



Hazus 5.1

Release Notes

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FEMA

HAZUS™

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1. Overview

Hazus 5.1 was released on October 29, 2021. This version includes 21 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 limitations associated with a given software change. Changes are identified using a key (HAZ-XXX) that helps the Hazus Team track important information related to development projects. Hazus 5.1 includes the following general updates: For any questions related to the Hazus 5.1 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 5.1 enhancements.

Software Architecture Notes

- Hazus uses Windows Authentication for Microsoft SQL Server 2019 for its backend database.
- Hazus Package Region (HPR) files created in previous versions (4.2 and newer) of Microsoft SQL Server can be imported into Hazus 5.1.

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-1060: Establish backwards compatibility between Hazus 5.1 and Older Versions of Hazus Study Regions

2.1.1. USER STORY

As a Risk Analyst, I want to be able to open HPRs created using prior versions of Hazus in Hazus 5.1 so that I still have access to valuable risk assessment work after upgrading to the latest version of Hazus.

2.1.2. ACCEPTANCE CRITERIA

- Hazus 4.2 and newer Study Regions (HPRs) open in Hazus 5.1 with identical functionality.

2.2. HAZ-1018: Remove the UDF Datasets for Kenai, AK, Tillamook, OR and Grays Harbor, WA

2.2.1. USER STORY

As a Hazus User, I want outdated User Defined Facilities data removed, so that I can confidently run an analysis using the latest available data.

2.2.2. ACCEPTANCE CRITERIA

- UDF Datasets for Kenai, AK, Tillamook, OR and Grays Harbor, WA are removed from State Databases.

2.3. HAZ-1004: Technical Enabler: Windows Authentication

2.3.1. USER STORY

As a Risk Analyst, I want to use the SQL Server 2019 using my Windows Authentication credentials so that I don't need a separate username and password for SQL Server 2019.

2.3.2. ACCEPTANCE CRITERIA

- SQL Server 2019 Windows Authentication is implemented

2.4. HAZ-809: Update Hazus – Remove Obsolete Source Code

2.4.1. USER STORY

As a Developer, I want to create a clean version of up-to-date SQL scripts as well as remove obsolete

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source code from Hazus 5.1 stream, so that security vulnerabilities associated with outdated pieces of code are not flagged and the effort to remediate the security vulnerabilities is reduced.

2.4.2. ACCEPTANCE CRITERIA

- A clean version of up-to-date SQL scripts is created
- Obsolete source code from Hazus 5.1 stream is removed

2.5. HAZ-963: Bulk Changes to Get Security Vulnerabilities Resolved

2.5.1. USER STORY

As a Risk Analyst, I want to use secure code, so that my machine is protected against hackers.

2.5.2. ACCEPTANCE CRITERIA

- Fortify Scan shows lower number of security vulnerabilities

2.6. HAZ-791: Deprecate Unused Stored Procedures and Implement Alternatives to Dangerous Function: xp_cmdshell Hazus

2.6.1. USER STORY

As a Risk Analyst, I want to use secure code, so that my machine is protected against hackers.

2.6.2. ACCEPTANCE CRITERIA

- Solution for xp_cmdshell security vulnerability is identified and implemented

2.7. HAZ-958: Security Vulnerability: Critical (6) - Cross-Site Scripting: DOM

2.7.1. USER STORY

As a Risk Analyst, I want to use secure code, so that my machine is protected against hackers.

2.7.2. ACCEPTANCE CRITERIA

- Fortify Scan does not show any Cross-Site Scripting: DOM Critical vulnerabilities

2.8. HAZ-877: VS Security Vulnerability: Critical (8) - Buffer Overflow: Format String

2.8.1. USER STORY

As a Risk Analyst, I want to use secure code, so that my machine is protected against hackers.

2.8.2. ACCEPTANCE CRITERIA

- Fortify scan shows 0 Buffer overflow: format string critical security vulnerabilities

2.9. HAZ-876: VS Security Vulnerability: Critical (11) - Buffer Overflow

2.9.1. USER STORY

As a Risk Analyst, I want to use secure code, so that my machine is protected against hackers.

2.9.2. ACCEPTANCE CRITERIA

- Fortify scan shows 0 Buffer overflow critical security vulnerabilities

3. Flood Model Software Changes

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

3.1. HAZ-1044: FL: Errors in Shelter Module Stored Procedure

3.1.1. USER STORY

As a Risk Analyst, I want reliable results for people needing shelter estimates that align with the methodology in the Technical Manual, so that I have confidence in results and they are consistent with the methodology.

3.1.2. ACCEPTANCE CRITERIA

- The income categories are defined based on the percent of the population in each income category and not the number of households as specified in the Technical Manual.

3.2. HAZ-39: FL: Implement bypass of the USGS API to directly obtain the staged DEM tiles

3.2.1. USER STORY

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

3.2.2. ACCEPTANCE CRITERIA

- Latest USGS DEM tiles are obtained from AWS

4. Hurricane Model Software Changes

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

4.1. **HAZ-1139: HU: Northeast Inland Mapping Schemes is Missing the 100% Asphalt Shingle Roof Type**

4.1.1. **USER STORY**

As a Risk Analyst, I want to resolve errors in hurricane losses as a results of missing roof type information for Northeast Inland schemes introduced in Hazus 5.0, so that results are reliable.

4.1.2. **ACCEPTANCE CRITERIA**

- Negative losses in some damage state categories no longer occur in inland areas of the Northeast.

4.2. **HAZ-955: DLL version issues and circular references with Hurricane and Tsunami modules**

4.2.1. **USER STORY**

As a Developer, I want to resolve a circular reference in the Hurricane and Tsunami modules, so that the code is easily maintained going forward.

4.2.2. **ACCEPTANCE CRITERIA**

- New library is created and circular references in Tsunami and Hurricane modules are resolved.

5. Tsunami Model Software Changes

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

5.1. **HAZ-955: DLL version issues and circular references with Hurricane and Tsunami modules**

5.1.1. **USER STORY**

As a Developer, I want to resolve a circular reference in the Hurricane and Tsunami modules, so that the code is easily maintained going forward.

5.1.2. **ACCEPTANCE CRITERIA**

- New library is created and circular references in Tsunami and Hurricane modules are resolved.

6. Earthquake Model Software Changes

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

6.1. HAZ-801: EQ: Improve Reliability of Hazard Map Addition

6.1.1. USER STORY

As a Risk Analyst, I want to be able to add detailed hazard map data, so that I can correctly classify hazard susceptibilities for essential facilities and pipeline systems

6.1.2. ACCEPTANCE CRITERIA

- Users are able to add landslide and liquefaction susceptibility from detailed hazard maps

6.1.3. NOTES

- Running on dissolved statewide feature classes (single part) is much slower than multipart, especially for polyline analysis since spatial indexing is not leveraged. We recommend that users with dissolved data run the single part to multi part Esri Geoprocessing Tool before ingesting in Hazus.
- A new defect was discovered where some polyline datasets with multipart features are failing to add susceptibility values (eg. OR natural gas pipelines). HAZ-818 was created to either clean up the data or add to the Stored Procedure to handle multi-line strings or both
- Very detailed landslide data, such as that created from lidar data rasters, that cannot be clipped or handled outside of Hazus in ArcGIS fgdb will not work in Hazus.

6.2. HAZ-818: EQ Natural Gas Pipeline data have multiline strings

6.2.1. USER STORY

As a Risk Analyst, I want to be able to have hazards data be applied to multi-line strings so that analysis can continue.

6.2.2. ACCEPTANCE CRITERIA

- Pipeline results complete where multi-line strings exist
- Multi-line strings do not cause errors when hazard data are added

6.2.3. NOTES

The November 2019 HIFLD data updates contain some data with multi-line strings (eg. OR and WA). Pipeline results are not completing for OR and WA. Multi-line strings could be removed when updating inventory and the Stored Procedure fix outlined in HAZ-801 will allow hazard data to be applied to multi-line strings so analysis will not fail.

6.3. HAZ-269: EQ Missing Slight and Moderate Damage State Probabilities for Transportation Segments

6.3.1. USER STORY

As a Risk Analyst, I want to have a complete set of damage states for transportation line segments, so that I can have accurate and complete transportation loss results.

6.3.2. ACCEPTANCE CRITERIA

- Discrete EQ damage states will be available for Slight and Moderate and be used to estimate functionality and economic losses for transportation segment and facility losses that are based on permanent ground deformation only.

6.3.3. NOTES

Airport Runways, Railway, Lightrail and Highway segment result tables were missing discrete damage state probabilities for PDsSlight and PDsModerate. These damages are driven by PGD from landslide and liquefaction.

6.4. HAZ-25: EQ Airport Runway PGD threshold fragilities don't match tech manual

6.4.1. USER STORY

As Risk Analyst, I want to have the Airport Runway PGD threshold fragilities match tech manual, so that I am confident in the methodology and the results for Hazard Analysis.

6.4.2. ACCEPTANCE CRITERIA

- Airport Runway PGD threshold fragilities match tech manual

6.5. HAZ-16: EQ Bus, Port, Ferry and Air Facilities Ground Deformation Fragilities in SQL Don't Match Tech Manual

6.5.1. USER STORY

As a Risk Analyst, I want to have a Bus, Port, Ferry and Air Facilities Ground Deformation Fragilities in Hazus to match the technical manuals, so that I can have accurate and complete loss results.

6.5.2. ACCEPTANCE CRITERIA

- Ground Deformation Fragility Functions match the Manual

6.6. HAZ-1167: EQ Align Earthquake Specific Building Type Exposure with New Hurricane Mapping Schemes for PR

6.6.1. USER STORY

As a Risk Analyst, I want to have earthquake and hurricane building types aligned, so that I can have accurate and consistent loss results.

6.6.2. ACCEPTANCE CRITERIA

- Single-family earthquake and hurricane building type distributions match for PR

6.6.3. NOTES

Earthquake specific building type exposures were adjusted resulting in fewer concrete and more unreinforced masonry single-family homes based on local expertise and the known prevalence of informal construction to align with recent hurricane mapping scheme updates.