 53)
Reference: Module 3, Section 1, #8 (page 55)
Reference: Standards 5.6.2 and 5.6.3 (page 177)

Proprietary: Yes
Verified: Yes

Professional Team Comments:

Reviewed plot of storms effecting Florida showing the relationship between Rmax and CP. Discussion on EQE's use of a profile factor to match actual events' Radius of Hurricane Force Winds.

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 33 – 34)
Reference: Module 3, Section I (pages 52 – 67)

Proprietary: Yes
Verified: Yes

Professional Team Comments:

Reviewed details of the USWIND® land friction database including land friction maps by Zip Code showing the smooth versus rough transition factors.

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 33)
Reference: Module 3, Section I (pages 52 – 67)

Proprietary: Yes
Verified: Yes

Professional Team Comments:

Verified the USWIND® filling rate is within 20% of the Kaplan/DeMaria filling rate. Reviewed graphical comparisons of the USWIND® degradation rates over time.

5.3 Vulnerability Standards – *John Pepper, 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 25)
Reference: Module 3, Section III (pages 70 – 73)
Reference: Module 3, Section IV, #3-6 (pages 76 – 79)
Reference: Standard 5.6.2 (page 177)

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

Professional Team Comments:

Derivation of vulnerability functions was verified. Functions are derived and updated from historical insurance data. The method of derivation is theoretically sound.

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 (pages 70 – 73)
Reference: Module 3, Section IV, #3 (pages 76 – 77)

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

Professional Team Comments:

Reviewed details on the vulnerability functions and assumptions used including ALE reconstruction time. EQE uses actual claims data to develop vulnerability functions. Method of derivation is theoretically sound.

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 (pages 70 – 73)

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

Professional Team Comments:

Reviewed details on how the USWIND® model handles the changes to the Florida Building Code including the use of wind-borne debris zones.

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 (pages 24 – 25)
Reference: Module 3, Section III (pages 70 – 73)

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

Professional Team Comments:

Reviewed vulnerability curves for different ISO construction classifications. Discussed definitions of each ISO construction type. All found to be reasonable and appropriate.

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 (pages 71 – 72)
Reference: Module 3, Section III, #6 (pages 72 – 73)

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

Professional Team Comments:

Reviewed details on modification factors including strong, average and weak cladding. The development was reviewed and found to be theoretically sound.

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 77 – 79)

Proprietary: Yes
Verified: Yes

Professional Team Comments:

Development of the ALE vulnerability curves is based on historical insurance data and therefore implicitly includes the time of reconstruction and damage to infrastructure.

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

Professional Team Comments:

Reviewed details on EQE's development of mitigation measures. Verified that no mitigation measures are included in the model this year.

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 28)
Reference: Module 1, Section II, A.3-5 (page 32, 25, 27-28, 29,39)

Reference: Module 3, Section IV (pages 74 – 83)

Proprietary: Yes
Verified: Yes

Professional Team Comments:

Discussed underwriting assumptions, use of actual insurance claims data, detection of errors and method for correcting errors found. Reviewed several examples of insurer data.

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 24)
Reference: Module 1, Section I, A.10 (pages 26 – 27)
Reference: Module 1, Section I, C.1.c (page 29)
Reference: Module 3, Section III, #3 (pages 71 – 72)

Proprietary: Yes
Verified: Yes

Professional Team Comments:

Reviewed details on the modification factors for building and contents damage.

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 28)
Reference: Module 1, Section I, C.1.a (page 29)
Reference: Module 3, Section III, #2 (pages 70 – 71)
Reference: Module 3, Section V (pages 84 – 96)
Reference: Module 3, Section VII (pages 99 – 113)

Proprietary: **No**
Verified: **Yes**

Professional Team Comments:

No change from previous years as attested by Shawna Ackerman, Consulting Actuary on 4/24/02.

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 (pages 26 – 27)
Reference: Module 1, Section I, B.4 (page 28)
Reference: Module 1, Section II, A.3-4 (page 32, 25, 27, 29)
Reference: Module 3, Section IV (pages 74 – 83)

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

Professional Team Comments:

Verified there was no change from previous years.

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 and shall be demonstrated to be reasonable.

Reference: Module 1, Section I, C.1.a (page 29)
Reference: Module 3, Section III, #2 (pages 70 – 71)
Reference: Module 3, Section VII (pages 99 – 113)

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

Professional Team Comments:

Verified that demand surge was not used in preparation of loss cost projections. Reviewed EQE's demand surge definition, how USWIND® calculates the catastrophe inflation, and verified that it is removed from the claims data used.

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 (page 34)

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

Professional Team Comments:

Information is based on insurance data as attested by Shawna Ackerman, Consulting Actuary on 4/24/02.

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

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

7. Loss costs cannot increase as the quality of building codes and enforcement 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 29)
Reference: Module 3, Section V, #2 (pages 85 – 86)
Reference: Module 3, Section V, #5 (pages 91 – 92)
Reference: Module 3, Section VII (pages 99 – 113)

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

Professional Team Comments:

Reviewed color-coded maps detailing ground-up loss costs by structure type, deductible levels, and friction.

5.4.8 Deductibles and Policy Limits

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

Reference: Module 1, Section I, B.3 (pages 27 – 28)
Reference: Module 3, Section IV, #1-2 (pages 74 – 76)
Reference: Standard 5.6.2 (page 177)

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

Professional Team Comments:

Reviewed details on wind speed and damage distributions and the effect of removing the deductible. Received presentation of methods used to account for deductibles and policy limits.

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 (pages 77 – 78)
Reference: Module 3, Section IV, #7 (page 79)
Reference: Standard 5.6.2 (page 177)

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

Professional Team Comments:

Discussed and reviewed methodology used for calculating damage to contents.

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 (pages 78 – 79)
Reference: Standard 5.6.2 (page 177)

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

Professional Team Comments:

Reviewed details on USWIND® method for calculating damage to ALE. Reconstruction time is included in the ALE function.

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 1, C.1.b (page 29)
Reference: Module 3, Section III, #3 (pages 71 – 72)
Reference: Standard 5.6.2 (page 177)

Proprietary: Yes
Verified: Yes

Professional Team Comments:

USWIND® does not explicitly incorporate building code quality on enforcement because at this time, there is no reliable accurate source available.

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.

Reference: Module 1, Section I, A.6 (page 24)

Proprietary: Yes
Verified: Yes

Professional Team Comments:

Verified that mitigation factors are not included in the model at this time.

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 80 – 82)
Reference: Module 3, Section V, #2 (pages 85 – 86)
Reference: Standard 5.6.3 (page 177)

Proprietary: Yes
Verified: Yes

Professional Team Comments:

Reviewed table detailing loss costs for several insurance company's actual loss data for different storm events compared to modeled loss costs.

5.4.14 Comparison of Estimated Hurricane Loss Costs

The model shall provide the annual average zero deductible 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 Fund's (FHCF) aggregate personal residential 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 (pages 24 – 25)
Reference: Module 3, Section I, #10 (pages 58 – 59)
Reference: Module 3, Section V, #2 (pages 85 – 86)
Reference: Module 3, Section V, #4 (Output Ranges pages 116 – 150)
Reference: Standard 5.6.3 (page 177)

Proprietary: Yes
Verified: Yes

Professional Team Comments:

Reviewed details on the t-tests which showed the difference between historical and modeled to be statistically insignificant.

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 including, but not limited to:

1. Differences from prior submission of greater than ten percent in maximum or minimum loss costs for any county shall be specifically listed and explained.
2. Differences from prior submission in the relativities between loss costs for building and the corresponding loss costs for contents shall be explained.
3. Differences from prior submission in the relativities among corresponding deductibles shall be explained.

Reference: Module 3, Section V, #4-5 (pages 91 – 92, Output Ranges pages 116 – 150)

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

Professional Team Comments:

Reviewed several changes from previous year submission and verified they were only attributable to the revised storm set and the updated Zip Code database.

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 (pages 40 – 41)
Reference: Standard 5.6.3 (page 177)

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

Professional Team Comments:

Reviewed graphical presentations and verified error in lost costs estimates to be negligible based on the resolution of the USWIND® stochastic storm database and the sampling process used.

5.4.17 Total Estimated Losses

The modeler shall demonstrate through the information submitted in Form B and Form D (Module 3, Section VII) that the model produces reasonable relationships among the total estimated losses produced by the model for building, appurtenant structures, contents, and additional living expense.

Reference: Module 3, Section VII Form B & Form D

Proprietary: **No**
Verified: **Yes**

Professional Team Comments:

Discussed in detail Form B and the relationships between building construction, appurtenant structures, contents, and ALE.

EQE gave presentation highlighting the changes to Form D as a result of updating the Zip Code database. Random county samples were examined in detail.

5.5 Computer Standards – *Paul Fishwick, Leader*

5.5.1 Primary Document Binder

A primary document binder, in either electronic or physical form, 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. All computer software (i.e., user interface, scientific, engineering, actuarial) relevant to the modeler's submission must be consistently documented.

Reference: Module 1, Section I (pages 11 – 30)
Reference: Module 1, Section II (pages 31 – 42)

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

Professional Team Comments:

Reviewed the primary document binder and the master list of reference documents.

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 (pages 11 – 30)
Reference: Module 1, Section II (pages 31 – 42)
Reference: Module 3, Section VI, #2 (page 98)

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

Professional Team Comments:

Reviewed the following documentation on all requirements specifications of the software:

- USWIND® Requirement Specification, Revision 1, August 25, 1994
- Design Specification EQECAT Additional Reports, February 1, 1999
- Design Specification EQECAT Additional Projects, Revision 2, June 30, 1999

Lotus Notes Database with the following documents:

- Treaty Underwriter Module Hardware/Software Requirements, Revision 2, November 7, 2000
- Treaty Underwriter Module Software Requirements Specification (SRS) Volume 3 of 3, Preliminary Draft, September 12, 2000
- Treaty Underwriter Module Software Requirements Specification (SRS) Volume 1 of 3, Preliminary Draft, September 7, 2000
- Treaty Underwriter Module Software Requirements Specification (SRS) Volume 2 of 3, Preliminary Draft, September 7, 2000
- Treaty Underwriting Module Product Requirements Document, Revision 1.0.8, March 6, 2000
- WORLDCAT enterprise Version 2.0 Product Requirements Document, Revision 1.0.0, September 20, 2000

5.5.3 Software Architecture and Component Design

The modeler shall document detailed control and data flow diagrams, interface specifications, and a schema for all data files along with field type definitions. Each network diagram shall contain components (including referenced sub-component diagrams), arcs, and labels. A *model component custodian* (that individual who can explain the functional behavior of the component and respond to questions concerning changes in code, documentation, or data for that component) shall be identified and documented. For each component in the

system decomposition, the modeler shall list the installation date under configuration control, the current version number, and the date of the most recent change(s).

Reference: Module 1, Section I (pages 11 – 30)
Reference: Module 1, Section II (pages 31 – 42)

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

Professional Team Comments:

Reviewed model custodian responsibility cross-listing for code, documentation, and data. Reviewed the following documentation on all design levels of the software, including software components and interfaces, data files, and database elements:

- EQECAT Catastrophe Management Output Reports Definitions, Revision 2, November 30, 1994
- EQECAT Catastrophe Management System, Version 3, GUI Design Specification, Revision 5, February 21, 1996
- EQECAT Natural Hazard Applications, Version 5, System Analysis and Data Flow Diagrams, Revision 2, December 1, 1998
- EQECAT Natural Hazard Applications, Version 5, System Design and Implementation, Revision 4, April 16, 2000
- EQECAT Natural Hazard Applications, Version 5, Interface Control Document, Revision 9, September 22, 2000
- EQECAT Data Directory Help File on CD-ROM
- Design Specification EQECAT Additional Reports, February 1, 1999
- Design Specification EQECAT Additional Projects, Revision 2, June 30, 1999
- EQECAT User Manual
- EQECAT Reference Guide
- EQECAT File Layout & Import Manual
- QA Test Procedure
- (Lotus Notes) Application Programmers Interface (API) for the EQE TUM Analysis Engine Broker, Revision 0, August 11, 2000
- (Lotus Notes) Treaty Underwriter Module Data Dictionary Modifications, Revision 0, September 27, 2000

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 (pages 11 – 30)
Reference: Module 1, Section II (pages 31 – 42)

Proprietary: Yes
Verified: Yes

Professional Team Comments:

Reviewed the following documentation:

- USWIND® Requirement Specification, Revision 1, August 25, 1994
- EQECAT Natural Hazard Applications, Version 5, System Design and Implementation, Revision 4, April 16, 2000
- EQECAT Catastrophe Management System, Version 3, GUI Design Specification, Revision 5, February 21, 1996
- EQECAT Natural Hazard Applications, Version 5, Interface Control Document, Revision 9, September 22, 2000
- (Lotus Notes) WORLDCAT Enterprise Installation Guide, Revision 2, May 17, 2001

5.5.5 Software Verification

The modeler shall employ and document procedures employed, such as code inspections, reviews, calculation crosschecks, and walkthroughs, sufficient to demonstrate code correctness. The code shall contain 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.

Reference: Module 1, Section I (pages 11 – 30)
Reference: Module 1, Section II (pages 31 – 42)

Proprietary: Yes
Verified: Yes

Professional Team Comments:

Reviewed the following documentation:

- Technical Reference, USWIND® Version 4.0 to 5.x, December 1997 – April, 2001
- Technical Reference, Damage to Loss Calculation, USWIND® and USQUAKE Version 4.0 to 5.x, December 1997 – April, 2001

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 (pages 11 – 30)
Reference: Module 1, Section II (pages 31 – 42)
Reference: Standards 5.6.4 and 5.6.5 (pages 177 – 178)

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

Professional Team Comments:

Reviewed the following documentation:

- QA Test Procedure
- Test Runs, Test Plan and Summary of Results
- Test Runs, QA Verification of Scenario Wind Speed
- Test Runs, QA Verification for Wind Speed and Damage Calculations
- Test Runs, QA Verification for Scenario Damage Calculation
- Test Runs, QA Verification for Scenario Gross Loss Calculation
- Test Runs, QA Verification for Scenario Net Loss Calculation
- Test Runs, QA Verification for Gross to Net Calculation
- Test Runs, QA Verification for Probabilistic Gross Loss Calculation
- Test Runs, QA Verification for Probabilistic Net Calculation
- (Lotus Notes) Tum Technical Test lan R.4

5.5.7 Software Maintenance and Revision

The modeler shall specify all policies and procedures used to maintain code, data, and documentation. The modeler shall use tracking software to track all errors, as well as modifications to code, data, and documentation.

Reference: Module 1, Section I (pages 11 – 30)
Reference: Module 1, Section II (pages 31 – 42)

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

Professional Team Comments:

The modeler has augmented their documentation and source maintenance system.

Reviewed the following documentation:
- QA Test Procedure
- SourceSafe
- EQECAT Build Machine/Process

Verified there were no changes to the model software. Only changes were to the Zip code database and the storm set database. Data files have no effect on coding, debugging, etc.

5.5.8 User Documentation

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

Reference: Module 1, Section I (pages 11 – 30)
Reference: Module I, Section II (pages 31 – 42)

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

Professional Team Comments:

Reviewed the following documentation:
- EQECAT User Manual
- EQECAT Reference Guide
- EQECAT File Layout & Import Manual
- EQECAT Data Dictionary Help File

5.6 STATISTICAL STANDARDS – *Mark Johnson, Leader*

5.6.1 Use of Historical Data

The use of historical data in developing the model shall be demonstrated to be reasonable using rigorous methods published in the scientific literature.

Reference: Module 1, Section II, B.12 (page 38)
Reference: Module 3, Section I, #7 (page 55)

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

Professional Team Comments:

Reviewed chi-square goodness-of-fit tests showing the fit between historical data and modeled data. Shown visual comparisons (beta distribution) of input claims data at different wind speeds. Reviewed Kolmogorov-Smirnov tests on storm translational velocity and K-S tests confirming the high wind speed data fit to claims data (damage function) as also shown in the chi-square tests.

5.6.2 Comparison of Historical and Modeled Results

The modeler shall demonstrate the agreement between historical and modeled results for hurricane frequencies, tracks, intensities, and physical damage using accepted scientific and statistical methods.

Reference: Module 1, Section II, A.1 (page 31)
Reference: Module I, Section II, B.7 (page 35)
Reference: Module 1, Section II, C.1 (pages 39 – 40)
Reference: Module 1, Section II, C.3 (page 41)
Reference: Module 1, Section II C.5-6 (page 42)
Reference: Module 3, Section III, #4-5 (page 72)
Reference: Module 3, Section IV, #3-6 (pages 76 – 79)

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

Professional Team Comments:

No change from last year. Reviewed several comparisons of insured losses produced by USWIND® versus historical losses including comparisons of probabilistic versus modeled results and PCS reported losses versus modeled losses.

5.6.3 Uncertainty Characterization

The modeler shall provide an assessment of uncertainty using confidence intervals or other accepted scientific characterizations of uncertainty.

Reference: Module 1, Section II, B.9 (pages 35 – 36)

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

Professional Team Comments:

Shown numerous examples while reviewing other sections of the Standards and verified appropriateness.

5.6.4 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 using accepted scientific and statistical methods. Statistical techniques used to perform sensitivity analysis shall be explicitly stated and the results of the analysis shall be presented in graphical format.

Reference: Module 1, Section I, A.5 (pages 22 – 24)
Reference: Module 1, Section II, B.13-15 (pages 38 – 39)

Proprietary: Yes
Verified: Yes – Contingent on analysis of revised Form F
Analysis of Revised Form F: Verified

Professional Team Comments:

Reviewed EQE sensitivity analysis per page 15 of the submission.

5.6.5 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 using accepted scientific and statistical methods. The analysis shall identify and quantify the extent that input variables impact the uncertainty in model output as the input variables are simultaneously varied. Statistical techniques used to perform uncertainty analysis shall be explicitly stated and results of the analysis shall be presented in graphical format.

Reference: Module 1, Section I, A.5 (pages 22 – 24)
Reference: Module 1, Section II, B.9 (pages 35 – 36)
Reference: Module 1, Section II, B.13-15 (pages 38 – 39)

Proprietary: Yes
Verified: Yes – Contingent on analysis of revised Form F
Analysis of Revised Form F: Verified

Professional Team Comments:

Reviewed EQE uncertainty analysis. Form F results were reviewed and then EQE re-ran Form F while Professional Team was on-site. Our verification is contingent upon further analysis that could not be completed during the visit.