Recommended Edits to the 12-22-14 Draft Vulnerability Flood Standards

Flood Standards Development Committee Meeting

March 31, 2015

VF-1, Derivation of Residential Structure Flood Vulnerability Functions

<mark>Standard</mark>

Professional Team: **Technical**

Explanation: Flood and building characteristics separated as there are so many. List of important building characteristics revised and expanded. Mold consideration added. Moved contents from VF-2 as in the NFIP and the residential flood world, it is common to lump structure and contents together.

Amendatory/Suggested Language:

VF-1 Derivation of Residential Structure and Contents Flood Vulnerability Functions

A. DevelopmentSpecification of the residential structure and contents flood vulnerability functions shall be based on at least onea combination of the following: (1) historical data, (2) tests, (3) rational structural analysis, and (24) post-flood site inspections, (3) technical literature, (4) expert opinion, (5) physical testing, and (6) insurance claims data. AllAny development of the residential structure flood vulnerability functions based on rational structural analysis, site inspections, and tests shall be supported by historical data.

B. The method of derivation of the residential structure flood vulnerability functions and their associated uncertainties shall be theoretically sound and consistent with fundamental engineering principles.

D. The following flood and building characteristics shall be used in the derivation of rResidential structure and contents flood vulnerability functions:

   1. Flood Characteristics: flood elevation and depth above ground, flood velocity, wave action (in coastal areas), flood-induced erosion, flood-borne debris, salinity (saltwater versus freshwater flooding), flood duration, likelihood of mold following flooding.

   2. Building Characteristics: foundation type, lowest floor elevation relative to ground, number of stories and use of each story (e.g., habitable space, parking, storage, other), presence of basement, market value of building, structure and contents value by story, primary construction materials, height/number of stories, year of construction, location (flood hazard zone), building code in effect at time of construction, square footage of living area, and other construction characteristics, as applicable, shall be used in the derivation and application of residential structure flood vulnerability functions.

F. The relationship between the modeled residential structure and contents flood vulnerability functions and historical residential structure and contents losses shall be reasonable. (moved from VF-2.B)

G. Where a building is subject to both flood and wind effects, the combined flood and wind losses cannot exceed the value of the structure and contents.

F. Residential structure flood vulnerability functions shall include damage as attributable to still flood water height, duration of the flood event (time needed for flood waters to recede), flood water velocity, wave action, impact of flood debris, and flood erosion and scour.

AIR: **Technical**

Problem Statement: In Standard VF-1.A, the last sentence currently mandates the development of the residential structure vulnerability functions to be supported by the historical data, which is hard to accomplished because there can be POTENTIALLY NO DETAILED FLOOD CLAIMS DATA, so we suggest to re-word the sentence to allow modelers to use other methodologies for the development. As this data becomes available over time, future versions of the ROA can mandate the use of historical claims data.

Explanation: This is a general edit. We suggest updating the last sentence to allow modelers to use other methodologies when historical data is not available.

Amendatory Language:

A. Development of the residential structure flood vulnerability functions shall be based on at least one of the following: (1) historical data, (2) tests, (3) rational structural analysis, and (4) site inspections. Any development of the residential structure flood vulnerability functions based on rational structural analysis, site inspections, and tests shall be supported by historical data Historical data, as applicable, shall be considered for development of the residential structure flood vulnerability functions.

AIR: **Technical**

Problem Statement: Standard VF-1.F currently requires structure vulnerability functions to include numerous specific flood attributes. We believe the current standard is too prescriptive. The modelers will use their own scientific judgment in selecting the appropriate parameters, and the Commission's meteorological, hydrological and other experts will evaluate the methods. The simpler language of the suggested edit will allow the Commission to do this. Additionally, the standards should foster and encourage the use of various loss projections methodologies, including simpler but more robust methods that may be necessary to be supported by the data available.

Explanation: This suggestion is general in nature. We suggest updating the standard to allow flexibility in model development depending on the available data.

Amendatory Language:

F. Residential structure flood vulnerability functions shall includeconsider damage as attributable to relevant flood characteristics still flood water height, duration of the flood event (time needed for flood waters to recede), flood water velocity, wave action, impact of flood debris, and flood erosion and scour.

Professional Team: **Technical**

The development of rResidential structure and contents flood vulnerability functions shall not be based exclusively on rational structural analysis or site inspections are to account for both flood and building characteristics. This standard requires the development of residential flood vulnerability functions to be based on at least two procedures, both of which are supported by historical data. Use of rational structural analysis or site inspections shall be supported by tests and historical data, and their use shall be appropriate.

The development of residential structure flood vulnerability functions shall are to be documented with respect to the methods and sources, including any use of insurance claims data, structural analysis and calculations, post-flood and site inspections, technical literature, expert opinion, and technical literature. Flood vulnerability functions are to be supported by historical data.

Building codes and their enforcement affect the residential structure flood vulnerability functions.

This standard allows iinsurance company data used in residential structure flood vulnerability function development may to include appropriate insurer or modeling organization adjustments that do not diminish the usefulness of the data.

    Relevant Forms: GF-4,   Vulnerability Flood Standards Structural/Wind Hydraulic/Coastal Engineer Expert Certification
                         VF-1,   One XXX Hypothetical Flood Events
                         AF-6,   Logical Relationship to Flood Risk (Trade Secret item)

AIR: **Technical**

Problem Statement: The first paragraph currently requires vulnerability functions to be developed with the support of the historical data. This is problematic because there can be POTENTIALLY NO DETAILED FLOOD CLAIMS DATA.

Explanation: This is a general edit. We believe removing the first paragraph is necessary to allow modelers to develop vulnerability functions with alternative methodologies when historical data is not available.

Amendatory Language:

The development of residential structure flood vulnerability functions shall not be based exclusively on rational structural analysis or site inspections. Use of rational structural analysis or site inspections shall be supported by tests and historical data, and their use shall be appropriate.

The development of residential structure flood vulnerability functions shall be documented with respect to the methods and sources, including data, structural analysis and calculations, and site inspections.

Problem Statement: This paragraph is problematic because the existing building codes are mostly wind-oriented and do not currently contain provisions for flood. Instead of building codes, regulations and

recommendations provided by FEMA are more relevant because they are often part of the local flood plain management strategies.

Explanation: This change is a technical update. We recommend changing the requirement on building codes and their enforcement to FEMA flood management regulations which is more relevant in this context.

Amendatory Language:

~~Building codes and their enforcement affect the residential structure flood vulnerability functions~~Flood management regulations such as FEMA recommendations shall be considered in residential structure flood vulnerability development.

Professional Team: **Technical**

Explanation: In addition to the explanation provided under the Standard, a requirement has been added to disclose how wind and flood losses are combined as they cannot exceed the value of the structure and contents.

Amendatory/Suggested Language:

1. Provide ~~a~~ flow chart**s** documenting the process by which the residential structure and contents flood vulnerability functions are derived and implemented.

2. Describe the nature and extent of actual insurance claims data used to develop the flood model's residential structure and contents flood vulnerability functions. Describe in detail what is included, such as, number of policies, number of insurers, date of loss, and number of units of dollar exposure, separated into personal residential and mobile home.

3. Describe the research, data, methods, and processes used for the development of the residential structure ~~structure~~ flood vulnerability functions.

4. Describe the relationship between residential structure and contents flood vulnerability functions. (moved from VF-2, Disclosure 8)

~~4.~~5. Summarize site inspections, including the source, and provide a brief description of the resulting use of these data in development, validation, or verification of residential structure and contents flood vulnerability functions.

~~5.~~6. Describe the residential building stock classification and the categories of the different residential structure and contents flood vulnerability functions. Specifically, include descriptions of: building square footage and market value, building foundation type, ~~the~~ building primary construction material and characteristics, ~~building height,~~ number and use of stories and percent of structure and contents value by story, ~~regions within the state of Florida including designated flood zones (e.g., FEMA)~~lowest floor elevation relative to ground, presence of basement, year of construction and building code in effect, and flood hazard zone~~, and occupancy types in which a unique residential structure flood vulnerability function is used~~. Provide the total number of residential

4

structure flood vulnerability functions available for use in the flood model for personal residential structures in Florida.

6.7. Describe the process by which local construction practices and building code adoption and enforcement are considered in the ~~flood model~~development of residential flood vulnerability functions.

7.8. Describe the development of the flood vulnerability functions for appurtenant structures.

8.9. Describe the relationship between residential structure and appurtenant structure flood vulnerability functions and their consistency with insurance claims data.

9.10. Describe the assumptions, data, methods, and processes used to develop residential structure and contents flood vulnerability functions for unknown personal residential construction types and for when some primary characteristics are unknown.

10.11. Describe the assumptions, data, methods, and processes used to develop residential structure and contents flood vulnerability functions for various construction types for renters and condo-unit owners.

11.12. Describe any assumptions, data, methods, and processes used to develop and validate residential structure and contents flood vulnerability functions concerning insurance company claims.

12.13. Describe how the duration of a flood is considered. Include consideration of time after flooding before building access and cleanup can begin, and the likelihood of mold after flooding

13.14. Describe how the residential structure and contents flood vulnerability functions ~~flood model addresses~~incorporate depth of flo`od`ing (above ground and above lowest floor), flood velocity, ~~impact by flood water,~~ wave action (in coastal areas), undermining by erosion or scour, ~~and~~ flood-borne ~~induced~~ debris, and salinity of floodwater ~~impact damage~~.

14.15. Describe how the residential structure and contents vulnerability functions are developed for ~~storm surge are developed~~coastal and inland flooding.

16. Describe how wind and flood losses are combined for a structure. List any assumptions. Provide justification based on historical data and technical literature.

15.17. Provide a completed Form VF-1, ~~One~~ XXX Hypothetical Flood Events. Provide a link to the location of the form [insert hyperlink here]. <mark>(form to be developed)</mark>

AIR: **Technical**

Problem Statement: Disclosures 2, 8 and 11 currently require modelers to use insurance claims data in development of the vulnerability functions; however, there can be POTENTIALLY NO DETAILED FLOOD CLAIMS DATA.

Explanation: This is a general edit. We suggest changing the disclosure items to allow modelers to use alternative methodologies for the development of vulnerability functions when claims data is not available. When claims data is available and used in the development, the updated disclosure items still mandate the modelers to describe the use of the data.

Amendatory Language:

2. As applicable, d̶D̶escribe the nature and extent of actual insurance claims data used to develop the flood model's residential structure flood vulnerability functions. Describe in detail what is included, such as, number of policies, number of insurers, date of loss, and number of units of dollar exposure, separated into personal residential and mobile home.

8. Describe the relationship between residential structure and appurtenant structure flood vulnerability functions and their consistency with insurance claims data as applicable.

11. As applicable, d̶D̶escribe any assumptions, data, methods, and processes used to develop and validate residential structure flood vulnerability functions concerning insurance company claims.

AIR: **Technical**

Problem Statement: The current disclosure 5 requires the model to use the designed FEMA flood zone regulations as a measure for building vulnerability in different regions. This is problematic because although the flood management regulations are in place, the enforcement of the regulations heavily depending on the communities. The level of enforcement varies significantly across communities in Florida. As a result, vulnerability functions that are developed solely based on the designed flood zones in a lot of cases would not reflect the true vulnerability of the buildings in different flood zones. We believe that a building's vulnerability will be better represented by various categories of the building characteristics such as the foundation type, presence/absence of basements and basement finish on a case-by-case basis.

Explanation: This is a general update. We suggest removing the phrase, "regions within the state of Florida including designed flood zones (e.g. FEMA)". Due to the wide variation in community enforcement, this attribute will be a poor proxy for capturing regional distinction in vulnerability functions for the state of Florida.

5. Describe the residential building stock classification and the categories of the different residential structure flood vulnerability functions. Specifically, include descriptions of the building primary construction material and characteristics, building height, number of stories, ̶r̶e̶g̶i̶o̶n̶s̶ ̶w̶i̶t̶h̶i̶n̶ ̶t̶h̶e̶ ̶s̶t̶a̶t̶e̶ ̶o̶f̶ ̶F̶l̶o̶r̶i̶d̶a̶ ̶i̶n̶c̶l̶u̶d̶i̶n̶g̶ ̶d̶e̶s̶i̶g̶n̶a̶t̶e̶d̶ ̶f̶l̶o̶o̶d̶ ̶z̶o̶n̶e̶s̶ ̶(̶e̶.̶g̶.̶,̶ ̶F̶E̶M̶A̶)̶,̶ year of construction, and occupancy types in which a unique residential structure flood vulnerability function is used. Provide the total number of residential structure flood vulnerability functions available for use in the flood model for personal residential structures in Florida.

AIR: **Technical**

Problem Statement: The requirement of consideration of building codes in the development of vulnerability functions is not appropriate since existing building codes are wind-oriented and do not currently contain provisions for flood.

Explanation: This is a technical update. We suggest changing the requirement on building codes to flood management regulations which is more relevant in this context.

Amendatory Language:

6. Describe the process by which local construction practices ~~and building code adoption and enforcement~~and flood management regulations (such as the FEMA recommendations) are considered in the flood model.

AIR: **Editorial**

Problem Statement: Disclosure 14 is redundant because disclosure 3 asks modelers to describe how the structure vulnerability functions for flood are developed. This includes vulnerability functions for coastal flooding associated with storm surge, fluvial flooding and pluvial flooding. Therefore, the development of vulnerability functions for storm surge should be discussed as part of the response to disclosure 3.

Explanation: This is a general update. We suggest removing disclosure 14 that is redundant.

~~14. Describe how the residential structure vulnerability functions for storm surge are developed.~~

<mark>Audit</mark>

Professional Team: **Technical**

1. The residential structure and contents flood vulnerability components in the flood model will be reviewed in detail.

2. 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. For historical data used to develop residential structure and contents flood vulnerability functions, demonstrate the goodness-of-fit of the data. Complete reports detailing flooding conditions and damage suffered are required for any test data used. Complete rational structural analyses and calculations shall be presented so that a variety of different residential structure classes may be selected for review. Original site inspection reports shall be available for review. Other technical literature and expert opinion summaries will be reviewed.

3. Copies of any papers, reports, and studies used in the development of the residential structure and contents flood vulnerability functions shall be available for review.

4. Multiple samples of residential structure and contents flood vulnerability functions for personal residential structures, mobile homes, and appurtenant structures shall be available for review. The magnitude of logical changes among these items for given flood events shall be explained and validation materials shall be available.

5. ~~Justify~~ Justification of the residential structures construction classes and characteristics used will be reviewed.

6. ~~Provide v~~Validation of the mean residential structure and contents flood vulnerability functions and associated uncertainties will be reviewed.

7

7. Document~~ation~~ and ~~justify~~ justification for all modifications to the residential structure flood vulnerability functions due to building codes and their enforcement will be reviewed. If age of residential structure 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) will be reviewed.

9. ~~Describe h~~How the claim practices of insurance companies are accounted for when claims data for those insurance companies are used to develop or to verify residential structure and contents flood vulnerability functions will be reviewed. Examples include the level of damage the insurer considers a loss to be a total loss, claim practices of insurers with respect to concurrent causation, or the impact of public adjusting.

10. ~~Provide t~~The percentage of damage at or above which the flood model assumes a total structure loss and total contents loss will be reviewed.

11. Documentation and justification of the following will be reviewed:

    a. The method of derivation and data on which the contents flood vulnerability functions are based;
    b. Assumptions regarding the variability of contents flood losses by size of property;
    c. Regional and statewide application of contents flood coverage assumptions;
    d. Assumptions regarding contents flood coverage for various occupancies including mobile homes, tenants, and condo unit owners exposure.

~~11.~~12.   Form VF-1 (~~One~~ XXX Hypothetical Flood Event~~s~~) will be reviewed.

AIR: **Technical**

Problem Statement: Same as disclosure 6. The existing building codes are wind-oriented, and they do not currently contain provisions for flood.

Explanation: This is a technical change. We suggest updating the requirement on building codes to flood management requirements that are more relevant in this context.

Amendatory Language:

8. Document and justify all modifications to the residential structure flood vulnerability functions ~~due to building codes and their enforcement~~due to flood management requirements (such as FEMA recommendations) and local building practices. If age of residential structure is used as a surrogate for ~~ ~~flood management requirements (such as FEMA recommendations) and local building practices~~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).

VF-2, Derivation of Contents and Time Element Flood Vulnerability Functions

Professional Team: **Technical/Editorial**

Explanation: Moved contents from VF-2 as in the NFIP and the residential flood world, it is common to lump structure and contents together and to treat time element losses separately.

Amendatory/Suggested Language:

VF-2 Derivation of ~~Contents and~~ Time Element Flood Vulnerability Functions

A. ~~Development of the contents and time element flood vulnerability functions shall be based on at least one of the following: (1) historical data, (2) tests, (3) rational structural analysis, and (4) site inspections. Any development of the contents and time element vulnerability functions based on rational structural analysis, site inspections, and tests shall be supported by historical data.~~

B. ~~The relationship between the modeled residential structure and contents flood vulnerability functions and historical residential structure and contents losses shall be reasonable.~~ (moved to VF-1.F)

~~C.~~A. Time element flood vulnerability function derivations shall consider the estimated time required to repair or replace the property.

~~D.~~B. The relationship between the modeled residential structure and time element flood vulnerability functions and historical residential structure and time element losses shall be reasonable.

~~E.~~ C. Time element flood vulnerability functions used by the flood model shall include time element coverage claims associated with damage to the infrastructure caused by a flood.

AIR: **Technical**

Problem Statement: Same as Standard VF-1.A. The last sentence currently mandates the development of the content and time element vulnerability functions to be supported by the historical data, which is hard to accomplished because there can be POTENTIALLY NO DETAILED FLOOD CLAIMS DATA.

Explanation: This is a general edit. We suggest updating the standard to require modelers to utilize publically available information to develop vulnerability functions.

Amendatory Language:

A. Development of the contents and time element flood vulnerability functions shall be based on at least one of the following: (1) historical data, (2) tests, (3) rational structural analysis, and (4) site inspections. Historical data, as applicable, shall be considered for development of the residential structure flood vulnerability functions~~Any development of the contents and time element vulnerability functions based on rational structural analysis, site inspections, and tests shall be supported by historical data.~~

AIR: **Technical**

Problem Statement: Standard B and D are problematic due to the scarcity of insurance claims data for flood. The Commission should also be aware that the NFIP policies do not cover time element losses.

Explanation: The suggested change is general in nature. We suggest adding the phrase, "where applicable," that allows modelers to use alternative methodologies in development of content and time element vulnerability functions when historical data is not available.

Amendatory Language:

B. The relationship between the modeled residential structure and contents flood vulnerability functions and historical residential structure and contents losses, where available, shall be reasonable.

D. The relationship between the modeled residential structure and time element flood vulnerability functions and historical residential structure and time element losses, where available, shall be reasonable.

<mark>Purpose:</mark>

Professional Team: **Technical**

A reasonable representation of ~~contents and~~ time element flood losses is necessary in order to address policies that cover contents and time element losses.

Policies can provide varying types of time element coverage and insurance policies may pay for time element claims irrespective of flood damage to the insured property.

Relevant Forms: GF-4,   Vulnerability Flood Standards Structural/~~Wind~~ Hydraulic/Coastal Engineer Expert Certification

<mark>Disclosures:</mark>

Professional Team: **Technical**

~~a.   Provide a flow chart documenting the process by which the contents flood vulnerability functions are derived and implemented.~~

~~2.   Describe the data and methods used to develop flood vulnerability functions for contents coverage associated with personal residential structures.~~

~~3.   Describe the number of contents flood vulnerability functions and whether different contents flood vulnerability relationships are used for personal residential structures, mobile home, condo unit owners, and apartment renter unit location.~~

~~4.~~1. Provide a flow chart documenting the process by which the time element flood vulnerability functions are derived and implemented.

5.2. Describe the data and methods used to develop flood vulnerability functions for time element coverage associated with personal residential structures. State whether the flood model considers both direct and indirect loss to the insured property and explain how each is derived.

6.3. State the minimum threshold at which time element flood loss is calculated (e.g., loss is estimated for residential structure damage greater than 20%). Provide documentation of validation results to verify the approach used.

7.4. Describe how modeled time element flood loss costs take into consideration the damage to local and regional infrastructure due to flood events.

8. Describe the relationship between residential structure and contents flood vulnerability functions. (moved to VF-1, Disclosure 4)

9.5. Describe the relationship between residential structure and time element flood vulnerability functions.

10.6. Describe the assumptions, data, methods, and processes used to develop contents and time element flood vulnerability functions for unknown personal residential construction types and for when some primary characteristics are unknown.

11.7. Describe any assumptions, data, methods, and processes used to develop and validate contents and time element flood vulnerability functions concerning insurance company claims.

12.8. Demonstrate that contents and time element flood vulnerability function relationships are consistent with insurance claims data.

AIR: **Technical**

Problem Statement: Disclosure 6 currently asks for documentation of validation results which is problematic because historical data is scarcely available.

Explanation: This suggested change is general. We suggest modifying the requirement to allow disclosure of assumptions and require validation with historical data when it is available.

Amendatory Language:

6. State the minimum threshold at which time element flood loss is calculated (e.g., loss is estimated for residential structure damage greater than 20%). Provide documentation of validation resultsassumptions and validation data as applicable to verify the approach used.

AIR: **Technical**

Problem Statement: Disclosures 11 and 12 ask for insurance company claims, which is problematic due to POTENTIALLY NO DETAILED FLOOD CLAIMS DATA.

Explanation: The suggested edit is general. We recommend adding the phrase, "as applicable", to disclosure 11 and 12 to allow modelers to use alternative resource and research when insurance claims data is not available.

Amendatory Language:

11. As applicable, dDescribe any assumptions, data, methods, and processes used to develop and validate contents and time element flood vulnerability functions concerning insurance company claims.

12. As applicable, dDemonstrate that contents and time element flood vulnerability function relationships are consistent with insurance claims data.

<mark>Audit</mark>

Professional Team: **Technical**

1. The ~~contents and~~ time element flood vulnerability component in the flood model will be reviewed in detail.

2. To the extent that historical data are used to develop mathematical depictions of ~~contents~~ time element flood vulnerability functions, ~~demonstrate~~ the goodness-of-fit of the data to fitted models will be reviewed.

~~3. Documentation and justification of the following will be reviewed:~~
   ~~a. The method of derivation and data on which the contents flood vulnerability functions are based;~~
   ~~b. Assumptions regarding the variability of contents flood losses by size of property;~~
   ~~c. Regional and statewide application of contents flood coverage assumptions;~~
   ~~d. Assumptions regarding contents flood coverage for various occupancies including mobile homes, tenants, and condo unit owners exposure;~~

~~4. To the extent that historical data are used to develop mathematical depictions of time element flood vulnerability functions, demonstrate the goodness-of-fit of the data to fitted flood models.~~

~~5.~~ 3. Documentation and justification of the following will be reviewed:
   a. The method of derivation and data on which the time element flood vulnerability functions are based;
   b. Assumptions regarding the variability of time element flood losses by size of property;
   c. Regional and statewide application of time element flood coverage assumptions;
   d. Assumptions regarding time element flood coverage for various occupancies including mobile homes, tenants, and condo unit owners exposure;
   e. The methods used to incorporate the estimated time required to repair or replace the property due to flooding;
   f. The methodology and available validation for determining the extent of infrastructure flood damage and its effect on time element costs.

AIR: **Technical**

Problem Statement: Audit 3.b and 5.b ask for assumptions regarding the variability in property size, which is one of many building characteristics considered in contents flood vulnerability functions. We suggest making the language general to accommodate other relevant building characteristics.

Explanation: The first suggested edit is general. We recommend combining b, c and d. Also, modifying the language to be less prescriptive.

Amendatory Language:

3. Documentation and justification of the following will be reviewed:
    a. The method of derivation and data on which the contents flood vulnerability functions are based;
    b. Assumptions regarding the variability of contents flood losses by ~~~~relevant building characteristics~~ size of property~~;
    c. Regional and statewide application of contents flood coverage assumptions;
    d. Assumptions regarding contents flood coverage for various occupancies including mobile homes, tenants, and condo unit owners exposure.

5. Documentation and justification of the following will be reviewed:
    a. The method of derivation and data on which the time element flood vulnerability functions are based;
    b. Assumptions regarding the variability of time element flood losses by relevant building characteristics ~~size of property~~;
    c. Regional and statewide application of time element flood coverage assumptions;
    d. Assumptions regarding time element flood coverage for various occupancies including mobile homes, tenants, and condo unit owners exposure;
    e. The methods used to incorporate the estimated time required to repair or replace the property due to flooding;
    f. The methodology and available validation for determining the extent of infrastructure flood damage and its effect on time element costs.

VF-3, Flood Mitigation Measures

Professional Team: **Technical**

A. Modeling of flood mitigation measures to improve a residential structure's flood resistance and the corresponding effects on vulnerability shall be theoretically sound and consistent with fundamental engineering principles. These measures shall include fixtures or construction techniques that enhance the performance of the residential structure and its contents and shall consider:
    - Wall-to-floor-to-foundation strength and anchorage
    - Opening protection and seepage control
    - On-site flood mitigation measures associated with either the structure or the property (e.g., seawalls, floodwalls, retention ponds, water barriers, etc.)
    - Elevation of lowest floor (habitable space) above regulatory flood elevation (freeboard) from ground surface of first level of living area
    - Electrical outlets and mechanical equipment above regulatory flood levels or appropriately flood proofed
    - Restrict use of construction materials that deteriorate when wetted (moistened) as a result of flooding
    - Design of foundations exterior walls and siding to withstand water pressure, flood water, undermining, and debris impact, and wave loading
    - Use of ceramic tiles, concrete versus carpet and wood for floor covering
    - Lack of basements.

B. Application of flood mitigation measures that enhance the performance of the residential structure and its contents shall be justified as to the impact on reducing flood damage whether done individually or in combination.

C. Application of flood mitigation measures shall consider whether those measures are permanently installed and require no human intervention to activate/implement, or require human intervention.

AIR: **Technical**

Problem Statement: The current list of mitigation measures is prescriptive in requiring all of the measures to be considered in the model.

Explanation: The suggested change is general in nature. We recommend replacing Standard A with simpler language. The modelers will use their own scientific judgment in selecting the appropriate mitigations measures, and the Commission's vulnerability experts will evaluate their appropriateness. The simpler language of the suggested edit will allow the Commission to do this.

Amendatory Language:

A. Modeling of flood mitigation measures to improve a residential structure's flood resistance and the corresponding effects on vulnerability shall be theoretically sound and consistent with fundamental engineering principles. These measures shall include fixtures or construction techniques that

enhance the performance of the residential structure and its contents. The modeling organization shall justify all flood mitigation measures considered in the model. and shall consider:

- Wall-to-floor-to-foundation strength and anchorage
- Opening protection and seepage control
- On-site flood mitigation measures associated with either the structure or the property (e.g., seawalls, floodwalls, retention ponds, water barriers, etc.)
- Elevation from ground surface of first level of living area
- Electrical outlets and mechanical equipment above regulatory flood levels or appropriately flood proofed
- Restrict use of construction materials that deteriorate when wetted (moistened) as a result of flooding
- Design of exterior walls and siding to withstand water pressure, flood water and debris impact, and wave loading
- Use of ceramic tiles, concrete versus carpet and wood for floor covering
- Lack of basements.

Purpose

Professional Team: **Editorial**

This standard requires Mmitigation techniques and approaches to eliminate or reduce flood losses must beare accounted for in the flood model as they impact the residential exposures in the state of Florida.

Relevant Forms: GF-4,   Vulnerability Flood Standards Structural/Wind Hydraulic/Coastal Engineer Expert Certification

Disclosures

Professional Team: **Editorial**

6. Describe how structureal flood mitigation factors are accounted for in the flood model. Identify any assumptions.

AIR: **Editorial**

Problem Statement: Disclosures 6 and 7 contain terminology that is inconsistent with the rest of the standard. The term "flood mitigation factors" is used instead of the term "flood mitigation measures."

Explanation: This update is editorial. We suggest using consistent terminology for disclosures 6 and 7.

Amendatory Language:

6. Describe how structural flood mitigation factors measures are accounted for in the flood model. Identify any assumptions.

7. Describe how contents flood mitigation factorsmeasures are accounted for in the flood model. Identify any assumptions.

Professional Team: **Editorial**

3. Flood ~~M~~mitigation measures used by the flood model that are not listed as required in this flood standard will be ~~disclosed and shown to be~~reviewed to determine their theoretically soundness and reasonableness.

AIR: **Editorial**

Problem Statement: Audit Item 2 contains the term, "flood footprints". In the last Commission meeting on January 29th, it was suggested that "flood extent and depth" be used instead of "flood footprints".

Explanation: This change is editorial. We suggest updating the terminology to be consistent with the Met/Hydro Standards.

Amendatory Language:

1. Individual flood mitigation measures as well as their effect on flood damage due to use of multiple flood mitigation measures will be reviewed. Any variation in the change over the range of flood extent and depth ~~footprints~~ for individual and multiple flood mitigation measures will be reviewed.

Form VF-1: One Hypothetical Flood Event

Professional Team: **Technical**

Form VF-1: ~~One~~ XXX Hypothetical Flood Events

AIR: **Technical**

Form V-1: One Hypothetical Event

A. Flood depths for 96 geocoded locations and sample personal residential exposure data are provided in the file named *"FormV1Input13.xlsx."* The flood represents a hypothetical flood event. Model the sample personal exposure data provided in the file against these flood depths at the specified locations and provide the damage ratios summarized by flood depths (ft) and construction type.

The sample personal residential exposure data provided consists of four structures (one of each construction type – wood frame, masonry, mobile home, and concrete) individually placed at the geocode latitude and longitude provided. Each location is subjected to a specific flood depth. For completing Part A, Estimated Damage for each individual flood depth range is the sum of ground up loss to all structures subjected to that individual flood depth, excluding demand surge. Subject Exposure is all exposures geocoded locations subjected to that individual flood depth. For completing Part B, Estimated Damage is the sum of the ground up loss to all structures of a specific type (wood frame, masonry, mobile home, or concrete) in all of the flood depths ranges, excluding demand surge. Subject Exposure is all exposures of that specific type in all geocoded locations.

One reference structure for each of the construction types shall be placed at the population centroid of the ZIP Codes. Do not include contents, appurtenant structures, or time element coverages.

Reference Frame Structure:	Reference Masonry Structure:
One story	One story
Crawlspace foundation	Slab foundation
Wood framed exterior walls	Masonry exterior walls
Constructed in 1981	No vertical wall reinforcing
	Constructed in 1981
Reference Mobile Home Structure:	
Tie downs	
Single unit	
Manufactured in 1980	

B. Confirm that the structures used in completing the form are identical to those in the above table for the reference structures. If additional assumptions are necessary to complete this form (for example, regarding structural characteristics, duration), provide the reasons why the assumptions were necessary as well as a detailed description of how they were included.

C. Provide a plot of the Form V-1 (One Hypothetical Event), Part A data.

17

Form V-1: One Hypothetical Event

Part A

Flood depth (ft)	Estimated Damage/ Subject Exposure
0 – 0.5	
0.6 – 1	
2 – 3	
3 – 4	
4 – 5	
5 – 6	
7 – 8	
9 – 10	

Part B

Construction Type	Estimated Damage/ Subject Exposure
Wood Frame	
Masonry	
Mobile Home	
Concrete	

Form VF-2: Flood Mitigation Measures – Range of Changes in Flood Damage

AIR: **Technical**

A. Provide the change in the zero deductible personal residential reference building damage rate (not loss cost) for each individual mitigation measure listed in Form V-2 (Mitigation Measures – Range of Changes in Damage) as well as for the combination of the four mitigation measures provided for the Mitigated Frame Building and the Mitigated Masonry Building below.

B. If additional assumptions are necessary to complete this form (for example, regarding duration), provide the rationale for the assumptions as well as a detailed description of how they are included.

C. Provide this form in Excel format without truncation. The file name shall include the abbreviated name of the modeling organization, the standards year, and the form name. Form V-2 (Mitigation Measures – Range of Changes in Damage) shall also be included in a submission appendix.

Reference Frame Building:	Reference Masonry Building:
One story	One story
Crawlspace foundation	Slab foundation
Wood framed exterior walls	Masonry exterior walls
Constructed in 1981	No vertical wall reinforcing
	Constructed in 1981
Mitigated Frame Building: First flood height 4ft	**Mitigated Masonry Building:**
Flood proofed utilities	First floor height 3ft
	Flood proofed utilities

Reference and mitigated buildings are fully insured building structures with a zero deductible building only policy.

Place the reference building at specified geocode location.

INDIVIDUAL MITIGATION MEASURES		PERCENTAGE CHANGES IN DAMAGE ((REFERENCE DAMAGE RATE - MITIGATED DAMAGE RATE) / REFERENCE DAMAGE RATE) * 100									
		FRAME BUILDING					MASONRY BUILDING				
		FLOOD DEPTH (FT)					FLOOD DEPTH (FT)				
		0.5	1	2	3	4	0.5	1	2	3	4
	REFERENCE BUILDING	—	—	—	—	—	—	—	—	—	—
FIRST FLOOR HEIGHT	1 FT. ABOVE GROUND										
	2 FT. ABOVE GROUND										
	3 FT ABOVE GROUND										
FLOOD PROOFED UTILITIES	PROTECTED										
	UNPROTECTED										

MITIGATION MEASURES IN COMBINATION		PERCENTAGE CHANGES IN DAMAGE ((REFERENCE DAMAGE RATE - MITIGATED DAMAGE RATE) / REFERENCE DAMAGE RATE) * 100									
		FRAME BUILDING					MASONRY BUILDING				
		FLOOD DEPTH (FT)					FLOOD DEPTH (FT)				
		0.5	1	2	3	4	0.5	1	2	3	4
BUILDING	MITIGATED BUILDING										

Form VF-3: Flood Mitigation Measures – Mean Flood Damage Ratios and Flood Loss Costs (Trade Secret Item)

AIR: **Technical**

A. Provide the mean damage ratio (prior to any insurance considerations) to the reference building for each individual mitigation measure listed in Form V-3 (Mitigation Measures – Mean Damage Ratios and Loss Costs, Trade Secret item) as well as the percent damage for the combination of the four mitigation measures provided for the Mitigated Frame Building and the Mitigated Masonry Building below.

B. Provide the loss cost rounded to three decimal places, for the reference building and for each individual mitigation measure listed in Form V-3 (Mitigation Measurers – Mean Damage Ratios and Loss Costs, Trade Secret item) as well as the loss cost for the combination of the four mitigation measures provided for the Mitigated Frame Building and the Mitigated Masonry Building below.

C. If additional assumptions are necessary to complete this form (for example, regarding duration or surface roughness), provide the rationale for the assumptions as well as a detailed description of how they are included.

D. Provide a graphical representation of the vulnerability curves for the reference and the fully mitigated building.

Reference Frame Building:	**Reference Masonry Building:**
One story	One story
Crawlspace foundation	Slab foundation
Wood framed exterior walls	Masonry exterior walls
Constructed in 1981	No vertical wall reinforcing
	Constructed in 1981
Mitigated Frame Building:	**Mitigated Masonry Building:**
First flood height 4ft	First floor height 3ft
Flood proofed utilities	Flood proofed utilities

Reference and mitigated buildings are fully insured building structures with a zero deductible building only policy.

Place the reference building at the specified geocode location.

Form V-3: Mitigation Measures – Mean Damage Ratios and Loss Costs (Trade Secret Item)

INDIVIDUAL MITIGATION MEASURES		MEAN DAMAGE RATIO										LOSS COSTS	
		FRAME BUILDING					MASONRY BUILDING					FRAME BUILDING	MASONRY BUILDING
		FLOOD DEPTH (FT)					FLOOD DEPTH (FT)						
		0.5	1	2	3	4	0.5	1	2	3	4	ACROSS ALL DEPTHS	
	REFERENCE BUILDING												
FIRST FLOOR HEIGHT	1 FT. ABOVE GROUND												
	2 FT. ABOVE GROUND												
	3 FT. ABOVE GROUND												
FLOOD PROOFED UTILITIES	PROTECTED												
	UNPROTECTED												

MITIGATION MEASURES IN COMBINATION		MEAN DAMAGE RATIO										LOSS COSTS	
		FRAME BUILDING					MASONRY BUILDING					FRAME BUILDING	MASONRY BUILDING
		FLOOD DEPTH (FT)					FLOOD DEPTH (FT)					ACROSS ALL DEPTHS	
		0.5	1	2	3	4	0.5	1	2	3	4		
BUILDING													
	MITIGATED BUILDING												