

Risk MAP CDS

Hazus 4.2.3 (Service Pack 3)

User Release Notes

Version 2.0

May 31, 2019

## Document Management History

### Revision History

Version Number	Date	Summary of Changes	Team/Author
0.1	05/15/2019	Draft version	Risk MAP CDS
0.2	05/15/2019	Incorporates initial FEMA review	Risk MAP CDS
1.0	05/27/2019	Incorporates IV&V review	Risk MAP CDS
2.0	05/30/2019	Incorporates FEMA and External Affairs review	Risk MAP CDS

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## PLEASE READ FIRST IF YOU ARE SEEING THIS AS PART OF THE PATCH INSTALLATION

Hazus 4.2 Service Pack 3 (4.2.3) requires that Hazus 4.2, Hazus 4.2 Service Pack 1 (4.2.1) and Hazus 4.2 Service Pack 2 (4.2.2) have already been run and successfully installed. Hazus 4.2.3 contains several study region and State Database changes, and these changes are detailed in the “How to Apply” section of the table below. The State Database changes require download of new State Databases. Direct download links to Hazus software, Service Packs and State Databases are available from: <https://msc.fema.gov/portal/resources/hazus>. Users will be prompted to apply changes to any existing Hazus 4.2.2 study regions during patch installation or the user may decline the changes to existing study regions, if preferred. If no valid and existing regions are found, the region update tool will automatically close. No database changes will be automatically applied – users must apply them using the steps detailed in the table below.

Data Change Type	How to Apply
Database schema changes for existing study regions	<ul style="list-style-type: none"> <li>• When prompted during patch installation, select the existing Hazus 4.2.2 study regions to be updated to 4.2.3 schema.</li> <li>• Any 4.2.2 study regions you do not select will not be updated.</li> <li>• Any new 4.2.3 study regions you create will contain these changes.</li> <li>• If a non-updated version of 4.2.2 study region is imported after Hazus 4.2.3 patch install, the updateDB.exe (typically in C:\Program Files (x86)\Hazus-MH) should be run on the newly imported region.</li> </ul>
Defect fixes which may impact results data	Open an existing or patched Hazus 4.2.3 study region after installation and re-run analysis to see updated results.
State Database updates	Download the new and updated Hazus 4.2.3 State Database(s) from the Map Service Center (MSC) <a href="https://msc.fema.gov/portal/resources/hazus">https://msc.fema.gov/portal/resources/hazus</a> , extract in the Hazus Data folder, and aggregate a new study region.

## 1. Introduction

Hazus Release 4.2 Service Pack 3 (Hazus 4.2.3) is a service pack release, implementing State Database updates as well as defect fixes and major enhancements, detailed below. Hazus 4.2.3 is compatible with ArcGIS 10.5.1 and is supported for 64-bit Windows 7, Windows 8.1, and Windows 10 operating systems.

Hazus 4.2.3 is released via the automatic update tool in the Hazus software, and users are prompted to download the patch upon opening the Hazus application. A copy of the patch is also made available at: [FEMA Flood Map Service Center \(MSC\) Hazus download webpage](#) for free public download. Updated State Databases are also available for download as of May 31, 2019.

The purpose of this document is to describe the functional changes and known issues found in the Hazus 4.2.3 release package and associated data updates.

## 2. Contents of the Release

### State Database Changes:

- Hazus State Databases have been updated using the latest version available at the time of this release of Homeland Infrastructure Foundation-Level Data (HIFLD) Open Essential Facility (<https://hifld-geoplatform.opendata.arcgis.com/>) datasets for care facilities, emergency operation centers, police stations, fire stations, and schools.
- All State Databases were updated except for AS, GU, MP, VI, FL and HI due to data gaps in HIFLD data for some of the Territories and previous enhancements provided by users in FL and HI.
- Hazus attributes were dynamically calculated using Python scripts to enable frequent future updates. Detailed documentation can be obtained from [hazus-outreach@riskmapcds.com](mailto:hazus-outreach@riskmapcds.com). Highlights include:
  - Building areas for schools were estimated from numbers of students, teachers, and staff where available, and if number of students were 0, no area was assigned. Occupancy estimates are from FEMA P58, otherwise defaults were used.
  - Building areas for hospitals were estimated from number of beds where available, otherwise defaults were used.
  - Replacement costs in thousands (\$K) are estimated based on area for structure value only (not contents) using 2018 RS Means by occupancy type including County nonresidential adjustment factors.
  - Default earthquake building types and seismic design levels were assigned based on median year-built data from the U.S. Census 2010, seismic zonation and benchmark years for code adoption, as well as delineation of 2017 urbanized areas

(>50,000 persons) from U.S. Census.

- New HIFLD feature classes were added for each facility type incorporating both the HIFLD attributes and calculated Hazus attributes which can be useful for UDF modelling and other assessments.
- A summary of the HIFLD Open data used to update the Hazus default State Data are provided in the table below:

<b>HIFLD Open</b>		<b>Hazus</b>
Care Facilities	<ul style="list-style-type: none"> <li>• Hospitals: <a href="https://hifld-geoplatform.opendata.arcgis.com/datasets/hospitals">https://hifld-geoplatform.opendata.arcgis.com/datasets/hospitals</a></li> <li>• Veterans' Health Administration Medical Facilities: <a href="https://hifld-geoplatform.opendata.arcgis.com/datasets/veterans-health-administration-medical-facilities">https://hifld-geoplatform.opendata.arcgis.com/datasets/veterans-health-administration-medical-facilities</a></li> </ul>	hzCareFlty, eqCareFlty, flCareFlty
Schools	<ul style="list-style-type: none"> <li>• Public Schools: <a href="https://hifld-geoplatform.opendata.arcgis.com/datasets/public-schools">https://hifld-geoplatform.opendata.arcgis.com/datasets/public-schools</a></li> <li>• Private Schools: <a href="https://hifld-geoplatform.opendata.arcgis.com/datasets/private-schools">https://hifld-geoplatform.opendata.arcgis.com/datasets/private-schools</a></li> <li>• Colleges and Universities: <a href="https://hifld-geoplatform.opendata.arcgis.com/datasets/colleges-and-universities">https://hifld-geoplatform.opendata.arcgis.com/datasets/colleges-and-universities</a></li> <li>• Supplemental Colleges: <a href="https://hifld-geoplatform.opendata.arcgis.com/datasets/supplemental-colleges">https://hifld-geoplatform.opendata.arcgis.com/datasets/supplemental-colleges</a></li> </ul>	hzSchools, eqSchools, flSchools
Fire Stations	<ul style="list-style-type: none"> <li>• Fire Stations: <a href="https://hifld-geoplatform.opendata.arcgis.com/datasets/fire-stations">https://hifld-geoplatform.opendata.arcgis.com/datasets/fire-stations</a></li> </ul>	hzFireStation, eqFireStation, flFireStation
Police Stations	<ul style="list-style-type: none"> <li>• Local Law Enforcement Locations: <a href="https://hifld-geoplatform.opendata.arcgis.com/datasets/local-law-enforcement-locations">https://hifld-geoplatform.opendata.arcgis.com/datasets/local-law-enforcement-locations</a></li> </ul>	hzPoliceStation, eqPoliceStation, flPoliceStation
Emergency Operations Centers	<ul style="list-style-type: none"> <li>• State Emergency Operations Centers (EOC): <a href="https://hifld-geoplatform.opendata.arcgis.com/datasets/state-emergency-operations-centers-eoc">https://hifld-geoplatform.opendata.arcgis.com/datasets/state-emergency-operations-centers-eoc</a></li> <li>• Local Emergency Operations Centers (EOC): <a href="https://hifld-geoplatform.opendata.arcgis.com/datasets/local-emergency-operations-centers-eoc">https://hifld-geoplatform.opendata.arcgis.com/datasets/local-emergency-operations-centers-eoc</a></li> <li>• Federal Emergency Management Agency (FEMA) Regional Headquarters: <a href="https://hifld-geoplatform.opendata.arcgis.com/datasets/federal-emergency-management-agency-fema-regional-headquarters">https://hifld-geoplatform.opendata.arcgis.com/datasets/federal-emergency-management-agency-fema-regional-headquarters</a></li> </ul>	hzEmergencyCtr, eqEmergencyCtr, flEmergencyCtr

*HIFLD Update Notes:*

- *Since Hazus loads the National HIFLD data into State Databases, any differences between State abbreviation and spatial location results in a limited number of dropped records from the HIFLD datasets.*
- *Multiple facilities may occur at the same building site for all essential facility types, such as when Elementary, Middle, and High Schools or Police Precincts share the same building. **This can result in overestimating exposure and losses.***

**Shell Items:**

- Hazus system State and County boundaries were aligned to ensure agreement when thematically mapped for all hazards.
- MetaData documents for all essential facility feature classes were updated.

**Flood Model:**

- Developed a new module to allow the use of user-supplied hurricane surge data for combined wind-surge loss deterministic scenarios. This allows the use of high-resolution hurricane surge products from authoritative providers or those developed using field observations during or after future landfalling hurricanes. This surge data may be provided in IMAGINE Image (.IMG), ArcGRID, File Geodatabase (.fgdb), and TIFF (.TIF) formats. *Note: Performance (processing time and disk space demand) is improved when grids are already projected and saved in the Hazus required format (ArcGRID, UTM projection, and WGS84 Datum).*
- Combined wind-surge losses are available for Census Blocks that intersect both the wind and user-supplied coastal surge depth grid.
- Corrected highway bridge depth damage function loss computation to align with highway bridge return period damage functions.

**Earthquake Model:**

- Improved results quality by correcting an issue where lower than expected ground motions occurred for facilities located along slivers between ShakeMap grid data.
- Corrected the Earthquake Quick Assessment Summary (QAS) report and provided a new summary table of losses based on FEMA Individual Assistance (IA) Preliminary Damage Assessment (PDA) categories. This enhances the Hazus capability to support other programs and will be useful when calibrating Hazus against observed loss data.
- Provided enhancements for handling of ShakeMap grid parameters. This includes the handling of special characters, error checking, and the creation of a new study region table to preserve the ShakeMap event parameters. These enhancements ensure seamless performance in future earthquakes including the preservation of the event parameters and ShakeMap version used in the Hazus analysis.

- Collapse rates for AEBM profiles associated with S5L and PC1 earthquake specific building types are corrected.
- Rental and relocation cost calculations are corrected to align with the AEBM Manual. Rental income losses are now \$0 when the building is 100% owner occupied.
- An issue where ground motions were NULL and losses exaggerated for tracts that fell outside the ShakeMap grid was fixed.
- The crashing of the earthquake analysis on multi-line segments was fixed.

### **Hurricane Model:**

- Updated Hurrevac and historic hurricane data with 2017 and 2018 hurricanes:
  - Hurrevac .stm historic storm files were updated with hurricanes Olivia, Florence, and Michael
  - Historic hurricane windfield, track, and surge model input files were developed and provided for Olivia, Florence, and Michael
  - Florence and Michael historic windfields are developed using FEMA NHRAP provided observed windfield data
- Hurricanes Irma and Maria historic windfield data for both CONUS and OCONUS were updated based on new FEMA NHRAP provided topographically enhanced windfield data.
- Enabled a new combined hurricane wind-surge loss capability based on combinations of user-supplied wind and user-supplied surge hazard data.
- The hurricane analysis graphic user interfaces (GUIs) were modified to support a user option to provide a “User-Supplied Coastal Surge Grid” and optimized to skip Hazus Level 1 surge model computations when this option is selected.
- Combined hurricane wind-surge loss results are provided for Census Blocks that intersect both the wind and surge hazard data.
- All existing Hazus Level 1 hurricane surge modelling remains for those areas or storms where surge depth grids are unavailable.
- Existing Hazus damage state descriptions for the Hurricane Quick Assessment Summary (QAS) reporting were updated using the FEMA Individual Assistance (IA) Preliminary Damage Assessment (PDA) categories.
- Hurricane specific State boundaries were updated to align with system County and State boundaries to ensure agreement for thematic mapping.

### **Tsunami Model:**

- Corrected an issue to ensure that user reductions to the evacuation walking speed reduction factors in the analysis parameter table will now correctly increase pedestrian travel times for populations over and under 65.



### 3. Known Issues

In addition to items listed above, this section outlines issues that are known to occur in Hazus 4.2.3 and were present prior to Hazus 4.2.3 development. Recommendations to address these issues are provided where applicable.

- Very large (>50K Census Blocks) study regions may trigger memory limitations when running wind losses for combined wind and surge analysis. It is recommended that users keep combined wind and surge analysis study regions under this threshold.
- Very high-resolution depth grids (<1/9<sup>th</sup> ArcSecond) in metropolitan areas may occasionally fail at the delineate floodplain step due to a known Esri Dissolve limitation. Lowering the resolution of the grid or limiting the size of the study region will address the issue.
- Large depth grids (>10GB) or those in State Plane coordinate systems commonly fail during Hazus User-Supplied Depth Grid processing and transformations. It is recommended that users in these cases transform their depth grid to their Hazus study region required UTM Zone projected coordinate system, and WGS84 datum. Exporting these as ArcGRID will also save Hazus processing time and prevent the creation of ArcGRID copies in the users HazardInput folder.
- Importing a very large (>10GB) or mixed resolution Digital Elevation Model may require the user to perform mosaic, resample, and transform operations outside of Hazus. For best results, the DEM should be in a UTM projected coordinate system, WGS84 datum, and in the ArcGRID raster format.
- Flood loss results for essential facilities in the results GUI state that the losses are USD when they are in thousands (\$K). The essential facility flood loss reports correctly state that losses are in thousands (\$K).
- Customized flood specific attributes (first floor heights, damage functions, etc.) for essential facilities in State Databases are not used. Rather, defaults are inserted on aggregation. Modifying the values after aggregation is an option until this can be addressed.
- Railway and Light Rail bridges do not produce results in the flood model. Continuous span highway bridges produce identical losses based on scour potential (U, 1, 2, 3).
- Occasionally, running Historic and Hurrevac storms in hurricane with the surge option enabled will cause an error during analysis. This is believed to be caused by incomplete SLOSH basin data, however a more thorough investigation is needed.
- When available, using the Historic storm option in hurricane over those in the Hurrevac database will provide more accurate results since Hazus provides additional parameters for Historic events useful for SLOSH modelling.
- Occasionally users have reported crashing at the Fire Following Earthquake analysis step in the earthquake model. Typically reopening and restarting analysis of out of date modules will repair the issue.

- Some users have noted that Hazus closes unexpectedly after running Average Annual Loss for Earthquake. Users can reopen the study region, and results will be populated as expected.
- When mapping Hazus inventory and results, the SQL layer, which is generated by Hazus, may not support ArcGIS modifications. It is recommended that the user right click and export the layer. This new, exported layer can be modified.
- CDMS users at the FEMA's Emergency Management Institute (EMI) and users with similar workstation security settings may be unable to export to Excel. Recommend users export as a geodatabase from CDMS, open using ArcGIS Desktop or MS Access, and then export to Excel.
- When comparing general building stock and vehicle losses by counts to other losses in the flood model (eg. \$'s, sqft) rounding of counts can result in lower than expected losses. Losses by counts are generally less reliable than other losses.

Please contact the Hazus Help Desk for any technical support questions: [hazus-support@riskmapcds.com](mailto:hazus-support@riskmapcds.com).