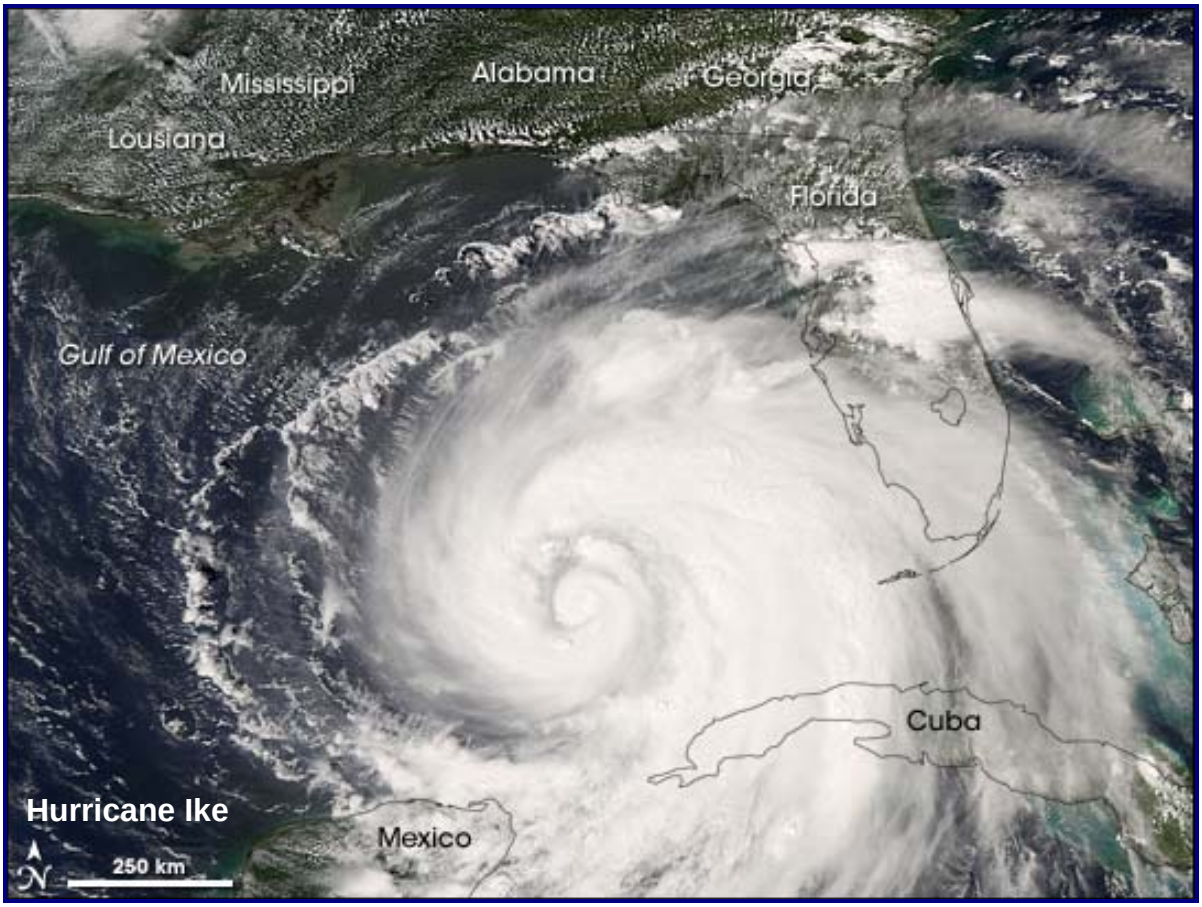
Florida Commission on Hurricane Loss Projection Methodology



Professional Team Report
2008 Standards

Florida Public Hurricane Loss Model
Florida International University

On-Site Review
April 27 – 29, 2009

Additional Verification Review
June 1, 2009

On April 27-29, 2009, the Professional Team visited on-site at Florida International University in Miami, Florida. The following individuals participated in the review:

FIU

Bachir Annane, Senior Research Associate III, CIMAS/HRD
Min Chen, Consultant, Assistant Professor of Computer Science, University of Montana
Shu-Ching Chen, Ph.D., Associate Professor, School of Computing and Information Science, Florida International University
Steve Cocke, Ph.D., Associate Scholar/Scientist, Department of Meteorology and COAPS, Florida State University
Gail Flannery, FCAS, MAAA, Consulting Actuary, AMI Risk Consultants, Inc.
Fausto Fleites, B.S., Student Programmer, Florida International University
Sneh Gulati, Ph.D., Professor, Department of Statistics, Florida International University
Kurt Gurley, Ph.D., Associate Professor, Department of Civil and Coastal Engineering, College of Engineering, University of Florida
Shahid Hamid, Ph.D., CFA, Professor, Director of MSF Program, Florida International University, Director of the Laboratory for Insurance, Financial and Economic Research, International Hurricane Research Center at Florida International University, PI and Project Director, Florida Public Hurricane Loss Model
Golam Kibria, Ph.D., Associate Professor, Department of Statistics, Florida International University
Ronald Ocampo, Student Programmer and B.S. Candidate, Florida International University
Jean-Paul Pinelli, Ph.D., Professor, Department of Civil Engineering, Florida Institute of Technology
Mark Powell, Ph.D., Senior Atmospheric Scientist, NOAA Hurricane Research Division, AOML

Professional Team

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

The review began with introductions and an overview of the audit process. The Professional Team reviewed FIU's response to the deficiency noted at the March 19, 2009 Commission meeting. An updated Expert Certification Form G-7 was provided.

The Professional Team was unable to verify Standard A-10 (Output Ranges). Consequently, Standard A-6 could not be verified and Standards G-1, G-4, G-5, C-4, and C-5 could not be verified as they require the verification of the other two standards. At the exit interview, modeler options as given in the Report of Activities were reviewed.

The Professional Team reviewed the following corrections to be included in the revised submission to be provided to the Commission no later than 10 days prior to the May 19-21, 2009 meetings.

1. Pages 7-8, Table of Contents, remove asterisks
2. Page 13, G-1.2, disclosure wording revised to reflect 2008 Report of Activities

3. Page 17, G-1.2, revised to include specific units for central pressure, Rmax, and latitude; parameter notations corrected in equation
4. Page 21, G-1.2, revise equation term notations in text for consistency
5. Page 22, G-1.2, "resistance" revised to "loading" in second paragraph under vulnerability component
6. Page 24, G-1.2, Figure 6 flowchart updated to include step for calculating missile impact
7. Page 28, G-1.2, Acronym CEIA defined
8. Page 31, G-1.2, vulnerability matrices text revised and Table 3 corrected
9. Page 33, G-1.2, Table 4 revised to reflect one age classification for the period 1970-1993
10. Page 34, G-1.2, Figure 8 updated for new vulnerability curves
11. Page 60, G-1.4, Kibria (2006) reference removed
12. Pages 60-61, G-1.4, Statistical references edited for consistency
13. Page 63, G-1.5, effect of two new mitigation measures revised; WBDR acronym defined; Florida Building Code year provided; "e.g." notation corrected
14. Page 68, G-2.2, Table 5, employment location provided for Bachir Annane and Neal Durst
15. Page 73, G-3.A, "primarily" replaced with "exclusively"
16. Page 89, M-2.3, text on Holland B parameter revised
17. Page 99, M-4.9, Holland Beta revised to B for consistency
18. Pages 121-124, Form M-3 revised
19. Page 128, V-1.1, Figure 27 flowchart updated to include step for calculating missile impact
20. Page 131, V-1.2, Figure 29 revised
21. Page 134, V-1.2, Table 10 revised to be consistent with Tables 8 and 9
22. Page 138, V-1.5, vulnerability matrices text revised
23. Page 139, V-1.6, Table 13 revised to reflect one age classification for the period 1970-1993
24. Page 174, A-6.D, reference to Form V-2 removed
25. Pages 175-177, A-6.1, Figures 33-36 revised
26. Page 183, A-8.1, Figure 37 and explanation revised
27. Pages 191-193, Form A-2, legends corrected for Figures 38-40
28. Pages 255-256, S-5.1, Table 21, Figure 66, and associated text revised
29. Pages 261-263, Form S-4 and Figure 67 revised

Additional Verification Review – June 1, 2009

FIU submitted revised Forms A-2, A-6, A-7, and A-8 on May 22, 2009. Forms A-6, A-7, and A-8 were regenerated in accordance with the Form A-6 instructions contained in the Report of Activities. The Professional Team met with FIU on June 1, 2009 in Tallahassee to review the revisions in completing Form A-6, Output Ranges and the correction made in completing Form A-2.

The following individuals participated in the additional verification review:

FIU

Bachir Annane, Senior Research Associate III, CIMAS/HRD

Shu-Ching Chen, Ph.D., Associate Professor, School of Computing and Information Science, Florida International University

Steve Cocke, Ph.D., Associate Scholar/Scientist, Department of Meteorology and COAPS, Florida State University
Gail Flannery, FCAS, MAAA, Consulting Actuary, AMI Risk Consultants, Inc.
Fausto Fleites, B.S., Student Programmer, Florida International University
Kurt Gurley, Ph.D., Associate Professor, Department of Civil and Coastal Engineering, College of Engineering, University of Florida
Shahid Hamid, Ph.D., CFA, Professor, Director of MSF Program, Florida International University, Director of the Laboratory for Insurance, Financial and Economic Research, International Hurricane Research Center at Florida International University, PI and Project Director, Florida Public Hurricane Loss Model
Mark Powell, Ph.D., Senior Atmospheric Scientist, NOAA Hurricane Research Division, AOML

Professional Team
Paul Fishwick, Ph.D., Computer Scientist
Mark Johnson, Ph.D., Statistician, Team Leader
Marty Simons, ACAS, Actuary
Donna Sirmons, Staff

FIU provided an explanation of the change in the weighting factors for the exposure data as the basis for completion of Form A-6, Output Ranges and an explanation for the revised Form A-2. All Standards are now verified by the Professional Team.

Report on Deficiencies

The Professional Team reviewed the following deficiency cited by the Commission at the March 19, 2009 meeting. The deficiency was corrected by the established time frame and the correction has been verified.

1. Standard G-1, Disclosure 5 (page 63)
   For item 3 on the "leak model," effect of the change on personal lines residential loss costs not provided

Professional Team Pre-Visit Letter

The Professional Team's pre-visit letter questions are provided in the report under the corresponding Standards.

Pre-Visit Letter

The purpose of the pre-visit letter is to outline specific issues unique to the modeler's submission. The goal is to identify lines of inquiry to be followed during the on-site review so as to allow adequate advance preparation by the modeler. Aside from due diligence with respect to the full submission, various requests for information and questions that the Professional Team is certain to ask the modeler during the on-site review are provided in this letter. This letter does not preclude the Professional Team from asking for additional information during the on-site review that is not given below or discussed during the upcoming conference call that will be

held, if requested by the modeler. One goal of the potential conference call is to clarify points in this letter. The comments are grouped by Standards sections. The overall intent is to expedite the on-site review and to avoid last minute preparations that could just as easily have been handled earlier.

The items provided below are to assist the modeler in preparing for the on-site review. Some of this material may have been shown or been available on a previous visit by the Professional Team. The Professional Team will also be considering material in response to the Commission's designation(s) of deficiencies and issues.

The goal of the Professional Team on-site review is to provide the Florida Commission on Hurricane Loss Projection Methodology (Commission) with a clear and thorough report of the model, subject to non-disclosure restrictions on proprietary information. All modifications, adjustments, assumptions, or other criteria that were included in producing the information requested by the Commission in the submission should be disclosed and will be reviewed.

It is important that all material prepared for presentation during the on-site review, be presented using a medium that is readable by all members of the Professional Team simultaneously. The Professional Team will review selected computer code in conjunction with the reviews performed for each section. Computer code should be available in a format that will allow simultaneous visualization by the entire Professional Team. Access to critical articles or materials referenced in the submission or during the on-site review should be available on-site for the Professional Team. The Professional Team should be provided access to an internet connection through one of the Professional Team member computers for reference work that may be required while on-site.

The Professional Team will interview the individuals signing the Expert Certification Forms G-1 through G-7.

Provide for the Professional Team's review, all engineering data (post event surveys, tests, etc.) received since 2005. Describe any processes used to amend or validate the model that incorporates this engineering data. Describe any processes used to amend or validate the model that incorporates insurance company claims data covering the 2004 and 2005 hurricane seasons, especially processes used since the prior visit by the Professional Team.
Provide and describe all studies performed to determine whether the model meets the "probable maximum loss" requirements added to the standards in the 2008 Report of Activities (Standard A-11 and several other standards and forms).

Provide an explanation for each loss cost change of more than 5% from the loss costs produced in the previous submission using the 2007 Florida Hurricane Catastrophe Fund (FHCF) exposure data to the corresponding loss costs produced in the current submission.

Demonstrate that output reports produced by a user of the model reveal the values of all user inputs and selections used to run the model.

When the Professional Team arrives on-site, provide the electronic file used to complete Form V-3 on a removable drive medium. This material will be used during the on-site review and will be returned when the on-site review is complete.

Describe how the model determines the magnitude of demand surge to include in the calculation of loss costs and probable maximum loss levels.

Show the Professional Team "supportive design diagrams, equations, and pseudo-code" that you intend to show the Commission during the Modeler Presentation related to the items listed under Trade Secret List on page 46 of the 2008 Report of Activities.

For your information, the Professional Team will arrive in business casual attire.

ISSUES:

Describe how the model incorporates number of stories in the vulnerability functions.

Discuss the development and application of mitigation credits for various parts of the state, by region (North, Central and South), and by proximity to water (Coastal and Inland) as defined in Form A-7. Expansion to structure types that resemble the actual Florida building stock is desired.

GENERAL STANDARDS – Mark Johnson, Leader

G-1 Scope of the Computer Model and Its Implementation*

*(*Significant Revision)*

The computer model shall project loss costs and probable maximum loss levels for personal lines residential property insured damage 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 insured loss costs and probable maximum loss levels. Copies of all representative or primary technical papers that describe the underlying model theory shall be made available.

2. All 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 and probable maximum loss levels (1) fall within the scope of the Computer Standards, and (2) will be reviewed interactively (viewed simultaneously by all Professional Team members in conjunction with the review of each Standard).

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

Pre-Visit Letter

1. G-1, Disclosure 5, page 63: Explain the effect of the two new mitigation measures in item 4 on personal lines residential loss costs.

2. G-1, Disclosure 5, page 63: Describe the process as given in items 3, 4, and 5. For item 5, define WBDR and indicate how the ZIP Code centroids are impacted.

Verified: YES

Professional Team Comments:

Discussed the effect of the new mitigation measure metal roof and the revised membrane mitigation measure. The vulnerability functions are not adjusted for mitigation measures when estimating personal lines residential loss costs.

Reviewed the update to the vulnerability model for interior damage due to water leaks through window seals and soffits. Previously the leak model was terminated at 115 mph. A modification was made to allow for a smooth exponential transition in the damage probability distribution functions for windspeeds above 115 mph (given in 5 mph increments). Reviewed the revised vulnerability matrices as a result of this update.

Reviewed table comparison of old and new vulnerability matrices for damage ratios by windspeed, first with an abridged table and then with the full table.

Reviewed graphical comparison of old and new vulnerability curves for 2 story, concrete block structures.

Discussed the assumptions made for the update to the membrane mitigation measure:

1. Interior damage can result from water penetration due to roof cover damage.
2. Better underlayment reduces water penetration from roof cover damage.
3. Unmitigated case is assumed to have #15 lb felt for the underlayment.
4. Mitigated case is assumed to have a membrane similar to SHARKSKIN ULTRA SA™.

Reviewed results of a second water barrier test against wind driven rain for an unmitigated roof with #15 lb felt and a mitigated roof with an extra membrane of the type SHARKSKIN ULTRA SA™.

Discussed implementation of the metal roof mitigation measure. Assumption made is that as long as the roof sheathing is not damaged, there will be no loss of roof cover. The fastening strength of the metal cover to the sheathing underneath is higher than the one between the sheathing and the trusses. The roof cover damage in the damage matrix is identical to the sheathing damage.

Discussed the definition of wind-borne debris regions in Florida. Reviewed maps comparing the change in the wind-borne debris regions updated in August 2008 from the previous regions defined in ASCE-7 1998.

G-2 Qualifications of Modeler Personnel and Consultants*

*(*Significant Revision)*

A. Model construction, testing, and evaluation shall be performed by modeler personnel or consultants who possess the necessary skills, formal education, and 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 under consideration will be reviewed. Signatories on the individual Forms will be required to provide a description of their review process.

3. Discuss any 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

The Professional Team will interview the individuals signing the Expert Certification Forms G-1 through G-7.

3. G-2, Disclosure 2.B, page 69: Provide the resumes of the new individuals (Sneh Gulati, Crisanto Dorado, Mario Madarang, Hsin Yu, Ronald Ocampo, Zifang Huang, Juan Duarte, Enzo Alvarez, Joseph Rivera, Gonzalo Pita, and Kasturi Chatterjee).

Verified: ~~**CONTINGENT UPON RECEIPT OF COMPLETED EXPERT CERTIFICATION FORMS**~~
YES

Professional Team Comments:

Completed Expert Certification Forms are required for verification.

Reviewed resumes of new personnel:

- Sneh Gulati, Ph.D., Statistics, University of South Carolina, Columbia, South Carolina; M.A., Mathematics, University of South Carolina, Columbia, South Carolina; B.A., Mathematics, St. Stephen's College, Delhi University, Delhi, India
- Cris Dorado, ACAS, Ph.D., Statistics, Florida State University, Tallahassee, Florida; M.S., Applied Probability and Statistics, Northern Illinois University, Dekalb, Illinois; B.S., Applied Mathematics, University of the Philippines, Los Baños, Laguna, Philippines
- Mario Madarang, B.S., Commerce, Accounting University of San Jose-Recoletos, Cebu City, Philippines
- Hsinyu Ha, Ph.D. candidate, School of Computing and Information Sciences, Florida International University, Miami, Florida; B.S., Information Management, Chang Gung University, Tao-Yuan, Taiwan
- Ronald Ocampo, B.S. candidate in Computer Science, Minor in Mathematical Sciences, Florida International University, Miami, Florida
- Zifang Huang, Ph.D. candidate, Department of Electrical and Computer Engineering, University of Miami, Coral Gables, Florida; M.S., Engineering, School of Automation Science & Electronic Engineering, BeiHang University, Beijing, China; B.S., Engineering, School of Automation Science & Electronic Engineering, BeiHang University, Beijing, China
- Juan Duarte, B.S. candidate in Computer Science, Florida International University, Miami, Florida
- Enzo Alvarez, B.S., Computer Engineering, New York Institute of Technology, New York, New York; B.S. candidate in Computer Science, Florida International University, Miami, Florida
- Joseph Rivera, B.S. candidate in Computer Science, Florida International University, Miami, Florida
- Gonzalo Pita, Ph.D. candidate, Department of Civil Engineering, Florida Institute of Technology, Melbourne, Florida; M.S., Structures & Geotechnics, National University of Córdoba, Argentina
- Kasturi Chatterjee, Ph.D. candidate, Computer Science, Florida International University, Miami, Florida; M.S., Computer Science, Florida International University, Miami, Florida; B.T., Computer Science, Institute of Engineering and Management, Kalyani University, Kolkata, India

Discussed with Gail Flannery her review of the Actuarial Standards and forms.

Discussed with Sneh Gulati her review of the Statistical Standards and forms.

Discussed with Shu-Ching Chen his review of the Computer Standards and the interaction with other modeling personnel for testing and verification of the computer code.

*****Additional Verification Review Comments*****

Reviewed updated Expert Certification Forms.

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.

3. The treatment of ZIP Code centroids over water or other uninhabitable terrain will be reviewed.

Pre-Visit Letter

4. G-3.A, page 73: Provide details of the process used to obtain, validate, and integrate the revised ZIP Codes.

5. G-3.A, page 73: The first sentence implies that MapInfo is used “primarily” while in Disclosure 1 the text suggests exclusively. Define “primarily.” Describe how the WBDR work impacts ZIP Code files.

6. G-3, Disclosure 2, page 74: The current list of valid ZIP Codes may be an update from the ZIP Codes represented in historical (circa 2004, 2005) claims and exposure data. Indicate the proportion of insurance claims data eliminated by not checking

against contemporary ZIP Code information. Describe the impacts of not modeling invalid ZIP Codes (relative to the current active list of valid ZIP Codes).

Information to be presented to the Professional Team:

- G-3.C, page 73 – Maps showing the ZIP Code boundaries and the associated centroids will be provided to the Professional Team during the on-site visit.

Verified: YES

Professional Team Comments:

Reviewed the process for updating and validating the ZIP Code database.

Discussed the ZIP Codes used in the model are provided "exclusively" rather than "primarily" from MapInfo.

Reviewed the number of claims data records and the amount of the claims removed from the validation set as a result of the 2008 ZIP Code database update:

- Company 1 – Hurricane Charley (2004) – 27 records dropped for a total of $291,174
- Company 1 – Hurricane Frances (2004) – 30 records dropped for a total of $0
- Company 2 – Hurricane Andrew (1992) – 9 records dropped for a total of $584,112
- Company 2 – Hurricane Erin (1995) – 122 records dropped for a total of $135,927

Reviewed maps of ZIP Code centroid movements. Verified no ZIP Code centroids occur over water.

G-4 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.

Audit

1. Demonstrate that the model components adequately portray hurricane phenomena and effects (damage, loss costs, and probable maximum loss levels). 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: ~~**NO**~~ **YES**
~~**Unable to verify pending verification of Standard A-10**~~

Professional Team Comments:

*****Additional Verification Review Comments*****

There was no evidence to suggest that one component of the model was artificially adjusted to compensate for another component.

G-5 Editorial Compliance*

*(*Significant Revision due to new Audit language)*

The submission and any revisions provided to the Commission throughout the review process shall be reviewed and edited by a person or persons with experience in reviewing technical documents who shall certify on Form G-7 that the submission has been personally reviewed.

Audit

1. Demonstrate that the person or persons who have reviewed the submission has had experience in reviewing technical documentation and such person or persons is familiar with the submission requirements as set forth in the Commission's *Report of Activities as of November 1, 2008*.

2. Describe all changes to the submission document since the prior year's submission that might impact the final document submission.

3. Demonstrate that the modeler submission has been reviewed for grammatical correctness, typographical accuracy, completeness, and inclusion of extraneous data or materials.

4. The modification history for submission documentation will be reviewed.

5. A flowchart defining the process for Form creation will be reviewed.

6. Form G-7 will be reviewed.

Pre-Visit Letter

The Professional Team will interview the individuals signing the Expert Certification Forms G-1 through G-7.

7. G-5, Audit item 5 from page 73 of Report of Activities: Provide the flowchart used for form creation.

Verified: ~~**NO**~~ **YES**
~~**Unable to verify pending verification of Standard A-10**~~

Professional Team Comments:

Reviewed flowchart describing generic submission form creation.

Discussed with Steve Cocke his process for editorial review.

Editorial items noted by the Professional Team were satisfactorily addressed during the audit. The revised pages list on pages 2-3 of this report are unlikely to capture all of the notational difficulties in the submission. The Professional Team has reviewed the submission per Audit item 3, but cannot guarantee that all editorial difficulties were identified. The modeler is responsible for eliminating such errors.

The Professional Team expressed concern that the Florida Hurricane Public Model's process for identifying and correcting editorial problems could be improved.

*****Additional Verification Review Comments*****

Reviewed updated Editorial Certification Form G-7.

Meteorological Standards – Jenni Evans, Leader

M-1 Base Hurricane Storm Set*

*(*Significant Revision)*

A. Annual frequencies used in the model and model validation shall be based upon the National Hurricane Center HURDAT starting at 1900 as of June 1, 2008 (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.

B. Any trends, weighting or partitioning shall be justified and consistent with currently accepted scientific literature and statistical techniques. Validation and comparison shall encompass the complete Base Hurricane Storm Set as well as any partitions.

Audit

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

2. Reasoning and justification underlying any modification by the modeler to the Base Hurricane Storm Set will be reviewed.

3. Reasoning and justification underlying any short-term and long-term variations in annual storm frequencies incorporated in the model will be reviewed.

4. Modeled probabilities will be 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.

5. Form M-1 will be reviewed for consistency with Form S-1.

6. Comparisons of modeled probabilities and characteristics from the complete historical record will be reviewed. Modeled probabilities from any subset, trend, or fitted function will be reviewed, compared, and justified against the complete historical record. In the case of partitioning, modeled probabilities from the partition and its complement will be reviewed and compared with the complete historical record.

Pre-Visit Letter

8. Form M-1, page 109: The report detailing counts will be reviewed.

Verified: YES

Professional Team Comments:

Verified that the June 2008 version of HURDAT for years 1900-2007 was incorporated for Florida and adjacent states. Reviewed Florida Public Hurricane Loss Model documentation detailing storm counts.

Reviewed results provided in Form M-1.

Reviewed storm totals from Form M-1 for consistency with Form S-1.

Discussed no adjustments for climate variations were made to the Base Hurricane Storm Set.

M-2 Hurricane Parameters and Characteristics

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

Audit

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

2. Prepare graphical depictions of hurricane parameters as used in the model. Describe and justify:
   - the data set basis for the fitted distributions,
   - the modeled dependencies among correlated parameters in the windfield 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 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.

5. All modeler cited scientific literature provided in Standard G-1 will be reviewed to determine applicability.

6. All external data sources that affect model generated windfields will be identified and their appropriateness will be reviewed.

7. Describe the value(s) of the far-field pressure used in the model and approximate its sensitivity on the average annual zero deductible statewide loss costs.

Pre-Visit Letter

9. M-2, Disclosure 11, page 93: Define exit relative to the change in intensity parameterization.

10. Form M-2, page 118: Discuss the results for Bay, Franklin, Wakulla, Hernando, and Citrus counties.

11. Form M-2.A, pages 117-118: Explain the increase in windspeeds for some areas compared to the previous submission.

Verified: YES

Professional Team Comments:

Verified no change in the land use land cover database in the current submission. However, adjustment to ZIP Code centroids required recalculation of roughness for new centroid locations.

Reviewed map of storm tracks for storms that changed in the base set.

Reviewed the windspeed increases in Form M-2 compared to the previous submission as a result of the change in the base storm set tracks and intensity, and the change in ZIP Code centroids.

Discussed the results provided in Form M-2 for Bay, Franklin, Wakulla, Hernando, and Citrus counties. Maximum winds in Bay county heavily affected by Hurricane Opal (1995) and Hurricane Eloise (1975). Citrus and Hernando counties heavily affected by Hurricane Easy (1950) and Hurricane Gladys (1968). Franklin county winds are higher due to centroids very close to the coast with very little roughness. Wakulla county centroids are much further inland and less impacted by storms.

M-3 Hurricane Probabilities

A. Modeled probability distributions of hurricane parameters and characteristics shall be consistent with historical hurricanes in the Atlantic basin.

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

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

3. 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.

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

Verified: YES

Professional Team Comments:

Reviewed the process for selecting stochastic storm tracks. Verified that all storms which are hurricanes are captured in the stochastic storm set.

Discussed the damage distance threshold developed to save computing resources where the windfield is not evaluated unless a hurricane passes within a distance from the coast at which damage might be possible. The damage distance threshold is a function of Rmax.

Reviewed the filter criteria for removing storms which have no impact on Florida. Reviewed the equation for Holland B and other parameters for determining if a by-passing hurricane would have damaging winds over Florida.

Documentation reviewed:

Powell, M.D., G. Soukup, S. Cocke, S. Gulati, N. Morisseau-Leroy, S. Hamid, N. Dorst, and L. Axe, 2005: State of Florida Hurricane Loss Projection Model: Atmospheric Science Component. *Journal of Wind Engineering and Industrial Aerodynamics*, 93, 651-674.

M-4 Hurricane Windfield Structure

A. Windfields generated by the model shall be consistent with observed historical storms affecting Florida.

B. The translation of land use and land cover or other source information to geographic surface roughness distribution shall be consistent with current state-of-the-science.

Audit

1. Provide any modeler-specific research performed to develop the windfield functions used in the model. Identify the databases used.

2. Provide any modeler-specific research performed to derive the roughness distributions for Florida and adjacent states.

3. The spatial distribution of surface roughness used in the model will be reviewed.

4. Identify other variables in the model that affect over-land surface windspeed estimation.

5. Provide detailed comparisons of the model windfield with Hurricane Charley (2004), Hurricane Katrina (2005), and Hurricane Wilma (2005).

6. For windfield and/or pressure distributions not previously reviewed, the modeler will present time-based contour animations (capable of being paused) to demonstrate scientifically reasonable windfield characteristics.

7. Form M-2 will be reviewed.

Verified: YES

Professional Team Comments:

Reviewed the results provided in Form M-2.

Discussed relative locations of maximum winds between 100 year and 250 year return periods.

Discussed the small differences in open and actual terrain winds for maximum values at the coast.

M-5 Landfall and Over-Land Weakening Methodologies

A. The magnitude of land friction coefficients shall incorporate current geographic surface roughness distributions and shall be implemented with appropriate geographic information system data.

B. The hurricane over-land weakening rate methodology used by the model shall be consistent with historical records.

C. Models shall use maximum one-minute sustained 10-meter windspeed 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 windspeed shall be within the range of windspeeds (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

1. Describe the variation in over-land decay rates used in the model.
2. Comparisons of the model's weakening rates to weakening rates for historical Florida hurricanes will be reviewed.
3. Transition of winds from over-water to over-land (i.e., landfall) will be reviewed.

Pre-Visit Letter

12. M-5, Disclosure 1, page 103: Discuss the variation of B and Rmax after landfall.
13. M-5, Disclosure 3, page 106: Discuss any minimum or maximum values used for roughness.

Verified: YES

Professional Team Comments:

Discussed the variation of Holland B and Rmax after landfall. Discussed that both of these vary weakly with *DelP*, so will change as the storm weakens over land.

Discussed that the distribution difference for Rmax between Category 5 and weaker storms will result in an Rmax increase for landfalling Category 5 storms as they weaken. Discussed the validation of this effect compared to historical storms.

Discussed the minimum values used for roughness. For each ZIP Code centroid, a minimum roughness equivalent to that of a low density residential neighborhood is used within 50 km of the centroid over land. The local roughness minimum is applied before computing the effective roughness.

Verified the transition of the boundary layer depth at landfall is instantaneous.

Reviewed H*Wind plots of Hurricane Frances (2004) at 15 and 18 hours after landfall and discussed maximum winds offshore prior to center exiting land. Discussed that this effect was captured in the stochastic storm set.

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 mean windspeed 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

14. Form M-3, page 121: Explain how the Form S-6 track files are suitable for this Form.

15. Form M-3, page 122: Clarify the interpretation of the two sets of ranges given for each wind threshold and pressure band.

16. Form M-3, pages 122-123: Justify the upper bound for Rmax in Figure 26 as it relates to the table.

Verified: YES

Professional Team Comments:

Reviewed revised Form M-3 reverting to the form provided in the previous submission except for units now given in miles. Reviewed the reason for adjustments in histograms resulting from unit conversions and new data used in that figure.

Reviewed revised description of figures in Form M-3 to clarify different datasets used for figures and table in the form.

VULNERABILITY STANDARDS – Masoud Zadeh, 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, and 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 justified.

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

G. The minimum windspeed that generates damage shall be reasonable.

Audit

1. Historical data shall 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 shall be available for review.

2. Copies of any papers, reports, and studies used in the development of the vulnerability functions shall 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 shall be available. The magnitude of logical changes among these items for a given windspeed shall be explained and validation materials shall 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. If age of building is used as a surrogate for building code and code enforcement, provide complete supporting information for the number of age groups used as well as the year(s) of construction that separates particular group(s).

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

7. The effects on building vulnerability from local construction characteristics and building codes will be reviewed.

8. Form V-1 will be reviewed.

Pre-Visit Letter

From preamble: Provide for the Professional Team's review, all engineering data (post event surveys, tests, etc.) received since 2005. Describe any processes used to amend or validate the model that incorporates this engineering data. Describe any processes used to amend or validate the model that incorporates insurance company claims data covering the 2004 and 2005 hurricane seasons, especially processes used since the prior visit by the Professional Team.

17. V-1, Disclosure 5, page 138: Demonstrate the complete process, including all input data and assumptions, necessary to develop an individual vulnerability matrix for a site built home.

18. V-1, Disclosure 6, page 139 (new this year): Discuss in detail how the model considers regional variations in construction and building codes. Describe the process of examining the building code revisions and enforcement and their impact on the vulnerability model, including Florida Building Code Revisions 2001, 2004, and their supplements/amendments.

ISSUE:
Describe how the model incorporates number of stories in the vulnerability functions.

Verified: YES

Professional Team Comments:

Reviewed results from Damage Study of 2004 Florida hurricane season conducted in 2005 and presented to the Florida Building Commission in 2006. The results of the study were not used to calibrate the model, but were used for validation purposes.

Reviewed sample individual field survey files and photos for homes in Pensacola and Port Charlotte from the post 2004 hurricane field surveys.

Reviewed the methodology for the 2004 damage study used to determine if the 2002 Florida Building Code change reduced the vulnerability of residential single family homes. The study randomly selected homes within the age groups of 1994 to 2001 and 2002 to 2004 across wind swath contours for Hurricane Charley (2004), Hurricane Frances (2004), Hurricane Ivan (2004), and Hurricane Jeanne (2004). Reviewed graphic of 126 surveyed homes after Hurricane Charley (2004) plotted on a wind swath map. Reviewed plot of shingle roof cover damage by year built from the 2004 Damage Study of Hurricane Charley (2004).

Discussed the application of the 2004 Damage Study. The observable differences in component damage as a function of year built led to the development of the weak/medium/strong model concept.

Reviewed validation of roof cover and sheathing damage. Reviewed curves for the weak model and the strong model comparing roof cover and sheathing damage with data for homes built in the periods of 1994 to 2001 and 2002 to 2004.

Reviewed aerial photos of roof cover damage from Hurricane Katrina (2005) on the Mississippi coast used for validation of the weak and strong model. Reviewed classification examples used to categorize the percentage of damage. Reviewed statistical results for roof cover loss based upon 461 samples over a 2-mile stretch near the Mississippi coast, but outside the storm surge impacted area.

Discussed how the model incorporates numbers of stories in the vulnerability functions. Separate vulnerability functions are created for 1 and 2 story houses.

Discussed on-going research not yet incorporated in the model:

- Roof cover damage from Hurricane Ike (2008) and Hurricane Gustav (2008)
- Glass vulnerability testing at University of Florida on shingles and dowels
- Shutter vulnerability testing at University of Florida on tile impact on code approved shutter systems
- Sheathing testing at University of Florida on capacity of sheathing with different nailing schedules
- Wind driven rain water intrusion through soffits and windows experiments

Reviewed the process for developing damage matrices. Reviewed table of the distribution of the nine building types for Florida residential construction for Central, North, and South regions.

Discussed modifications and reduction factors applied to the code pressure coefficients based on results from wind-tunnel tests.

Reviewed table of differences among the weak, medium, and strong vulnerability models. Reviewed mapping of building strength to year built.

Reviewed basis and composition of the matrices used to develop vulnerability functions related to structure type and region.

Reviewed example of a damage matrix used to develop the vulnerability function for a concrete block home in south Florida.

Discussed separate vulnerability functions for appurtenant structures and the differences between buildings and appurtenant structures.

It was noted that there were inconsistencies in the submission as to the number of damage matrices for site built homes in the model on pages 31 and 138. These pages were subsequently revised.

It was noted that Table 4 on page 33 and Table 13 on page 139 indicate the same vulnerability models for the periods 1970 to 1983 and 1984 to 1993. These tables were subsequently revised to include one period from 1970 to 1993.

It was noted that Figure 8 on page 34 depicted vulnerability models from older version of model. This figure and page was subsequently revised.

Discussed the relationship between structure damage and content damage as given in Figure 37 on page 183 and supporting data. This figure and the related text was subsequently revised.

Discussed the vulnerability matrices for site built homes specific to each Monte Carlo model (36 models) plus the additional considerations for each to yield a total of 504 vulnerability matrices. Discussed that these 504 matrices were ultimately consolidated into 72 vulnerability matrices for efficiency.

Discussed the evolution of the Florida Building Code, building practice, and code enforcement over time. Discussed how the model reflects different eras in building code development and practice through the use of the 3 sets of models (weak, medium, and strong), the 3 regions (north, south, central), and the construction characteristics for wood/masonry and hip/gable. Discussed reasons for revisions to the Florida Building Code not used to refine the model.

Reviewed revised Figure 29 (page 131) of contents losses from Hurricane Andrew (1992) claims data.

Reviewed base structure vulnerability curves used to complete Form V-1.
Documentation reviewed:

- Post 2004 Hurricane Field Survey – an Evaluation of the Relative Performance of the Standard Building Code and the Florida Building Code, Structures Research Communication No. 53102-2, UF Project No. 00053102 Final Report, March 2006
- Post Disaster Investigation Manual for Hurricanes, Institute for Business & Home Safety, May 5, 2006

V-2 Mitigation Measures

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 empirically justified both individually and in combination.

Audit

1. Forms V-2 and V-3 provide the information used in auditing this Standard.

2. Individual mitigation measures as well as their effect on damage due to use of multiple mitigation measures will be reviewed. Any variation in the change over the range of windspeeds for individual and multiple mitigation measures will be reviewed.

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

When the Professional Team arrives on-site, provide the electronic file used to complete Form V-3 on a removable drive medium. This material will be used during the on-site review and will be returned when the on-site review is complete.

19. Form V-2, page 151: Explain the negative values.

ISSUE:

Discuss the development and application of mitigation credits for various parts of the state, by region (North, Central and South), and by proximity to water (Coastal and Inland) as defined in Form A-7. Expansion to structure types that resemble the actual Florida building stock is desired.

Verified: YES

Professional Team Comments:

Reviewed the results of a study on the analyses, costs benefits, and combinations of various mitigation measures across the state. Reviewed table of four basic sets of mitigation measures. Reviewed the sources used for cost estimation. Reviewed summary of cost estimates for a gable roof wood home. Reviewed cost ratios of mitigation for a gable roof wood home for each region. Reviewed vulnerability curves for a weak wood frame home in the south region with mitigated vulnerabilities.

Discussed how the study allows the benefit over cost ratio of any particular mitigation set to be investigated for any ZIP Code in the state of Florida. Reviewed maps depicting the benefit of costs for different mitigation sets for different ZIP Codes in Florida.

Discussed the results provided in Form V-2. Negative values were attributed to rounding off of smaller values within the uncertainty scatter of the model indicating zero change. For roof deck, the negative values were attributable to the counterproductive influence of strengthening the roof deck without strengthening the roof connections.

Reviewed Form V-3 and confirmed consistency with Form V-2.

ACTUARIAL STANDARDS – Marty Simons, Leader

A-1 Modeled Loss Costs and Probable Maximum Loss Levels*

*(*Significant Revision)*

Modeled loss costs and probable maximum loss levels shall reflect all insured wind related damages from storms that reach hurricane strength and produce minimum damaging windspeeds 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

20. A-1, Disclosures 2 & 3, page 159 (new this year): Provide all analyses performed relating to the effects of "preceding flood or storm surge" as well as the effects of hurricanes on structure that have been weakened or destroyed by flood or storm surge. Provide justification for the way these effects are incorporated in the model.

Verified: YES

Professional Team Comments:

Verified no change in the definition of an event or a by-passing storm.

Reviewed the process and filter criteria for selecting by-passing storms.

Discussed that the effects of "preceding flood or storm surge" are not incorporated into the model.

Dr. Mark Powell presented an overview of current research by NOAA and Florida State University on wind versus storm surge focusing on Hurricane Ike (2008) and Hurricane Dennis (2005). Reviewed plots of water level time series for several stations and the corresponding windfield plots.

Discussed the potential for shelf waves to result in inundation far from landfall. Discussed Hurricane Dennis (2005) as an example of this type of event.

A-2 Underwriting Assumptions*

*(*Significant Revision)*

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 and probable maximum loss level 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 appropriate.

Audit

1. 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" or claim practices of insurers with respect to concurrent causation.

Pre-Visit Letter

21. A-2.A, page 161: Provide a detailed description of the process used to map the claims data to the model criteria as described in the first paragraph under "Adjustments."

22. A-2, Disclosure 2, page 162: Provide a detailed description of the option noted, including data used, calculations performed, and process of disclosing whether the option is activated.

Verified: YES

Professional Team Comments:

Reviewed the mapping process for the claims data validation sets. Discussed communications with companies through the Office of Insurance Regulation on clarification of the claims data.

Discussed the post-conversion testing performed and the treatment of ZIP Codes deemed invalid.

Discussed company claims paying practices for ALE claims based on time limit rather than dollar limit.

Discussed the model option for converting damage in excess of 50% to total 100% loss. Discussed that the option was included during model development based on anecdotal evidence but is manually turned off and has not been used.

Discussed the Commission requirement that the model output report should reflect all options and should document which options are used.

A-3 Loss Cost Projections and Probable Maximum Loss Levels*

*(*Significant Revision)*

A. Loss cost projections and probable maximum loss levels 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 and probable maximum loss levels shall not make a prospective provision for economic inflation.

C. Loss cost projections and probable maximum loss levels shall not include any provision for direct hurricane storm surge losses.

Audit

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

Verified: YES

Professional Team Comments:

Verified modeled loss costs do not include expenses, risk load, investment income, premium reserves, taxes, assessments, or profit margin, and the model does not make a prospective provision for economic inflation.

A-4 Demand Surge*

*(*Significant Revision)*

A. Demand surge shall be included in the model's calculation of loss costs and probable maximum loss levels using relevant data.

B. The methods, data, and assumptions used in the estimation of demand surge shall be actuarially sound.

Audit

1. Provide the data and methods used to incorporate individual aspects of demand surge on each coverage type, inclusive of the effects from building material costs, labor costs, contents costs, repair time, etc.

2. All referenced literature will be reviewed to determine applicability.

Pre-Visit Letter

Describe how the model determines the magnitude of demand surge to include in the calculation of loss costs and probable maximum loss levels.

Verified: YES

Professional Team Comments:

Verified no change in the methodology for demand surge calculations from the previous submission.

Discussed the dataset and calculations used to determine demand surge losses.

A-5 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 shall 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.

Pre-Visit Letter

Demonstrate that output reports produced by a user of the model reveal the values of all user inputs and selections used to run the model.

Verified: YES

Professional Team Comments:

Discussed that all user inputs and selections used to run the model should be provided on the model output reports.

A-6 Logical Relationship to Risk*

*(*Significant Revision due to new Form)*

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 the quality of construction type, materials and workmanship increases, all other factors held constant.

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

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

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

G. 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, and A-5 will be used to assess coverage relationships.

Pre-Visit Letter

23. A-6, Disclosure 1, page 175: Provide analyses performed to determine that the relationships among coverages (A, B, C, D) are reasonable.

24. A-6, Disclosure 1, pages 175-177: Provide the data underlying Figures 33-36 in spreadsheet form (Excel).

25. A-6, Disclosure 1, page 177: Define the data points with large Modeled APP values and zero actual APP losses in Figure 36.

26. Form A-2, page 191: Discuss the spatial distribution of losses with reference to Form M-2 (page 118).

27. Form A-5, page 211: Two interior ZIP Codes in Okaloosa County are 2%-5% bracketed to the south by <0.1% and to the north by 0.2-5%. Explain these results.

Verified: ~~**NO**~~ **YES**
~~**Unable to verify pending verification of Standard A-10 as well as revision of Form A-2**~~

Professional Team Comments:

Discussed the spatial distribution of losses depicted in Form A-2 in comparison to the maximum windspeeds given in Form M-2. The modeler will provide information reconciling the differences between these two disclosure items.

Discussed the analyses performed by the engineers to determine the reasonability of the model's relationships among coverage loss costs.

Reviewed the Excel spreadsheet with the underlying data for the comparisons of modeled versus actual losses for structure, content, ALE, and appurtenant structures.

Reviewed the results provided in Figure 36 (page 177) for the modeled appurtenant structure losses. Appurtenant structure and structure losses were combined in the loss data provided by one company, but not combined for the modeled losses. The modeled losses for appurtenant structures and structures were combined for comparability and a revised graph was reproduced and reviewed.

Discussed the distribution of Hurricane Ivan (2004) losses in Okaloosa County shown in Figure 44 (page 211).

Discussed the contradiction in the response provided to part D of the Standard on page 174. A revised response was reviewed.

*****Additional Verification Review Comments*****

Reviewed revised Form A-2 corrected to show loss costs by ZIP Code rather than by county.

A-7 Deductibles and Policy Limits

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

1. Describe the process used to determine the accuracy of the insurance-to-value criteria in data used to develop or validate the model results.

2. The actuary for the modeler may be asked to attest to the actuarial soundness of the procedure for handling deductibles and policy limits.

3. 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.
4. Justify changes from the prior submission in the relativities among corresponding deductible amounts for the same coverage.

Verified: YES

Professional Team Comments:

Verified no change in the process for calculating and applying deductibles and policy limits. Deductible calculations are in compliance with s. 627.701(5)(a), F.S.

A-8 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

1. The actuary for the modeler may be asked to attest to the actuarial soundness of the procedure for calculating loss costs for contents coverage.

2. 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.

3. 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:

Verified no change in calculation methods for contents loss costs from previous submission.

Discussed the relationship between structure and content damage ratios. Reviewed a revised Figure 37 (page 183) of Hurricane Andrew (1992) claims data and modeled results showing the relationship between structure and content damage ratios for Hurricane Andrew (1992).

A-9 Additional Living Expense (ALE)

A. The methods used in the development of 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 (1992);
    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:

Verified no change in calculation methods for ALE loss costs from previous submission.

Discussed that ALE claims are time-limited (per insurance company practice).

A-10 Output Ranges

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

B. All other factors held constant, output ranges produced by the model shall reflect lower loss costs for:

1. masonry construction versus frame construction,

2. residential risk exposure versus mobile home risk exposure,

3. in general, inland counties versus coastal counties, and

4. in general, northern counties versus southern counties.

Audit

1. Forms A-6, A-7, and A-8 will be reviewed.

2. The modeler will be required to justify all changes from the prior submission using the 2007 Florida Hurricane Catastrophe Fund aggregate exposure data.

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

Provide an explanation for each loss cost change of more than 5% from the loss costs produced in the previous submission using the 2007 Florida Hurricane Catastrophe Fund (FHCF) exposure data to the corresponding loss costs produced in the current submission.

28. Form A-8, pages 217-224: The patchwork quilt pattern (i.e., lack of spatial pattern) should be attributable to the changes made in the model from the previous submission. Explain this apparent random distribution of changes.

Verified: ~~**NO**~~ **YES**

Professional Team Comments:

Discovered that Form A-6 was not completed using the FHCF exposure data in accordance with Report of Activities instructions. A re-run of the output ranges is necessitated.

Reviewed spreadsheet of 2% deductible owners frame loss costs showing the loss cost percentage changes by county for each model update, 1) HURDAT update and sampling error, 2) vulnerability matrices regenerated, 3) ZIP Codes/windborne debris region, 4) change in roughness due to ZIP Code centroid shifts, and 5) unidentified interaction. In light of the likely production of revised output ranges, modeler was unwilling to speculate on the nature of the "unidentified interaction" in counties where this was a significant component of the overall change from last year. "Unidentified interaction" will be discussed based on the revised output ranges.

Discussed the results shown in the Form A-8 maps (pages 218-224) being attributed to the change in roughness values.

*****Additional Verification Review Comments*****

Reviewed handling of exposure data for Forms A-6, A-7, and A-8.

Reviewed the method for calculating the loss costs in Form A-6.

Reviewed examples where FHCF masonry loss costs were lower than FHCF frame loss costs.

Reviewed percentage changes by county in Form A-8. Discussed the interaction between the HURDAT update and the change in roughness due to ZIP Code centroid shifts.

A-11 Probable Maximum Loss*

*(*New Standard)*

The methods, data, and assumptions used in the estimation of probable maximum loss levels shall be actuarially sound.

Audit

1. Provide the data and methods used for probable maximum loss levels for Form A-9.

2. All referenced literature will be reviewed to determine applicability.

3. The actuary for the modeler may be asked to attest to the actuarial soundness of the procedures used for calculating probable maximum loss levels.

Pre-Visit Letter

Provide and describe all studies performed to determine whether the model meets the "probable maximum loss" requirements added to the standards in the 2008 Report of Activities (Standard A-11 and several other standards and forms).

Verified: YES

Professional Team Comments:

Reviewed and discussed the methodology for producing probable maximum loss estimates.

Reviewed the Excel spreadsheet of modeled losses by year that underlies Form A-9.

Documentation reviewed:

- Conover, W.J., excerpts from *Practical Nonparametric Statistics*
- Wilkinson, Margaret E., *Estimating Probable Maximum Loss with Order Statistics*, Casualty Actuarial Society, 1982 Discussion Papers on Pricing, Underwriting and Managing Large Risk
- Reiss, R.D., excerpts from *Approximate Distributions of Order Statistics with Applications to Nonparametric Statistics*

STATISTICAL STANDARDS – Mark Johnson, Leader

S-1 Modeled Results and Goodness-of-Fit*

*(*Significant Revision due to new Form and Audit language)*

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 in the appropriate disciplines.

Audit

1. Forms S-1, S-2, and S-3 will be reviewed. Provide justification for the distributions selected including, for example, citations to published literature or analyses of specific historical data.

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

Pre-Visit Letter

29. S-1, Disclosure 3, pages 238-239: Discuss the interpretation of the asymmetry between the model-based versus H*WIND-based threshold error calculations in Tables 18 and 19.

30. S-1, Disclosure 4, page 241: Clarify the absence of 2005 storm data.

Verified: YES

Professional Team Comments:

Reviewed plot of modeled maximum windspeeds overlaid on swath of observed contours for Hurricane Andrew (1992) and plot of H*Wind observed windspeeds overlaid on swath of the modeled Hurricane Andrew (1992) windfield. Discussed spatial distribution of differences.

Discussed 2005 storm data not available to be included in current validation studies. Discussed the plan for analyzing and incorporating 2005 storm data in the validation studies when the data is received.

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 in the appropriate disciplines 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-6 will be reviewed for models submitted by modeling organizations which have not previously provided the Commission with this analysis.

Verified: YES

Professional Team Comments:

The model updates did not necessitate an update to Form S-6. Verified no new sensitivity tests were performed since the previous submission.

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 in the appropriate disciplines 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-6 will be reviewed for models submitted by modeling organizations which have not previously provided the Commission with this analysis.

Verified: YES

Professional Team Comments:

The model updates did not necessitate an update to Form S-6. Verified no new uncertainty tests were performed since the previous submission.

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

1. 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 graphs of percentage of the loss cost estimate versus number of simulation years for Jefferson County and Nassau County.

Reviewed spreadsheet of average loss, standard deviation, and coefficient of variation by county in assessing convergence.

S-5 Replication of Known Hurricane Losses

The model shall estimate 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 windfield applied to a particular hurricane for the purpose of validation and the windfield used in the model under consideration,
   h. The type of property used in each hurricane to address:
      1. Personal versus commercial
      2. Residential structures
      3. Mobile homes
      4. Condominiums
      5. Structures only
      6. 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-4 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:

Discussed that a few isolated company claims data records and claim amounts were eliminated from the validation study dataset. Reviewed revised actual loss values provided in Table 21 (page 255) with the claims removed.

Reviewed paired t-test analysis between actual and modeled losses and other assessments of the agreement.

Reviewed validation comparisons provided in Form S-4.

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-5 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 windfield, 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

Professional Team Comments:

Reviewed values in Form S-5.

COMPUTER STANDARDS – Paul Fishwick, Leader

Trade Secret Information to be presented to the Professional Team (page 4):

- The source code for the loss model will be available for review by the Professional Team.

C-1 Documentation*

*(*Significant Revision)*

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. The modeler shall maintain (1) a table of all changes in the model from the prior year's submission to the initial submission this year and (2) a table of all substantive changes since this year's initial submission.

D. 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, verification) 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.

6. The tables specified in C-1.C that contain the items listed in Standard G-1, Disclosure 5 will be reviewed. The tables shall contain the item number in the first column. The remaining five columns shall contain specific document or file references for affected components or data relating to the following Computer Standards: C-2, C-3, C-4, C-5, and C-6.

7. Trace the model changes specified in Standard G-1, Disclosure 5 through all Computer Standards.

Pre-Visit Letter

31. C-1.C, page 265: Relate the table of contents with the response to Standard G-1, Disclosure 5 on pages 63-64 by demonstrating individual table item compliance with the Computer Standards C-1 through C-7.

Verified: YES

Professional Team Comments:

Reviewed the Florida Public Hurricane Loss Model Version 3.1 Primary Document Binder, including:

- FPHLM Architecture
- Storm Forecast Module
- Windfield Module
- Damage Estimation Module
- Insurance Estimation Module
- Database Document
- Quality Assurance
- Security
- System Hardware & Software Configuration
- Testing Team Training Plan
- Probable Maximum Loss Calculation

Reviewed the table of changes in the model from the previous year's submission:

- HURDAT update
- 2008 ZIP Code centroids update
- Leak model update
- Mitigation measures update
- Windborne debris region update

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

1. 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.

Verified: YES

Professional Team Comments:

Reviewed requirements for the software based on a change list from the modeler's response to Standard G-1, Disclosure 5 and Standard C-6.

Reviewed requirements associated with automated form generation.

Reviewed the new requirements for the model changes from the previous submission and listed in Standard G-1, Disclosure 5 of the modeler's submission.

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, shall be available for the review of each component.

Information to be presented to the Professional Team:

- C-3, page 267 – These documents will be made available to the Professional Team during the site visit.

Verified: YES

Professional Team Comments:

Discussed the automated process for completing Form A-3 and Form A-6. Reviewed the flowcharts for generating Form A-3 and Form A-6. Discussed the inputs used to generate these forms.

Reviewed the flowcharts for probable maximum loss calculation to generate Form A-9, Parts A and B.

Reviewed a flowchart for the generation of the vulnerability curves.

Reviewed a flowchart for manufactured home vulnerability damage.

Reviewed a class diagram for vulnerability damage matrix generation.

*****Additional Verification Review Comments*****

Reviewed flowchart of processing exposure data for Form A-6.

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.

F. The modeler shall maintain the following documentation for all components or data modified by items identified in Standard G-1, Disclosure 5:

1. A list of all equations and formulas used in documentation of the model with definitions of all terms and variables.

2. A cross-referenced list of implementation source code terms and variable names corresponding to items within F.1.

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:
    a. component name,
    b. date created,
    c. dates modified and by whom,
    d. purpose or function of the component, and
    e. 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.

Information to be presented to the Professional Team:

- C-4.D, page 268 – The table is available for review by the professional team.

Verified: ~~**NO**~~ **YES**
~~**Unable to verify pending verification of Standard A-10**~~

Professional Team Comments:

Reviewed the change in the code for implementation of the leak model to a gradual transition for windspeeds above 115 mph at 5 mph increments.

Reviewed a table of variables and equations relating to the updated leak model.

Reviewed the code change for the vulnerability factor and corresponding exponential smoothing, when windspeed exceeds 115 mph.

Reviewed MATLAB implementation of the vulnerability damage curves. The implementation performed the following steps: 1) calculation of the average cost of new homes, 2) determination of replacement ratios, and 3) creation of the vulnerability matrices.

Reviewed the C++ implementation of the probable maximum loss calculation.

Reviewed the code metrics table reflecting changes to the model from the previous submission.

*****Additional Verification Review Comments*****

Reviewed code for processing exposure data for Form A-6.

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. Verification procedures shall include tests performed by modeler personnel other than the original component developers.

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 including compliance with independence of the verification procedures.

Verified: ~~**NO**~~ **YES**
~~**Unable to verify pending verification of Standard A-10**~~

Professional Team Comments:

Reviewed Excel-based verification checks on the model changes associated with changes in ZIP Code centroids, HURDAT update, and vulnerability matrix calculations.

Verified that the modeler performed a cross-check between Excel and C++ implementations associated with the probable maximum loss calculation.

Verified that regression and unit tests were performed for Florida Public Hurricane Loss Model Version 3.1.

Reviewed verification methods relating to the changes in the model, including domain expert visual inspections, statistical validations, and calculation cross-checks.

*****Additional Verification Review Comments*****

Reviewed Form A-6 unit and aggregation testing.

C-6 Model Maintenance and Revision*

*(*Significant 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.

D. The modeler shall maintain a list of all model versions since the initial submission for this year. Each model description shall have a unique version identification, and a list of additions, deletions, and changes that define that version.

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 shall 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.

4. The list of all model revisions as specified in C-6.D will be reviewed.

Information to be presented to the Professional Team:

- C-6.1, page 274 – The detailed information will be made available to the Professional Team during its site visit.

Pre-Visit Letter

32. C-6.D, page 273: Provide the model version history leading up to the version identified in the submission.

Verified: YES

Professional Team Comments:

Reviewed the model version history leading to the current Version 3.1.

Reviewed the policy for model revision.

Reviewed the table listing the changes from the previous submission.

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.

Verified: YES

Professional Team Comments:

Verified no change to the security procedures since the previous submission.