Florida Public Hurricane Loss Model (FPHLM) Requirements Document of Model Changes to FPHLM V6.1 to become FPHLM V6.2

This document specifies the requirements related to each model change identified in Standard G-1, Disclosure 5.

1. Changes in the low-rise commercial residential model (LR-CR) of the Engineering Component

1.1. Calculation of Soffit Areas of Hip and Gable Roof Buildings

Purpose

V6.1 calculated hip roof soffit areas using the same area as for gable roof soffit areas. V6.2 now calculates them differently taking into account the differences in geometry between hip and gable roofs.

Scope

Programs Affected

The change occurs in the *IntExt_calc_CL_V60* function, which is called by the *Vulns_calc_CL080112* function. The output of these two functions is utilized by *Vulns_run_CL080112* in order to store data in the vulnerability matrices.

Source Code Line Numbers

Lines 136-149 are the location of the change within the *IntExt_calc_CL_V60* function.

Variables Affected

The change affects the *AreaSoffit* variable directly. The program utilizes this parameter in the calculation of both the WatIngrDfN variable and the WatIngrBrN variable, both of which evaluate damage due to rain intrusion through defects and breaches (respectively) in the soffits.

Description

The change Introduced an “if“ function to properly handle differences in soffit area calculations between gable and hip roofs, as well as the appropriate code for calculation of the hip soffit areas. Additionally, the final calculations of soffit areas account now for the net areas due to minimum attic ventilation design requirements per FBC (2014).

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Comparison Plots

Figure 1 shows that the overall effect is an increase in vulnerability, mainly at wind speeds under 200mph. The increase is less noticeable as the number of stories increases.

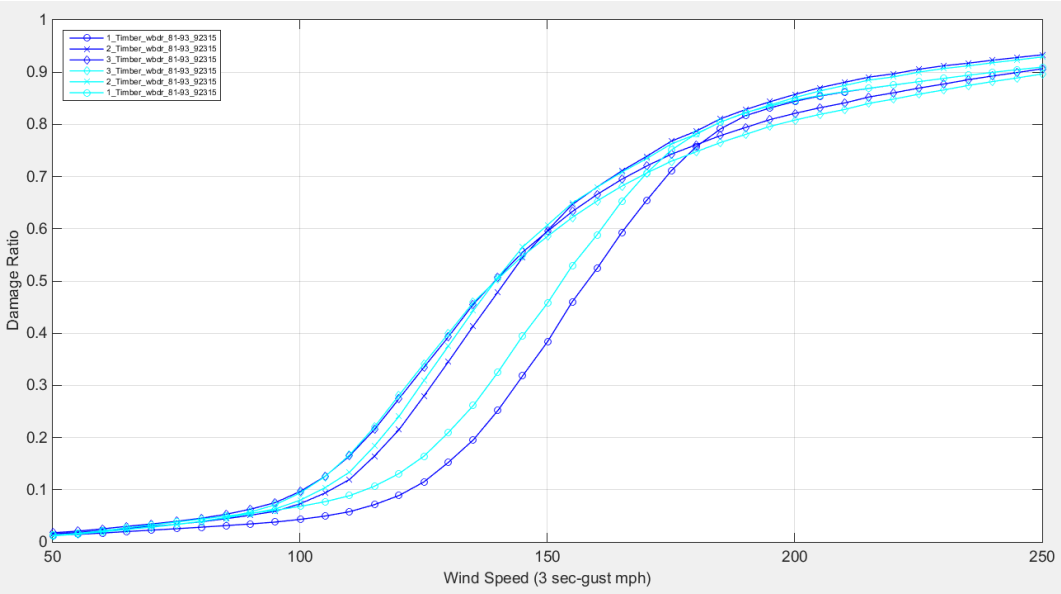

Figure 1: Weighted Vulnerabilities for V6.1 (Dark Blue) vs Soffit Correction (Light Blue)*

*Base and test cases generated for 1-3 story timber homes in the WBDR for the 81-93 era (representative of other model cases)

Reference

FBC. *Florida Building Code, 5th Edition, 2014*. http://www.floridabuilding.org/bc

For information refer to the FPHLM Primary Document Binder Volume III (Damage Estimation Module) (Use Case IV) Section 1.4.3 and 1.4.6.

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1.2. Correction in the Handling of WDR2

Purpose

V6.1 assumed the wind driven rain WDR2 to be equal to one in the calculation of water ingress due to breaches. Now, in V6.2 samples WDR2 from the WDR2 distribution.

Scope

Program Affected

The change occurs in the *IntExt_calc_CL_V60* function, which the *Vulns_calc_CL080112* function calls. *Vulns_run_CL080112* utilizes the output of these two functions in order to store data in the vulnerability matrices.

Source Code Line Numbers

Lines 942-1223 are the location of the intermittent changes within the *IntExt_calc_CL_V60* function.

Variables Affected

WatIngrBrN_DI and *WatIngrBrN_SR* are the two variables directly affected by the change. Ultimately, these values affect the total water ingress into the building, represented by the *WAT* variable.

Description

The value of WDR2 is now appropriately inputted into the calculations of the water ingress due to breaches and is no longer assumed equal to 1 in these calculations.

Comparison Plots

Figure 2 shows that the overall effect is a very slight increase in vulnerability at wind speeds above 150mph. The increase is very slight because the amount of total rain that impacts the building is unaffected by the value of the WDR2 variable, since the model first randomly selects the total WDR value and computes the variable WDR1 as WDR-WDR2. In other words, the change only shifts the cause of interior damage from WDR1 to WDR2, but the total value remains almost the same.

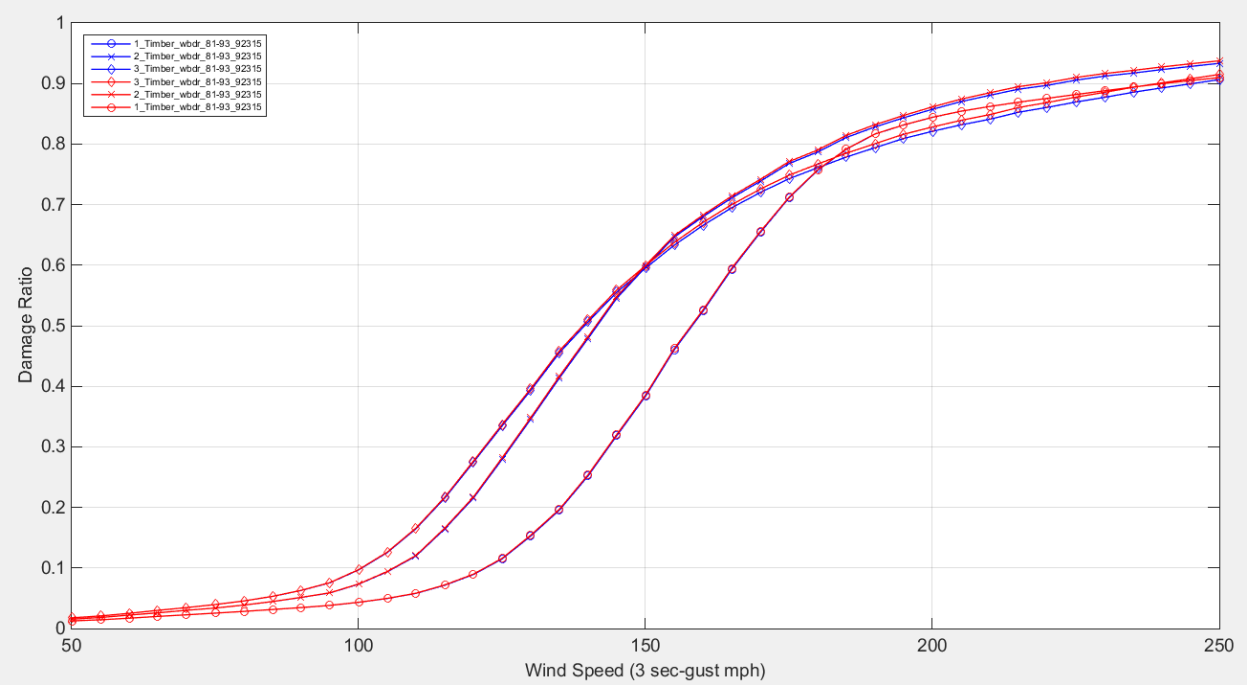

Figure 2: Weighted Vulnerabilities for V6.1 (Dark Blue) vs WDR2 Correction (Red)*

*Base and test cases generated for 1-3 story timber homes in the WBDR for the 81-93 era (representative of other model cases)

Reference

For information refer to the FPHLM Primary Document Binder Volume III (Damage Estimation Module) (Use Case IV) Section 1.4.3 and 1.4.6.

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1.3. Removal of Rain Sampling Bounds

Purpose

This original section of code in V6.1 only utilized wind driven rain data within the interval [-0.5 standard deviation, +0.75 standard deviation] of the rain simulation data. V6.2 now uses he entire range of simulation data to determine the wind driven rain before and after the occurrence of exterior damage in the model. This change reflects the fact there was no real justification to limit the sample space.

Scope

Program Affected

The change occurs in the *IntExt_calc_CL_V60* function, which the *Vulns_calc_CL080112* function calls. *Vulns_run_CL080112* utilizes the output of these two functions in order to store data in the vulnerability matrices.

Source Code Line Numbers

Lines 348-351 are the location of the change within the *IntExt_calc_CL_V60* function.

Variables Affected

outU and *outL* are the two variables the change directly affects. These two variables define the bounds for which sampling occurs in the development of the *WDR1* and *WDR2* variables.

Description

The upper bound (outU) is now set to the maximum point in the sample space and the lower bound (outL) is now set to zero.

Comparison Plots

Figure 3 shows that the overall effect is a general decrease in vulnerability for wind speeds above 120mph.

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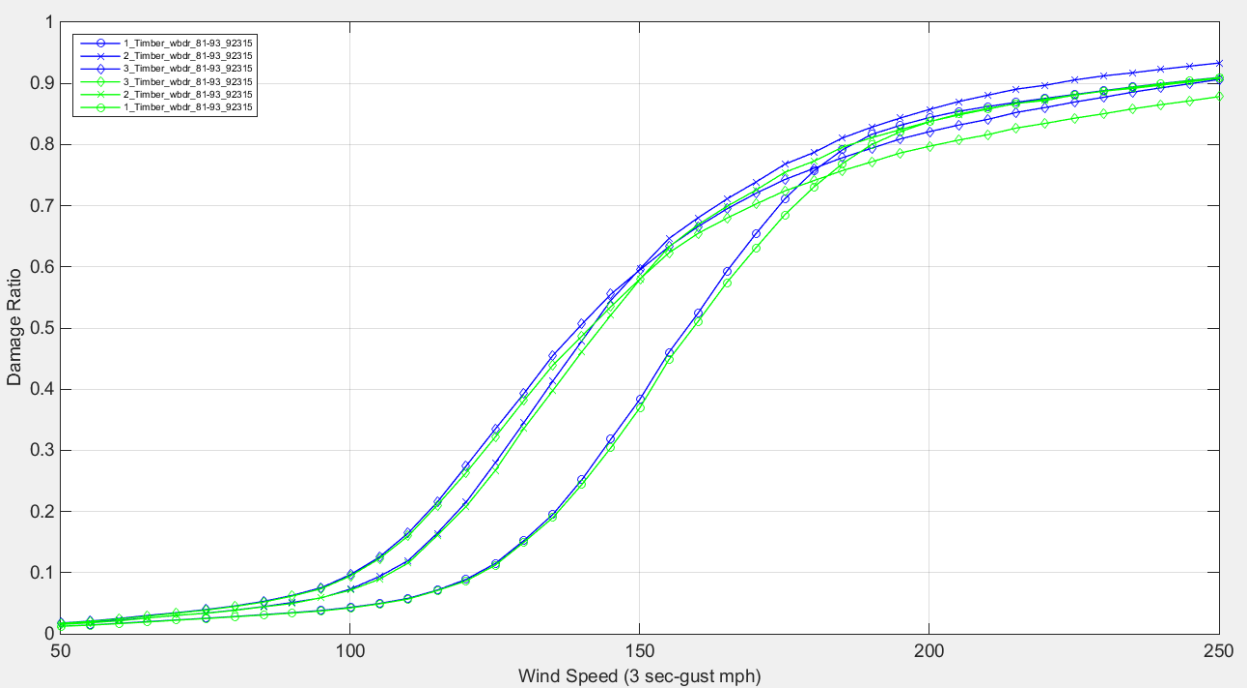

Figure 3: Weighted Vulnerabilities for V6.1 (Dark Blue) vs Bounds Change (Green)*

*Base and test cases generated for 1-3 story timber homes in the WBDR for the 81-93 era (representative of other model cases)

Reference

For information refer to the FPHLM Primary Document Binder Volume III (Use Case IV) (Damage Estimation Module) Section 1.4.3 and 1.4.6.

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1.4. Update of the statistics used to weigh the low-rise commercial residential vulnerability matrices

Purpose

V6.2 takes into account the latest information from the tax appraiser databases statistics to weigh the vulnerability curves.

Scope

In all, 22 counties yielded statistics for structural characteristics by era. The 22 counties with a complete (or mostly complete) set of building statistics per era, result in more accurate conditional probabilities. The weighting table for both masonry and timber models in the weighing program was updated to incorporate these statistics. The corresponding affected file is Weight_calc_CL080112.m.

Description

The combination of data from 22 county tax appraiser databases resulted in the conditional probabilities per era and per type of exterior wall necessary to weight the curves, for each of the three regions (WBDR, inland, and HVHZ).

Reference

Joshua Michalski, "Building Exposure Study in the State of Florida and Application to the Florida Public Hurricane Loss Model," Master Thesis, Civil Engineering Department, Florida Tech, Melbourne, Florida, December, 2016

For information on the overall process refer to Volume III (Use Case IV) Section 1.4.3 of the FPHLM Primary Document Binder.

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2. Changes in the personal residential model (PR) of the Engineering Component

2.1. Update of the statistics used to weigh the personal residential vulnerability matrices

Purpose

V6.2 updated the probabilities used to weigh the vulnerability matrices, based on the latest information from an additional 33 county tax appraiser databases.

Scope

These additional 33 county tax appraiser databases combined with databases obtained in previous studies resulted in personal residential data available for 51 counties representing 95% of Florida's population.

Description

The file "Statistical Data for Random Generation 06-04-16" stores all the building statistics for personal residential structures. This file, displays the conditional probabilities for each county with a separate page for each era. In addition, present within the file is a sheet titled "Single Characteristics", which displays the conditional probabilities for the county as a whole as well as the distribution of construction throughout time. A Matlab file named "statData" references the file "Statistical Data for Random Generation 06-04-16". While the naming convention of this file is not particularly crucial, it is essential that the format be kept the same for implementation into the FPHLM models.

Reference

Joshua Michalski, “Building Exposure Study in the State of Florida and Application to the Florida Public Hurricane Loss Model,” Master Thesis, Civil Engineering Department, Florida Tech, Melbourne, Florida, December, 2016

For information on the overall process, refer to Volume III (Use Case III) Section 1.4.3 of the FPHLM Primary Document Binde

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3. Changes in the Meteorology Component

3.1. Update of the HURDAT database

Purpose

The HURDAT database was updated to include storms up through the 2015 hurricane season.

Scope

The HURDAT2 database was downloaded from the National Hurricane Center web site, converted to HURDAT original format and then processed to obtain updated probability distributions that are used as input to the Storm Track Generator (STG).

Description

The HURDAT database was updated to the 2/17/2016 version of HURDAT2. This database provides the historical initial conditions and motions for the simulated storm tracks generated by the STG.

The format of the HURDAT2 was converted to the old format of HURDAT; consequently, no modifications of the code of the STG were required as a result of this update.

Reference

For detailed information on the format of the HURDAT database, refer to Volume V of the FPHLM Primary Document Binder.

The National Hurricane Center web site can be visited at http://www.nhc.noaa.gov/.

3.2. Update of the ZIP Code database and the centroid locations

Purpose

The ZIP Code boundaries were updated to recalculate the ZIP Code centroids.

Scope

ZIP code boundaries were obtained from the vendor and then processed using GIS software to compute population-based centroids. These centroids are used for specifying location of the exposure in the Wind Speed Correction (WSC) for calculating wind hazard when the street address is not known or used.

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Date: March 17, 2016
Version 1.0

Description

The model uses 5-digit ZIP Codes distributed by Pitney Bowes. The 5-digit ZIP Codes product constitutes a geographic data set that contains the boundaries for each 5-digit ZIP Code in the United States assigned by the U.S. Postal Service.

As per Standard G-3, the ZIP Code database was updated to the March 2015 ZIP code boundaries, and the population-weighted centroids recalculated accordingly.

The final list of ZIP Codes, which serves as input to the model's components (Wind Speed Correction and Insured Loss Modules) was recreated. No modifications of the model's source code were required.

Reference

A description of the WSC module can be found in Volume II of the FPHLM Primary Document Binder.

Author: Steve Cocke
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