Hazus 6.0

Release Notes

November 2022

FEMA

HAZUS™

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Table of Contents

1. Overview

Hazus 6.0 was released on November 14, 2022. This version includes 44 software changes that are summarized below. Each change summary includes a User Story, Acceptance Criteria, and Notes (if applicable).

User Stories describe a software change in plain language from the perspective of a Hazus stakeholder. Acceptance Criteria describe the conditions required for the software change to be considered complete. Notes summarize important information associated with a given software change. Changes are identified using a key (HAZ-XXXXX) that helps the Hazus Team track important information related to development projects. For any questions related to the Hazus 6.0 release, please email the Hazus Team (FEMA-Hazus-Support@fema.dhs.gov) and include the HAZ-XXX key if available. Below is a summary of the Hazus 6.0 enhancements.

Software Architecture Notes

- Upgraded from Esri ArcGIS Desktop version 10.8.1 to Esri ArcGIS Desktop version 10.8.2 Desktop.
- A manual SQL Server 2019 Cumulative Update is available for users to download. FEMA recommends that users run this cumulative update installer to remediate a log4j security vulnerability identified in SQL Server 2019. Read more in the Hazus Installation and Testing Procedures guide.
- Hazus Package Region (HPR) files created in previous versions of Hazus can be imported to view and export table results, but users will not be able to map layers or re-run the analysis in Hazus 6.0 as a result of the Census boundary changes.
- Hazus 6.0 supports Windows 10 and 11 Enterprise and Pro operating systems.

Hazus 6.0 Inventory Data Update Notes

- Demographics data - updated from 2010 U.S. Census and American Community Survey (ACS) data values to the latest 2020 data values.
- Dasymetric data - updated methodology to use building footprints, point data and Land Use Land Cover (LULC) data to identify developed areas within Census blocks.
- General Building Stock (GBS) data – updated baseline data with Nationwide Structure Inventory (NSI 2022) for the Contiguous U.S. (CONUS), Alaska, and Hawaii, and FEMA developed data for Puerto Rico (PR), Virgin Islands (VI), District of Columbia (DC) and Pacific Territories. Valuations are updated with values derived from 2022 RSMeans.
- Utilities and Transportation data - updated utility and transportation systems and components using the Homeland Infrastructure Foundation-Level Data (HIFLD Open).

- Essential Facilities data – updated fire stations, police stations, emergency operations centers (EOCs), and schools using the HIFLD Open data.
- For full details refer to the Hazus 6.0 Inventory Technical Manual.

Software Enhancements Notes

- Extensive security vulnerability remediation made Hazus desktop software and baseline inventory databases more secure and resistant to hacking.
- Earthquake probabilistic scenario runtimes are optimized with the new data and are now about 20 times faster.
- ShakeMap processing times are now about 3 times faster.
- Hazard data updates utilize best available public data.
- Inventory data updates utilize best available public data.

Software Defect Notes

- When building a Hazus Flood Study Region based on National Flood Insurance Program (NFIP) community, tribal, or Special Land Use Area (SLUA) the "Show Map" functionality does not work. Users can aggregate these regions based on the listing feature.
- Hazus Installation GUI graphics are rendering smaller than anticipated and justified in the top left corner of the windows with high resolution screens.
- Users may have to adjust their screen resolution to use CDMS. Recommended resolution: scale 100%; resolution: 1920x1080
- Viewing results for the first time may result in ArcMap crash for the Study Region. However, when user re-opens the same Study Region the results should be saved and viewable after the initial crash. If user continues to have issues, please contact the Hazus Help Desk.
- Some Study Regions may have Essential Facilities located outside of Census Blocks. Currently, this prohibits users from being able to successfully run a combined hurricane and flood analysis in Hazus 6.0. If a user needs to run this type of multi-hazard analysis for a Study Region that has this issue, please contact the Hazus Help Desk for guidance on how to troubleshoot.

2. General Software Changes

The changes below apply to functionality shared by all four hazard models contained in the Hazus software program.

2.1. HAZ-63829: CDMS: Import Functionality Updated in CDMS for Shapefile (.shp) and Personal Geodatabase (.mdb)

2.1.1. USER STORY

As a Risk Analyst, I want to be able to import .mdb or .shp files in Hazus, so that I can run an analysis with user-defined inventory data.

2.1.2. ACCEPTANCE CRITERIA

- Users can import point and line segments from .mdb or .shp using CDMS to be assessed in a Hazus analysis.

2.2. HAZ-65648: Implemented HIFLD Open Data Essential Facility Updates

2.2.1. USER STORY

As a Hazus user, I want to use the latest HIFLD Open data for Essential Facility updates, so that I can confidently run an analysis using best available data.

2.2.2. ACCEPTANCE CRITERIA

- Hazus State databases are updated with the latest HIFLD Open data for hospitals, fire stations, police stations, emergency operations centers, and schools.

2.3. HAZ-65649: Implemented HIFLD Open Data Transportation Updates

2.3.1. USER STORY

As a Hazus user, I want to use the latest HIFLD Open data for Transportation updates, so that I can confidently run an analysis using best available data.

2.3.2. ACCEPTANCE CRITERIA

- Hazus State databases are updated with the latest HIFLD Open data for highway tunnels, railway segments, railway bridges, light rail segments, light rail facilities, bus facilities, port facilities, airports, and airport runways.

2.4. HAZ-65650: Implemented HIFLD Open Data Utility Updates

2.4.1. USER STORY

As a Hazus user, I want to use the latest HIFLD Open data for Utility updates, so that I can confidently run an analysis using best available data.

2.4.2. ACCEPTANCE CRITERIA

- Hazus State databases are updated with the latest HIFLD Open data for wastewater facilities, natural gas facilities, natural gas pipelines, and electrical power facilities.

2.5. HAZ-66015: Updated All Census Tract IDs to Reflect 2020 Values

2.5.1. USER STORY

As a Risk Analyst, I want to use Census 2020 Tract IDs, so that I can confidently run an analysis using best available data.

2.5.2. ACCEPTANCE CRITERIA

- Hazus State databases are updated with the 2020 Census Tract IDs.

2.6. HAZ-66425: Updated General Building Stock (GBS) with Nationwide Structure Inventory (NSI 2022)

2.6.1. USER STORY

As a Hazus user, I want to use the GBS updated based on NSI 2022 building valuations, counts, and square footage, so that I can confidently run an analysis using the best available data.

2.6.2. ACCEPTANCE CRITERIA

- The GBS has been updated based on NSI 2022 building valuations, counts, and square footage.

2.6.3. NOTES

- NSI 2022 data is available for the Continental U.S. (CONUS), Alaska, and Hawaii.
- Data for Puerto Rico, the U.S. Virgin Islands, the District of Columbia, and Pacific Territories was updated with data developed by FEMA's Natural Hazard Risk Assessment Program (NHRAP) and the Hazus Team.
- Improvements in data quality and coverage using NSI 2022.

- Non-residential building data are vastly improved and more complete.
- Direct foundation and number of stories attribution from parcel data greatly improve replacement cost valuations over regional census methods.
- Multi-family attributions from parcel data improve the accuracy of the muti family RES3 assignment and classifications.
- Moving from the previous Standard Industrial Classification (SIC) to the more detailed North American Industry Classification System (NAICS) provides more refinement to the Hazus Commercial and Industrial type classifications.
- The use of site-specific building data and occupancy information for Schools, Colleges, Hospitals, Medical Facilities and Nursing Homes have greatly improved the counts, area, and valuation data for EDU1, EDU2, COM6&7 and RES6 counts, area and valuations.
- Parking structures (COM10) values are now included.
- Government (GOV1) occupancy types appear to be significantly more complete and better represented.
- Using the multifamily duplex (RES3A) as the default when the number of units per structure is not provided may elevate RES3A counts and valuations.
- The lack of comprehensive jails data may result in group quarters (RES5) counts, areas and valuations that are incomplete.
- Some location data, based on parcel centroids or dasymetric data for counties where Lightbox parcel data were not available are not well located on structure, however, aggregation to the Census Block helps remediate any location errors.
- The NSI 2022 methodology for estimating number of stories can produce anomalies that can influence the estimation of building areas. Some post processing was done against 2020 Census RESUNITs data at the Census Block level to remove these issues for multifamily (RES3) occupancy types.
- Number of stories was the only attribute in Census 2021 used to define Urban Areas, assuming mid and high rises in rural and suburban areas were more likely to be anomalies.
- Use of footprints from Oak Ridge National Laboratory (ORNL) and NHRAP improved counts and distribution of buildings in Pacific Island Territories.

2.7. HAZ-66657: Implement New Cost Tables

2.7.1. USER STORY

As a Hazus user, I want to use updated cost tables in Hazus, so that I can confidently run an analysis using the best available data.

2.7.2. ACCEPTANCE CRITERIA

- All cost tables are updated in the Hazus_model_data database and for the County Modification Factors in each state database.

2.7.3. NOTES

- GBS and Essential Facility replacement costs were updated using 2022 RSMeans derived values to calculate the valuation of structures and contents.
- Transportation Systems replacement costs were updated using a combination of costs escalated to 2021 based on CPI, county modification factors, RSMeans derived values, and U.S. data for aboveground projects from the Eno Center for Transportation Transit Capital Construction database.
- Updated replacement cost tables are viewable in the Analysis>Parameters menu.
- For more detailed information please review the Hazus Inventory Technical Manual.

2.8. HAZ-66658: Implement New Census Geometries

2.8.1. USER STORY

As a Hazus user, I want to use updated homogeneous and dasymetric census geometries, so that I can confidently run an analysis using the best available data.

2.8.2. ACCEPTANCE CRITERIA

- Hazus State databases are updated with homogeneous and dasymetric geometries feature classes for 2020 Blocks, Tracts, and Counties.

2.8.3. NOTES

- This included updates for: BlockType, Length, Mapping Scheme IDs, and Income ratio.
- For states with duplicate county name equivalents, the feature representing the city was updated with the word “City” (e.g., St. Louis City).

- Dasymetric data now uses 2019 National Land Cover Data (NLCD) for open water determination and dasymetric pixelation grid size.

- A new building based dasymetric processing methodology was implemented. This methodology provided a more refined method for defining developed areas.

2.9. HAZ-66894: Implement New Demographics Data

2.9.1. USER STORY

As a Hazus user, I want to use updated demographics data, so that I can confidently run an analysis using the best available data.

2.9.2. ACCEPTANCE CRITERIA

- Hazus baseline inventory state databases are updated with 2020 demographics data for all census blocks and tracts.

2.9.3. NOTES

- Data was updated using a combination of U.S. Decennial Census, American Community Survey, Longitudinal Employer and Household Data from NSI 2022, Pacific Disaster Center (PDC) for Pacific Territories, and data developed by FEMA's Natural Hazards Risk Assessment Program and the Hazus Team.

- More accurate population migration (time of day estimates), K-12 school enrollment, nursing home, hospital, working COM, and working IND data provided by NSI 2022

- More accurate college/university (EDU2) populations integrated using Homeland Infrastructure Foundation-Level Data (HIFLD) data.

- Integration of U.S. Census Blocks used in territories instead of Landscan grids.

- U.S. Census population data used in territories instead of Landscan-derived products.

2.10. HAZ-75639: Resolve Security Vulnerability Findings

2.10.1. USER STORY

As a Hazus user, I want to use secure code, so that my machine is safe from hackers.

2.10.2. ACCEPTANCE CRITERIA

- Hazus 6.0 release removes all critical and moderate security vulnerabilities and significantly reduces the high security vulnerabilities.

2.11. HAZ-75908: Update CDMS Tables to Reflect New Data Updates

2.11.1. USER STORY

As a Hazus user, I want CDMS to use updated census IDs and replacement cost data values, so that I can load user-defined data and take advantage of the latest inventory data updates.

2.11.2. ACCEPTANCE CRITERIA

- CDMS is updated with the latest 2020 U.S. Census data and 2022 replacement costs.

2.12. HAZ-66947: Next and Cancel Buttons are Now Visible when Installing Hazus 6.0

2.12.1. USER STORY

As a Hazus user, I want to see an updated installation graphical user interface (GUI), so that I can click the next and cancel button during Hazus 6.0 installation setup.

2.12.2. ACCEPTANCE CRITERIA

- Hazus installation GUI has been updated so that the Next and Cancel buttons are visible to all users throughout the Hazus 6.0 installation setup wizard.

2.12.3. NOTES

- Users may experience issues with the graphic size in the Installation Wizard GUI especially on high resolution monitors, or when the display scale setting is greater than 100%.

2.13. HAZ-66426: Hazus Public Shelter Needs Methodology Default Values Updated

2.13.1. USER STORY

As a Hazus user, I want the shelter needs methodology update, so that the methodology uses only income to estimate the population seeking shelter.

2.13.2. ACCEPTANCE CRITERIA

- Hazus model methodology for population seeking shelter has been updated so that it uses only income as the weighting factor to calculate estimation.

2.13.3. NOTES

- This effects the Earthquake, Flood, and Hurricane models, but does not impact the Tsunami model.

2.14. HAZ-33840: Highway Bridges Year Reconstructed New Default Date Approach Implemented

2.14.1. USER STORY

As a Hazus user, I want to see the reconstruction date set as the year-built date if there is currently a 0 or erroneous data, instead of 1900, so that the reconstruction date is being assigned a more accurate value.

2.14.2. ACCEPTANCE CRITERIA

- Where Hazus would have assigned Hazus a year reconstructed date as 1900, the year-built date is now assigned instead.

2.14.3. NOTES

- In previous versions of Hazus, there is a cosmetic issue where 1900 is used as the default reconstructed date when the date available is a 0 or erroneous (i.e., 6, 7, 8, etc.) since those are not allowed during aggregation.

3. Earthquake Model Software Changes

The changes below apply to functionality in the Hazus Earthquake model.

3.1. HAZ-63209: EQ: Implemented U.S. Geological Survey (USGS) Data for Probabilistic Ground Motions

3.1.1. USER STORY

As a Risk Analyst, I want to use updated USGS probabilistic ground motions, so that I can classify hazard susceptibilities for earthquake using the latest authoritative data.

3.1.2. ACCEPTANCE CRITERIA

- Hazus USGS probabilistic ground motion data has been updated to 2018 for CONUS and 2021 for Hawaii.

3.1.3. NOTES

- Alaska (2007), Puerto Rico (2003), and the U.S. Virgin Islands (2003) were not updated with this version of Hazus.

3.2. HAZ-27926: EQ: Updated InEdu5PM1 and OutEdu5PM1 Parameters in the eqAnalParams to Match the Earthquake Technical Manual

3.2.1. USER STORY

As a Risk Analyst, I want to see the earthquake model match the manuals, so that I can confidently communicate the results and methodology.

3.2.2. ACCEPTANCE CRITERIA

- The InEdu5PM1 and OutEdu5PM1 parameters are updated to match the manuals.

3.3. HAZ-34091: EQ: Updated GMPE Fault Mechanisms to Match the Earthquake Technical Manual

3.3.1. USER STORY

As a Risk Analyst, I want the ground motion prediction equation (GMPE) fault mechanisms updated to match the Earthquake Technical Manual, so that the tools and guidance I use are consistent.

3.3.2. ACCEPTANCE CRITERIA

- GMPE is updated to match the manuals

3.4. HAZ-34092: EQ: Updated Seyhan and Stuart Soil Amplification Hazard Parameters to Match the Earthquake Technical Manual

3.4.1. USER STORY

As a Risk Analyst, I want the Seyhan and Stuart soil amplification hazard parameters to match the technical manual documentation, so that the tools and guidance I use are consistent.

3.4.2. ACCEPTANCE CRITERIA

- Seyhan and Stuart soil amplification hazard parameters match tech manual.

3.5. HAZ-34093: EQ: Updated Light Rail Direct Current Power Substation Fragilities to Match the Earthquake Technical Manual

3.5.1. USER STORY

As a Risk Analyst, I want the Light Rail Direct Current Power Substation fragilities for anchored and unanchored to match the technical manual documentation, so that the tools and guidance I use are consistent.

3.5.2. ACCEPTANCE CRITERIA

- Light Rail Direct Current Power Substation fragilities are updated to match the Inventory Technical Manual.

3.6. HAZ-34094: EQ: Updated PGA Fragility Median Rows for Bus, Port, and Ferry Facilities to Match the Earthquake Technical Manual

3.6.1. USER STORY

As a Risk Analyst, I want the bus, port, and ferry facilities to have updated PGA fragility median rows of to match the technical manual documentation, so that the tools and guidance I use are consistent.

3.6.2. ACCEPTANCE CRITERIA

- Earthquake model updated for Bus, Port, and Ferry facilities PGA fragility median rows to match manual.

3.6.3. NOTES

- Anchored equipment damage functions are not currently available in Hazus 6.0. Please contact the Hazus Help Desk if you have additional questions.

3.7. HAZ-34095: EQ: Updated Highway Bridge HWB25 Shaking Values to Match the Earthquake Technical Manual

3.7.1. USER STORY

As a Risk Analyst, I want the Highway Bridge HWB25 shaking values in SQL to match the technical manual documentation, so that the tools and guidance I use are consistent.

3.7.2. ACCEPTANCE CRITERIA

- Earthquake model updated for Highway Bridge HWB25 shaking values to match manuals.

3.8. HAZ-34097: EQ: Updated Water Treatment Plant Fragilities to Match the Earthquake Technical Manual

3.8.1. USER STORY

As a Risk Analyst, I want the Water Treatment Plant Fragilities SQL Tables to match the technical manual documentation, so that the tools and guidance I use are consistent.

3.8.2. ACCEPTANCE CRITERIA

- Earthquake model updated for Water Treatment Plant Fragilities to match manuals.

3.8.3. NOTES

- Anchored equipment damage functions are not currently available in Hazus 6.0. Please contact the Hazus Help Desk if you have additional questions.

3.9. HAZ-34098: EQ: Updated Fuel Tank Farms PGA Fragility Functions to Match the Earthquake Technical Manual

3.9.1. USER STORY

As a Risk Analyst, I want the Fuel Tank Farms (OTF1 and OTF2) Fragility Functions to match the technical manual documentation, so that the tools and guidance I use are consistent.

3.9.2. ACCEPTANCE CRITERIA

- Earthquake model updated for Fuel Tank Farms (OTF1 and OTF2) so that PGA Fragility Functions match manuals.

3.9.3. NOTES

- Anchored equipment damage functions are not currently available in Hazus 6.0. Please contact the Hazus Help Desk if you have additional questions.

3.10. HAZ-34099: EQ: Updated Low Voltage (ESSL) Substation Fragilities to Match the Earthquake Technical Manual

3.10.1. USER STORY

As a Risk Analyst, I want the Low Voltage (ESSL) Substation Fragilities in SQL to match the technical manual documentation, so that the tools and guidance I use are consistent.

3.10.2. ACCEPTANCE CRITERIA

- Earthquake model updated for Low Voltage (ESSL) Substation Fragilities to match manuals.

3.11. HAZ-34100: EQ: Updated Distribution Circuit Fragilities to Match the Earthquake Technical Manual

3.11.1. USER STORY

As a Risk Analyst, I want the Distribution Circuit Fragilities for EDC1 and EDC2 to match the Earthquake Technical Manual, so that the tools and guidance I use are consistent.

3.11.2. ACCEPTANCE CRITERIA

- Earthquake model Distribution Circuit Fragilities were updated for EDC1 and EDC2 to match manuals.

3.11.3. NOTES

- Anchored equipment damage functions are not currently available in Hazus 6.0. Please contact the Hazus Help Desk if you have additional questions.

3.12. HAZ-34101: EQ: Updated Small Generation Facilities (EPPS) to Match the Earthquake Technical Manual

3.12.1. USER STORY

As a Risk Analyst, I want the Small Generation Facilities (EPPS) SQL Fragilities to match the technical manual documentation, so that the tools and guidance I use are consistent.

3.12.2. ACCEPTANCE CRITERIA

- Earthquake model updated for Small Generation Facilities Fragilities to match manuals.

3.12.3. NOTES

- Anchored equipment damage functions are not currently available in Hazus 6.0. Please contact the Hazus Help Desk if you have additional questions.

3.13. HAZ-34102: EQ: Updated Fragilities for Wells (PWE) to Match the Earthquake Technical Manual

3.13.1. USER STORY

As a Risk Analyst, I want the Wells (PWE) SQL Fragilities to Match Tech Manual Documentation, so that the tools and guidance I use are consistent.

3.13.2. ACCEPTANCE CRITERIA

- Earthquake model updated for Wells Fragilities to match manuals.

3.14. HAZ-34103: EQ: Updated Dispatch Facility Fragilities with Backup Power to Match the Earthquake Technical Manual

3.14.1. USER STORY

As a Risk Analyst, I want the Dispatch Facilities Fragilities with Backup Power to match the technical manual documentation, so that the tools and guidance I use are consistent.

3.14.2. ACCEPTANCE CRITERIA

- Earthquake model updated for Dispatch Facilities Fragilities with Backup Power to match manuals.

3.14.3. NOTES

- Anchored equipment damage functions are not currently available in Hazus 6.0. Please contact the Hazus Help Desk if you have additional questions.

3.15. HAZ-63637: EQ: Corrected the RM1L Debris Analysis Parameters to Match the Earthquake Technical Manual

3.15.1. USER STORY

As a Risk Analyst, I want the typo in the structural percentage of reinforced concrete and steel debris for RM1L Extensive category fixed, so that I can confidently interpret results.

3.15.2. ACCEPTANCE CRITERIA

- Corrected the value for the RM1L debris analysis parameter to be 25%, not 250%.

3.15.3. NOTES

- There was a typo in Hazus 5.1 for the structural percentage of reinforced concrete and steel debris for RM1L Extensive category that was previously listed at 250% but is now correct at 25%.

3.16. HAZ-63649: EQ: Updated Damage Algorithms for Fuel Facilities to Match the Earthquake Technical Manual

3.16.1. USER STORY

As a Risk Analyst, I want to have the technical manuals match the algorithms used in the Hazus damage functions, so that I can confidently interpret earthquake results.

3.16.2. ACCEPTANCE CRITERIA

- Earthquake model updated for Damage Algorithms for Fuel Facilities to match manuals.

3.16.3. NOTES

- Anchored equipment damage functions are not currently available in Hazus 6.0. Please contact the Hazus Help Desk if you have additional questions.

3.17. HAZ-65712: EQ: Updated Economic Loss Parameters for All Utility Facilities to Match the Earthquake Technical Manual

3.17.1. USER STORY

As a Risk Analyst, I want the Economic Loss Parameters for All Utility Facilities to match the technical manual documentation, so that the tools and guidance I use are consistent.

3.17.2. ACCEPTANCE CRITERIA

- Earthquake model updated for Economic Loss Parameters for All Utility Facilities to match manuals.

3.17.3. NOTES

- Anchored equipment damage functions are not currently available in Hazus 6.0. Please contact the Hazus Help Desk if you have additional questions.

3.18. HAZ-65713: EQ: Updated Port Restoration Functions to Match the Earthquake Technical Manual

3.18.1. USER STORY

As a Risk Analyst, I want the median and betas for port facilities to be corrected to match EQ Tech Manual, so that the tools and guidance I use are consistent.

3.18.2. ACCEPTANCE CRITERIA

- Earthquake model updated for Port Restoration Functions to match manuals.

3.18.3. NOTES

- Anchored equipment damage functions are not currently available in Hazus 6.0. Please contact the Hazus Help Desk if you have additional questions.

3.19. HAZ-65630: EQ: Update Tract Level Distribution Line Data (water, sewer, and gas) for All States

3.19.1. USER STORY

As a Hazus user, I want to see updated pipeline lengths for potable water pipelines, natural gas pipelines, and wastewater pipelines so that I am using current data in my risk assessments.

3.19.2. ACCEPTANCE CRITERIA

- Update pipeline lengths for eqPotableWaterDL, eqNaturalGasDL, and eqWasteWaterDL based on new Census Tract street lengths.

3.19.3. NOTES

- For eqPotableWaterDL: updated based on new Tract street length. Equals street length with 80% brittle, 20% ductile.
- For eqNaturalGasDL: updated based on new Tract street length. Is 40% of street length with 10% brittle, 90% ductile.
- For eqWasteWaterDL: updated based on new Tract street length. Is 60% of street length with 60% brittle, 40% ductile.

4. Flood Model Software Changes

The changes below apply to functionality in the Hazus Flood model.

4.1. HAZ-66661: FL: Updated syHazus Program Data for the Flood Model

4.1.1. USER STORY

As a Risk Analyst, I want to be able to use updated NFIP Community data, watersheds, and flood mapping schemes in Hazus, so that I can aggregate Flood Study Regions using recent data that accurately reflects my study area.

4.1.2. ACCEPTANCE CRITERIA

- The NFIP Community data, watersheds, and flood mapping schemes are updated in the syHazus database.

4.2. HAZ-66809: FL: Disabled the Hazus Flood Vehicle Module

4.2.1. USER STORY

As a Risk Analyst, I want the Hazus Flood Vehicle Module data to be removed, so that I am not using outdated methods and data.

4.2.2. ACCEPTANCE CRITERIA

- Data tables for the Hazus Flood Vehicle Module are removed

4.2.3. NOTES

- The previous dataset for this module used 2010 U.S. Census data that is no longer supplied in the 2020 U.S. Census data. Instead of completely disabling the module, the data was removed from the tables. We did this so that if a user has recent data values for the fields necessary to run the module, they can update the tables manually with their user-supplied values.

4.3. HAZ-63631: FL: Updated Utility System and User-Defined Facilities (UDF) Depth Damage Functions (DDF) to Select the Correct DDF when Provided by the User

4.3.1. USER STORY

As a Risk Analyst, I want to be able to assign user-supplied depth damage functions (DDFs), so that I can run a more accurate analysis with user-supplied data.

4.3.2. ACCEPTANCE CRITERIA

- When a user supplies a DDF, the new DDF is used and not the default.

4.4. HAZ-63683: FL: Update the Default Coastal A-Zone Damage Function to Match the Flood Technical Manual

4.4.1. USER STORY

As a Risk Analyst, I want to use accurate default damage functions assigned in Hazus, so that I have confidence in results, and they are consistent with the methodology.

4.4.2. ACCEPTANCE CRITERIA

- The default Coastal A-Zone damage function for RES1, 1 floor with basement, is changed from ID 114 to ID 106, assigning the appropriate damage function.

4.5. HAZ-63687: FL: Updated Essential Facility Functional Depths to Match the Inventory Technical Manual for the Flood Model

4.5.1. USER STORY

As a Risk Analyst, I want to see the Hazus damage functions for essential facilities match the Inventory Technical Manual, so that the tools and guidance I use are consistent.

4.5.2. ACCEPTANCE CRITERIA

- Fire stations, Police stations, and EOCs are updated to use the correct functional depth based on the Inventory Technical Manual when running a Hazus flood analysis.

4.6. HAZ-66955: FL: Corrected the 1/3-Arcsecond Digital Elevation Model (DEM) Download Error and Updated The National Map (TNM) Website Notification

4.6.1. USER STORY

As a Risk Analyst, I want to be able to obtain the latest USGS DEM tiles from the TNM website, so that I can run an analysis with best available data

4.6.2. ACCEPTANCE CRITERIA

- Website location is updated so users can obtain the latest USGS DEM tiles, and the error message references the correct website.

4.7. HAZ-64855: FL: Updated Shelter Parameters Required for Implementing the Hazus Demographics 2022 New Year-Built by Decade Columns

4.7.1. USER STORY

As a Risk Analyst, I want to have the new Demographics data including pre and post FIRM information in Hazus, so that I get more accurate loss assessments.

4.7.2. ACCEPTANCE CRITERIA

- New columns for Built00to09, Built10to13, BuiltAfter13, and change Built90to98 to 99 are handled in the flood stored procedures for the shelter module and pre- and post-FIRM building percentage calculations.

5. Hurricane Model Software Changes

The changes below apply to functionality in the Hazus Hurricane model.

5.1. HAZ-63283: HU: Disabled the Hurrevac .stm FTP Download Scenario Option and Updated How Files are Imported into Hazus

5.1.1. USER STORY

As a Risk Analyst, I want to be able to reliably download the new Hurrevac HVX web files using the Hurricane Hazard Import Tool (HHIT) and import them into Hazus, so that I can run a hurricane analysis with publicly available hazard data.

5.1.2. ACCEPTANCE CRITERIA

- Built-in Hurrevac FTP download scenario wizard option has been disabled and text is updated to direct users to HHIT for storm tract and wind field parameters needed for wind field generation information.

5.1.3. NOTES

Hurrevac files are no longer being stored as .stm files and users will need to utilize HHIT to access and validate Hurrevac HVX web storm files in Hazus.

5.2. HAZ-66895: HU: Updated Hurricane Hazard Data

5.2.1. USER STORY

As a Risk Analyst, I want to use updated hurricane wind hazard data for a hurricane analysis, so that I can be confident in my hurricane risk results.

5.2.2. ACCEPTANCE CRITERIA

- Program files for historic hurricane hazard data is updated in syHazus including distance to coast, .bin files in each state 'HU' folder, and surface roughness terrain data.

5.2.3. NOTES

- Updated three probabilistic wind event sets using 2020 census tract centroids:
    - Continental U.S. (CONUS): 300,000 years; flat, open terrain
    - Hawaii: 100,000 years
    - Puerto Rico and the U.S. Virgin Islands: 100,000 years

- Updated historical wind event sets using 2020 census tract centroids:
    - Total number of historical storms is 207
    - CONUS: 204 historical events from 1900 to 2021; flat, open terrain
    - Hawaii: Hurricane Iniki (1992) only
    - Puerto Rico and the U.S. Virgin Islands: 26 historical events from 1900 to 2021; all of these storms also appear in the CONUS historical event list except for Hurricanes Marilyn (1995) and Maria (2017)
- Updated distance inland from coast values to 2020 dasymetric census tract centroids for user-defined storms in all 36 azimuthal directions
- Updated surface roughness values by 2020 census block and census tract using most recent National Land Cover Databases (land use category and tree canopy percentage) up to and including NLCD 2019
- Dasymetric census blocks and tracts were used to develop the surface roughness values to ensure that the average roughness's are representative of developed areas
- See table below for specific data sources by region:

Region	Land Cover Data	Tree Canopy Data
CONUS	NLCD 2019 Land Cover (CONUS)	NCLD 2016 USFS Tree Canopy Cover (CONUS)
Hawaii	USGS Carbon Assessment of Hawaii (CAH) Land Cover Map (2017)	NCLD 2016 USFS Tree Canopy Cover (HAWAII)
Puerto Rico	NLCD 2001 Land Cover (PUERTO RICO)	NLCD 2016 USFS Tree Canopy Cover (PUERTO RICO)
U.S. Virgin Islands	Virgin Islands Land Use/Land Cover Data Layer (University of Virgin Islands, 2020)	NLCD 2016 USFS Tree Canopy Cover (PUERTO RICO)

5.3. HAZ-66898: HU: Updated Hurricane Hazard Data Tree Debris Collection Factors and Tree Density

5.3.1. USER STORY

As a Risk Analyst, I want to use updated tree debris collection factors and density data for a hurricane analysis, so that I can run a more accurate analysis.

5.3.2. ACCEPTANCE CRITERIA

- Hurricane hazard data for tree debris and density are updated in syHazus database.

5.3.3. NOTES

- Updated right-of-way tree debris collection factors by 2020 census block and census tract for estimating eligible tree debris.
- Tree type, stems per acre and height distribution parameters by 2020 census block and census tract using most recent Forest Inventory Analysis data as of 2021 and NLCD tree canopy percentage data listed in the table above.

6. Tsunami Model Software Changes

The changes below apply to functionality in the Hazus Tsunami model.

6.1. HAZ-75156: TS: Updated User Defined Facility (UDF) Non-Structural and Content Loss Damage State Probabilities to Match the Tsunami Technical Manual

6.1.1. USER STORY

As a Risk Analyst, I want to see accurate non-structural and content losses for moderate water depths, so that I can confidently communicate the results and methodology.

6.1.2. ACCEPTANCE CRITERIA

- UDF non-structural and content loss errors in the tsupUDFUpdDDSPs and tsupUDFUpdPDs stored procedures have been corrected to match manuals for the discrete and exceedance damage state probabilities.

7. Hazus 6.0 Model Limitations

The sections below describe Hazus model limitations.

7.1. General Limitations

- Importing inventories through the Hazus GUI is not supported and CDMS should be used. If editing lists of inventories greater than 1,000 rows, the Row Limit in the settings.xml will need to be edited.

- Hazus 4.2.3, 5.0 and 5.1 Study Regions are all allowed by Hazus 6.0 Import and Export functionality; however, results can only be viewed and exported. Mapping layers or re-running the analysis is not supported due to the census boundary changes.

- Tsunami only analysis is available in the U.S. Pacific Territories of American Samoa, Guam, and the Northern Mariana Islands.

- When building Study Regions for Hawaii, Puerto Rico, or the U.S. Virgin Islands, no other States should be included since they utilize damage functions specific for their inventories.

- Components of independently developed data sets in the baseline inventory data might not line up on maps, for example, the placement of bridges and roads, and facilities. This situation can be addressed by updating the default inventory data with user supplied data.

7.2. Earthquake Model Limitations

- After running Annualized Loss Analysis on large regions, the region may close when viewing the results for the first time. Please reopen the region and all results will be saved and accessible.

- When using large (>0.5gb) or very detailed (i.e., 1-arcsecond or higher) resolution liquefaction or landslide susceptibility maps, they may fail to add susceptibility values to all inventory items, especially polyline. Keeping hazard maps as single part, rather than multi-part or dissolved feature classes will improve performance when adding hazard map data. If your hazard maps are already dissolved, the Esri multipart to single part Geoprocessing Tool may be applied.

7.3. Flood Model Limitations

- Users cannot view the year built by decade data values from the Inventory → Demographics menu in the flood model. They may be observed in SQL Server Management Studio, ArcCatalog or the other hazard modules.

- Hazus will import flood depth grids from ArcGRID, GeoTIFF, IMG, or fgdb rasters converting them to projected ArcGRID's in WGS84 UTM and mask them to the Study Region boundary.

However, user's with very large grids (>0.5GB) should convert them to ArcGRID and project them outside of Hazus to save processing time, drive space, and to improve reliability. Very large (>2GB) depth grids may need to be broken up into smaller regions depending on computing resources.

- Due to the lack of default riverine data for hydrologic analysis, users in the State of Hawaii (except Honolulu County), U.S. Virgin Islands and parts of Alaska and Puerto Rico will be unable to perform hydrologic analyses. These users may still compute the riverine flood hazard; however, the specific return period and suite of return period's options will be unavailable. Instead, specific discharge or user provided depth grids should be input.

- When running the hydrology analysis, the recommended limitation is 125-reaches to ensure completion.

- When performing a level 1 coastal flood analysis, we recommend removing small offshore islands from the coastline and assess them separately if required since transects from these may cross other transects and interfere with the analysis.

7.4. Hurricane Model Limitations

- Probabilistic loss estimates for large Study Regions of 2,000 census tracts or blocks may require several hours of analysis time to complete.

- After running hurricane probabilistic scenarios for Hawaii or the U.S. Virgin Islands ArcMap may close, however, all results are saved and available when the region is reopened.

- User-supplied and Hazus modeled combined wind and hurricane surge can be analyzed for a single event hurricane scenario, but it cannot be run for a probabilistic hurricane hazard.

- Very large, combined wind and surge regions (e.g., Miami-Dade or larger) may exceed SQL server express database size limits (10GB). This limit is reached during the wind loss modeling step.

- Combined hurricane wind and surge loss is not supported for the U.S. Virgin Islands or Puerto Rico; however, they can be run separately using the coastal flood model.

7.5. Tsunami Model Limitations

- The current version of the Hazus Tsunami model does not estimate damage, loss, and functionality for Essential Facilities and Lifeline Infrastructure, Shelter Requirements, Debris, or Indirect economic losses.