Risk MAP CDS

Hazus 3.2

User Release Notes

Version 1.0

October 31, 2016

Document Management History

Revision History

Version Number	Date	Summary of Changes	Team/Author
1.0	10/31/2016	Initial version	Risk MAP CDS

Table of Contents

1. Introduction

Hazus Release 3.2 is a full versioned software release, implementing both defect fixes and major enhancements, detailed below. Hazus 3.2 is compatible with ArcGIS 10.4 and is supported for 64-bit Windows 7 and Windows 8.1, and Windows 10 operating systems.

Hazus 3.2 will be released via the [FEMA Flood Map Service Center (MSC) Hazus download webpage](#) for free public download. Updated state databases will also be available for download. The scheduled release date is October 31, 2016.

The purpose of this document is to describe the functional changes and known issues found in the Hazus 3.2 release and associated data, installation, and compatibility updates.

2. Contents of the Release

Installation:

- When upgrading Hazus 3.1 to 3.2, users must first upgrade ArcGIS 10.2.2 to ArcGIS 10.4

- When installing ArcGIS 10.4, a patch must be applied for Hazus 3.2 to properly display ArcGIS attribute tables from the ArcMap Table of Contents. The patch is available at: http://support.esri.com/download/7427

- After uninstalling Hazus 3.1 or any other version of Hazus, it is always recommended to uninstall all Microsoft SQL Server components as well. To do this, go to Windows Control Panel → Uninstall Programs and remove any instances of Microsoft SQL Server or related products

- Users should use a location other than the root C:\ drive for extracting the HAZUS_APP zip. When extracting the zip file, extract the files to an existing folder, or a new folder such as C:\HazusApp.

Flood Model:

- **During testing, a latent defect in the Census Data was discovered where census blocks with a value of zero for MedianYearBuilt were not producing results. Analysis results from previous versions of Hazus going back beyond the Census 2010 data updates may be impacted by this. Users are advised to download the new state data provided with this release for all analyses moving forward. Note there are a small number of census blocks which contain exposure but will still produce zero-value results because of their very small size (eg. major highway interchanges). For the methodology used to correct the data, see Appendix D.**
- The User Defined Facilities Report under Results → Summary Reports was updated so that losses now display in the $1000s, instead of actual dollars as before
- Content values and resulting losses for UDFs are now based on user-supplied input for contents
- A glitch caused by the apostrophe in O'Brien County, IA was fixed to remove an

error thrown in the Flood Specific Occupancy Mapping dialog
- The Agriculture Exposure Report now populates correctly with results, instead of showing blank as before
- Intermittent issues with SQL locking and denying access to some files were addressed; this should reduce errors or crashes within the Hydrology and Hydraulics analysis
All reports were upgraded to Crystal Reports 2011 and enhanced to include updated Hazus logo graphics. The Global Summary Report was further enhanced to include graphical representations of results

Earthquake Model:

- The Debris Summary Report now opens correctly. Previously, some users saw a blank Fire Following Earthquake report
- All reports were upgraded to Crystal Reports 2011 and enhanced to include updated Hazus logo graphics. The Global Summary Report was further enhanced to include graphical representations of results
- A new hazard interface was added to the Earthquake Scenario Wizard to allow direct import of USGS ShakeMap products with an internet connection. **Please note: USGS limits the types of ShakeMaps available for download into Hazus. By default, Hazus will search for events occurring within the last 90 days and with a magnitude of 5.0 or greater. The 90 day window can be manually adjusted within Hazus (see Step 2 below), however it may benefit the user to check the USGS ShakeMap download archive (http://earthquake.usgs.gov/earthquakes/shakemap/list.php?y=2016) for event availability prior to setting up a study region.** Once an appropriate study region for using the direct import is set up, please use the following steps to obtain the correct ShakeMap:

    1. In the study region, go to Hazard → Scenario → Next and choose "Define a New Scenario"
   2. A new option has been added to Hazard Type Selection. Choose "USGS ShakeMap" and click Next:
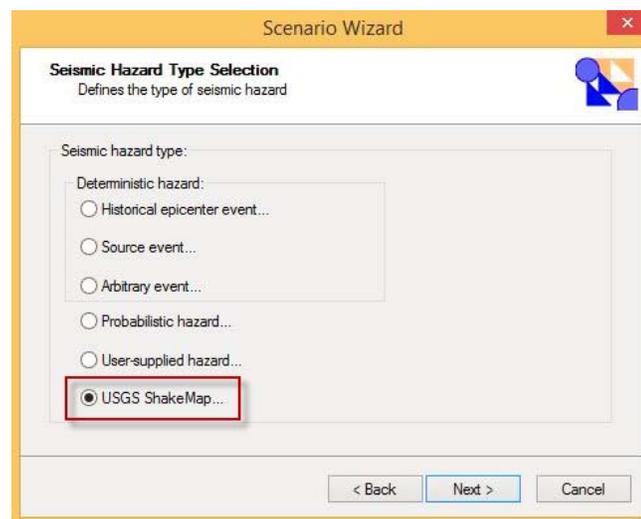
3. The ShakeMap Download window will open. Users can select a ShakeMap for download from the left pane, or adjust their USGS search parameters as needed. Highlighting an event in the left pane will display the properties and details in the two large windows on the right. **For some events, USGS may offer multiple grid files for download. In this case, a popup will appear with all available files asking the user to select one. A "preferred weight" value is provided for each file, and it is recommended the user select the largest preferred weight**. If a grid.xml file was downloaded previously and is stored on the local machine, users can re-import this file using the "Browse grid.xml" button:
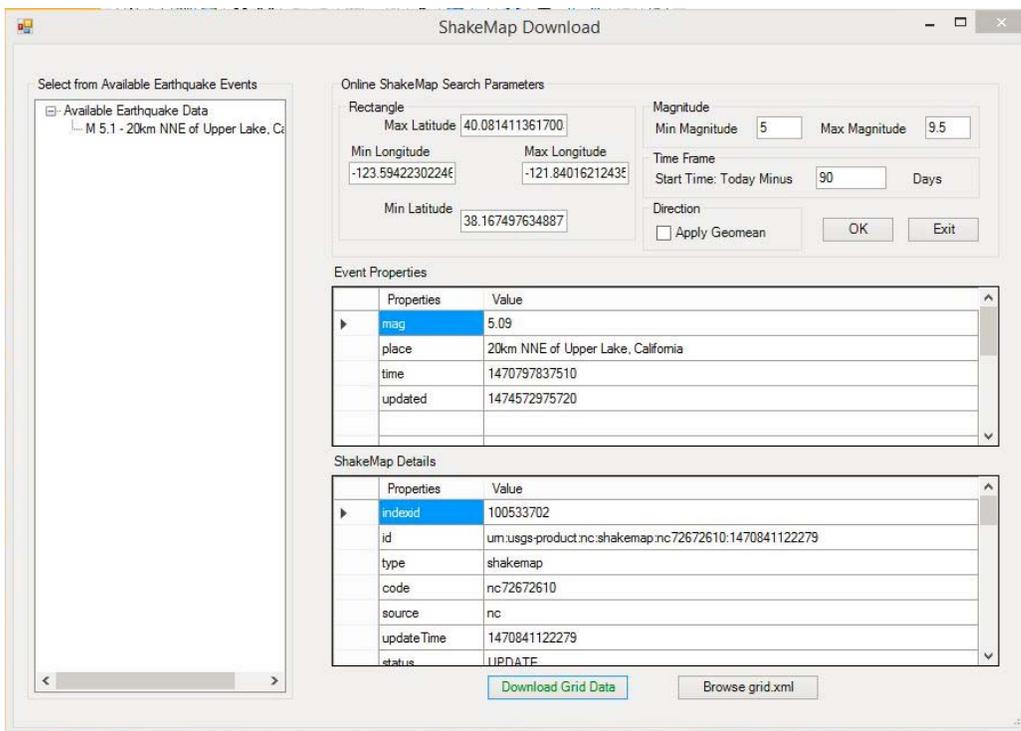

4. Once an event is selected, click "Download Grid Data" to import the ShakeMap data. A notice will appear to indicate the download is taking place. A notice that the download is "not responding" is dependent on the user's machine and does not mean the download has stopped. Please be patient; downloads can take up to 30 minutes to complete depending on the size of the event file.
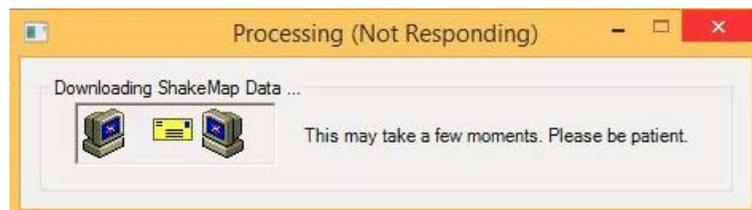
Occasionally, inconsistent labeling of data fields occurs within the USGS grid.xml file. Hazus will produce a series of error messages to notify the user. If this occurs, it is recommended the user select an alternative grid.xml file.
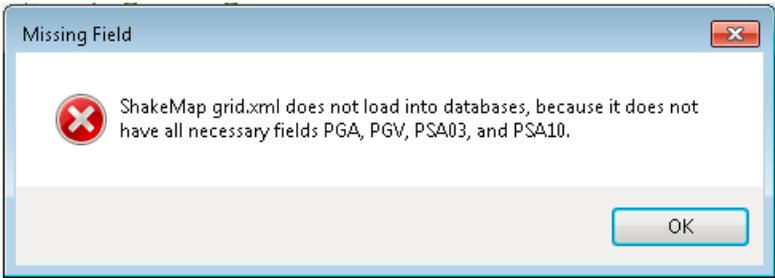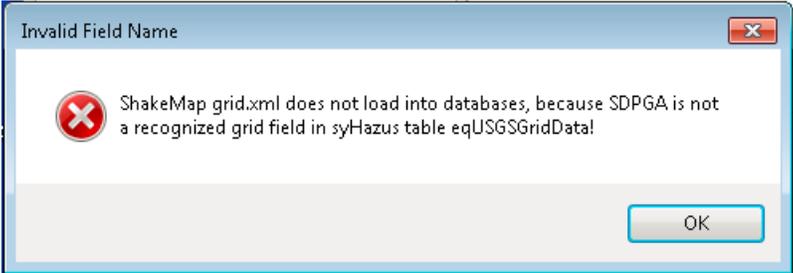
5. Once the download is complete, you will be guided through the rest of the Scenario Wizard as before. You will need to confirm the event parameters imported from ShakeMap before completing the wizard:
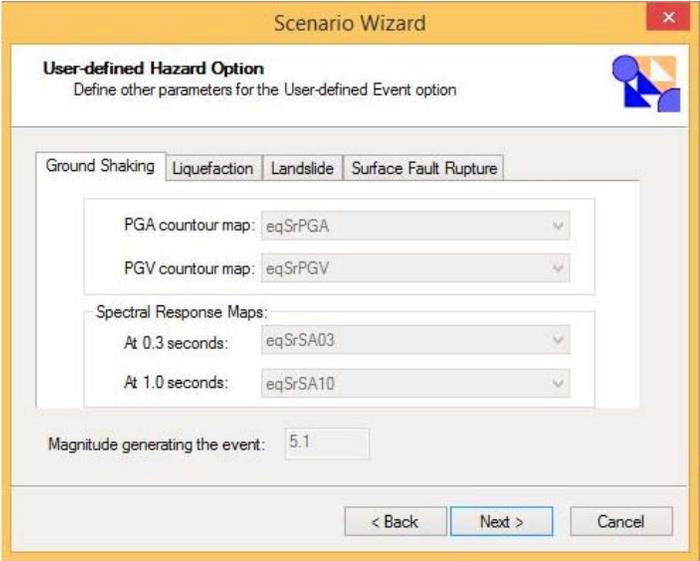
Hurricane Model:

- All reports were upgraded to Crystal Reports 2011 and enhanced to include updated Hazus logo graphics. The Global Summary Report was further enhanced to include graphical representations of results
- Please note, the following error may occur after clicking "Run" for Hurricane Analysis:
  "Error loading type library/DLL"
  This is a Windows issue and is not caused by Hazus. To remove the error, please ensure all Windows updates and patches have been applied to the machine

Shell and Utility Items:

- The entire Hazus application was upgraded to be compatible with ArcGIS 10.4. Additional changes were made to minimize the dependency on ArcGIS versions. For this reason, Hazus may be installed on and used on versions later than 10.4; however, these versions are not certified or supported by the Hazus program. Installation and use of Hazus on ArcGIS 10.4.1 is done at the user's risk
- In the backend code, ArcObject calls were reduced and replaced as much as possible to help modernize and simplify the software architecture. In earthquake, the calls were replaced with stored procedures. In flood, calls were replaced with ArcGIS Geoprocessing (GP) Tools. This eliminates duplication with the code, and allows troubleshooting and fixes to takes place in centralized procedures then propagate to parts of Hazus code where they are required.

CDMS and Data Changes:

- Major enhancements were made to CDMS data import capabilities:
  - Polyline data can now be imported to study regions through CDMS. Users will need to select the "life line" radio button on the home screen for to make sure of polyline import
  - UDF import to the UDF fields in the state databases is now supported by CDMS. Users wishing to use UDF in their study regions are advised to import the UDF through CDMS, then aggregate a study region, rather than using the UDF import options within the individual study regions
  - Auto-calculation of four required fields was added to CDMS, along with the option to edit the values produced by CDMS. This eases the import process for external data sources, such as HSIP, and improves the quality of imported data. For a listing of the fields and how they are calculated, see Appendix A
  - AEBM inventory data can now be imported through CDMS, provided the data belongs to one of the 16,000 profiles. CDMS will automatically generate your profile name based on the inventory data you input. Profile import and custom profile creation is not supported at this time. Hazus provides over 16,000 pre-populated profiles for imported AEBM data. Instructions for importing AEBM data into

CDMS are provided in Appendix B

- Before the data is pushed to the state database, a user may edit the values in the final table. A final validation process is then conducted on the data to ensure it is does not corrupt the state database

- **Due to ongoing issues with ArcGIS and recent changes made to CDMS import capability, the option to import MDB format UDF databases through the study region is no longer supported. Users wishing to import UDF data directly to the study region without CDMS must now convert their MDB file to a feature class using ArcCatalog. For instructions for exporting pipeline/lifeline data to a geodatabase from CDMS, see Appendix C**
- Import issues to the California state database were fixed
- All state data has been updated to include a value for the Median Year Built field based on the methodology described in Appendix D
- Study region aggregation was failing for places where <null> values were present in the BackupPower field; a default value of "0" was added instead of <null>
- For user data in a study region, Hazus limits the number of records visible at one time. This limit is set to 100,000 in Hazus 3.2. If you need to change this default setting to a higher value, use the following steps:
    1. Navigate to C:\Program Files (x86)\Hazus-MH and locate the file settings.xml
    2. **Create a copy of this file with a new name (example: settingsOriginal.xml) and save it in a separate location**
    3. **Open settings.xml in Notepad or XML Editor. Wordpad is not supported**
    4. Search for the settings for RowLimit, and change the limit to your desired number of records (in the screen shot, the default value of 100,000 is shown)

    ```
    <HazardFolderPath>C:\HazusData\HazardInput\</HazardFolderPath>
    <RegionVer>161616</RegionVer>
    <RowLimit>100000</RowLimit>
    <ServerName>FFX-PC-215\HAZUSPLUSSRVR</ServerName>
    <ServerStp>15</ServerStp>
    <SystemCatalog>syHazus</SystemCatalog>
    ```

    5. It is important to note that tampering with XML settings can permanently corrupt Hazus, and users make these changes at their own risk. Changing XML settings is not recommended or supported by the Hazus program. If Hazus does not work properly after editing settings.xml, please re-install Hazus from the MSC download package

3. Known Issues

This section outlines issues that are known to occur in Hazus 3.2, but were present prior to 3.2 development. Workarounds are provided where applicable.

- Opening a layer attribute table through the Table of Contents within Hazus has occasionally caused Hazus to crash in previous versions. With the upgrade to ArcGIS 10.4, Esri identified a bug where the attribute table crashes became much more frequent. A patch was provided by Esri for use in Hazus 3.2, and is now incorporated into this release. However, users should be aware that this issue may continue to occur on rare occasion. If the attribute table data is needed, a manual export of the data to a program outside of ArcMap or Hazus may be necessary
- A latent defect exists in the Hazus flood model which prevents Hazus from appropriately determining whether a riverine or coastal damage function should be used for a user-defined facility (UDF) in a combined riverine-coastal or coastal-only scenario. When working in coastal regions, an incorrect default damage function will be applied to an individual facility. Two workarounds are available:
  - Determine the correct damage function ID (3-digit unique identifier) from the damage function library according to the UDF characteristics, and whether a riverine or coastal hazard is being applied. Specify the damage function ID in the provided column within the UDF data entry window. Confirm the specific occupancy, number of stories, and foundation type (which indicates whether a basement is present) of the damage function matches that of the UDF.
  - In the damage function library, search for the desired depth damage function. Select this function (selected function will display in green in the preview window above the list of functions). Selected functions will also appear highlighted in yellow on the Structure/Contents/Inventory summary tabs. Hazus will apply the selected functions to the UDF list. Confirm the specific occupancy, number of stories, and whether a basement is present of the function matches those of the UDFs. Note: this bullet is applicable for UDF analysis only. Applying this workaround to GBS analysis is not recommended, and can result in incorrect GBS results.

- CDMS users at the FEMA's Emergency Management Institute (EMI) and users with similar workstation security settings may be unable to export to Excel. Please contact the Hazus Help Desk for a workaround: **hazus-support@riskmapcds.com**

- The table below lists the high priority latent defects which were identified during development or testing of 3.2. The term "latent" refers specifically to a defect that pre-existed and is reproducible in previous versions of the Hazus software (Hazus 3.1 or earlier). This is not a complete list of open defects in Hazus; however, users should be aware of these high-priority issues. Each item will be reviewed and prioritized to be addressed in later releases.

ID	Description	Functional Area
18969	Pipeline data does not export correctly from CDMS; no spatial data is created in the export	CDMS

18997	When running a riverine analysis for Hawaii, all reaches are problem reaches	Flood
19008	UDF analysis for coastal-only flood study regions will use riverine damage functions. To avoid this, use the workaround provided earlier in this section	Flood
18868	In a probabilistic hurricane analysis, wind speeds and building results decrease for the 1000-year return period compared to other return periods. The 1000-year event should have the highest wind speeds and worst damage	Hurricane
18893	Probabilistic hurricane analysis for Hawaii does not work.	Hurricane
18999	Losses to medium and large hospitals are disproportionately larger than losses for small hospitals	Hurricane
19041	New mapping schemes for essential facilities in hurricane are not saved, or applied to the individual facilities	Hurricane
19050	Damage to manufactured housing following a hurricane is less than that of more sturdy structures	Hurricane
19055	The Deep Water Surge option for surge analysis fails for user-defined or Hurrevac storms	Hurricane

Appendix A

Steps for Estimating Building Replacement Values (Cost):
For all Non-Residential:
BuildingArea(sfeet) * MeansCost[hzReplacementCost]*
MeansAdjNonRes[hzMeansCountyLocationFactor]

For all Residential Except RES1:
BuildingArea(sfeet) * MeansCost[hzReplacementCost]*
MeansAdjRes[hzMeansCountyLocationFactor]

For RES1:
BuildingArea(sfeet) *
{{Economy 2 story AverageBaseCost* hzRes1ConstructionWt(Economy) based on
hzCensusBlock{IncomeRatio} +
Average 2 story AverageBaseCost* hzRes1ConstructionWt(Average) based on
hzCensusBlock{IncomeRatio} +
Custom 2 story AverageBaseCost* hzRes1ConstructionWt(Custom) based on
hzCensusBlock{IncomeRatio} +
Luxury 2 story AverageBaseCost* hzRes1ConstructionWt(Luxury) based on
hzCensusBlock{IncomeRatio}}}
* MeansAdjRes[hzMeansCountyLocationFactor]
This step may be optimized/simplified by attaching the IncomeRatio from hzCensusBlock to the
UDF points and by precalculating the hzRes1ConstructionWt proportions for the 5 income ratio
categories.

Step for Estimating Building Content Replacement Values (ContentCost):
BuildingValue(Cost)* ContentValPct[hzPctContentOfStructureValue]

Location of tables needed for above calculations:
Hazus_model_data tables:
hzReplacementCost: contains the 2014 MeansCost by sqfoot for all occupancy types but RES1.
hzRes1ConstructionWt: Contains the proportions (weights) assigned to Luxury, Custom, Average,
Economy based on IncomeRatio for RES1 base cost.
hzMeansConstructSchemes: Contains ID's for Luxury(4), Custom(3), Average(2), Economy(1)
hzPctContentOfStructureValue: Contains ContentValPct based on building value by occupancy
type.
hzRes1ReplCost: This table contains a field misnamed "AverageBasementCost" which is really
supposed to be AverageBaseCost for RES1 by construction type and height class as corrected in
the GUI:

	Description	HeightClass	AverageBaseCost	
1	Economy	1 story	84.83	
2	Economy	2 story	90.11	
3	Economy	3-story	90.11	
4	Economy	Split level	83.59	
5	Average	1 story	115.20	
6	Average	2 story	112.40	
7	Average	3-story	118.19	
8	Average	Split level	104.01	
9	Custom	1 story	143.55	
10	Custom	2 story	141.49	
11	Custom	3-story	147.21	
12	Custom	Split level	131.78	
13	Luxury	1 story	175.81	
14	Luxury	2 story	168.80	
15	Luxury	3-story	174.21	
16	Luxury	Split level	156.91	

Note the relatively low variation by stories (so we use 2 story as default) but high variation from Economy through Luxury. Therefore, it's important to try to incorporate these construction classes when estimating replacement values.

StateDB tables:
hzMeansCountyLocationFactor: Contains the RS Means adjustment for non-residential MeansAdjNonRes and residential MeansAdjRes for each county FIPs
hzCensusBlock: Provides the IncomeRatio used in assigning the RES1 Economy, Average, Custom, Luxury proportions

Area Defaults:
To assign default Area, when not provided by user the Hazus defaults by occupancy type can be assigned from here:
hzSqftFactors in Hazus_model_data

Appendix B

Importing AEBM data through CDMS

1. Open CDMS and specify the state database you wish to work with. Select the button from the CDMS home screen for "Import into CDMS Repository from File"
2. Select the radio button for Point data
3. Select your source data – options include MDB, SHP, or XLS file formats for files that contain AEBM data
4. For Inventory Category, select AEBM
5. For Inventory Dataset, select Advanced Engineering Building Module

6. Click Continue
7. Choose the table to be imported, and the field containing a unique Hazus ID if available. In the example provided, this field is named "qAebmId." If your data does not contain a Hazus ID field, choose "NO HAZUS ID"
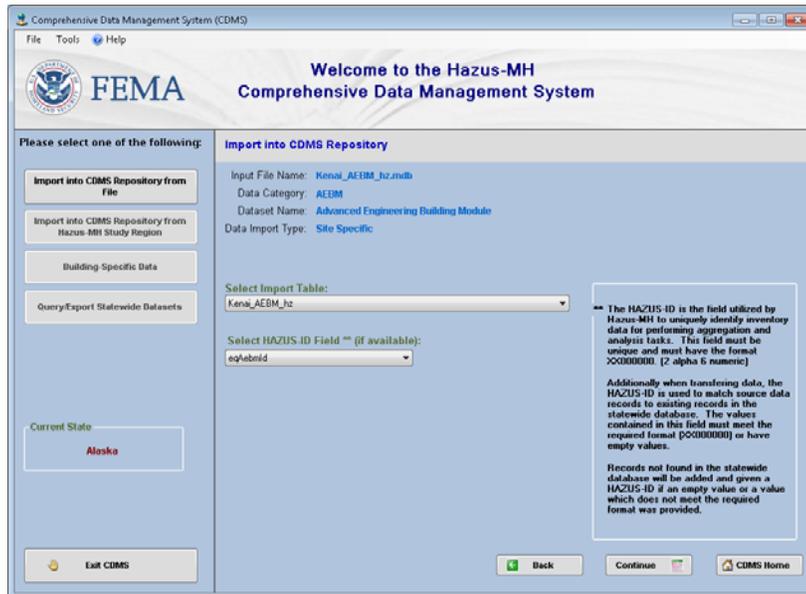
8. Click Continue
9. Proceed with field mapping as required. For fields that aren't mapped, CDMS will provide a popup with unmapped fields where a default value will be used. Click Yes to proceed.
10. CDMS will offer the user an option to use ShakeMap Beta values for AEBM. Select Yes or No to proceed, then click Continue.
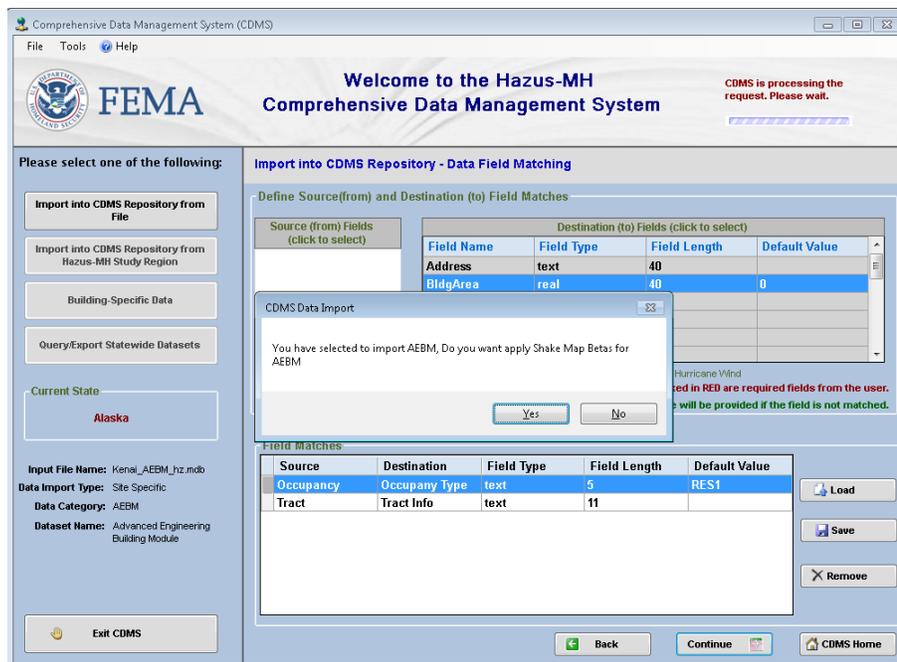
11. Once the data is successfully imported, the following message is displayed:
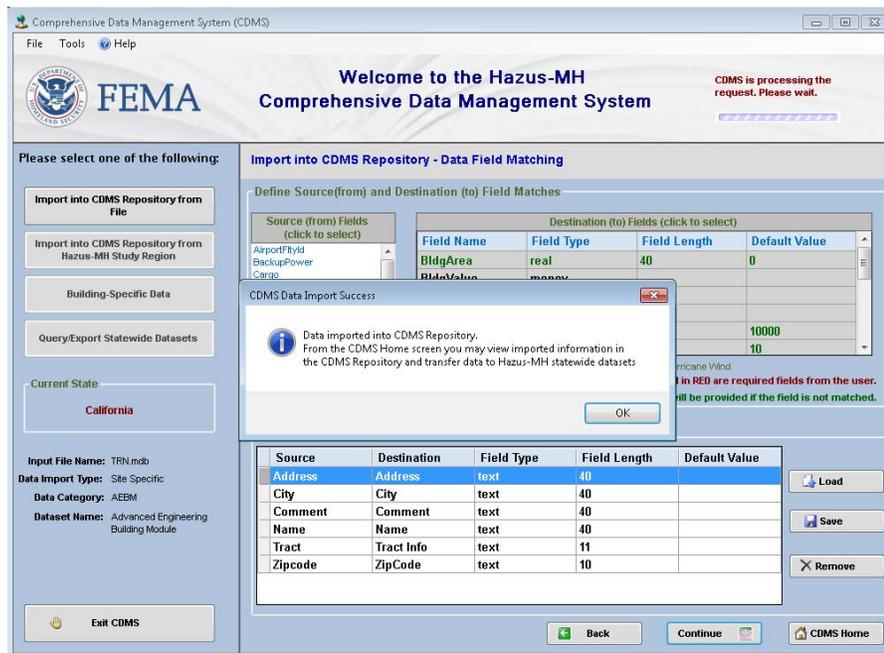
12. Click OK and CDMS will direct you to the standard page for moving the new data to the State Repository. Click Transfer to Statewide Dataset when you are ready to transfer your AEBM data.

13. OPTIONAL: CDMS will autopopulate your profile name in the state database based on attributes if your imported data. Hazus currently contains over 16,000 profile combinations. At this time, custom profile names cannot be created. To confirm that your profile name has been assigned, use a SQL database tool (SQL Server, SQL Management studio, etc.) and select records from the [<StateName>].[DBO.[eqAebm] table. Check the ProfileName column

14. OPTIONAL: To confirm your AEBM data is included in your study region, aggregate a study region for the state where the AEBM data was added. In a SQL database tool, view the eqAebm and hzAebm tables. The eqAebm table should have the ProfileName & Shape column updated. The hzAebm table must have the Shape field populated.

Appendix C

Exporting a life line table into a geodatabase from CDMS database using ArcCatalog:

In order to export a life line table to a geodatabase an ArcCatalog database connection is required
The following steps describe how to create a database connection in ArcCatalog:

1. Start ArcCatalog

2. Double-click the Database Connections folder in the Catalog tree to expand it

3. Double-click Add Database Connection. The Database Connection dialog box opens:
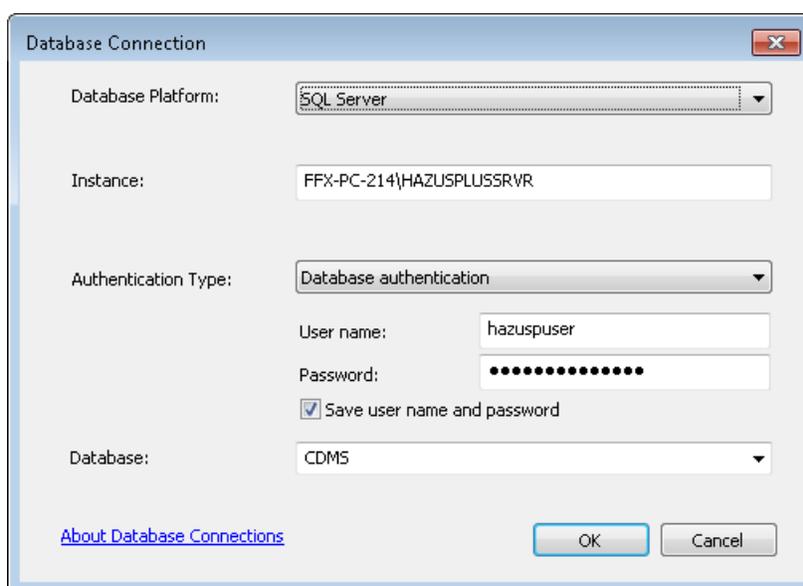
4. Provide the appropriate connection information:

Database platform: SQL Server
Instance: \<machine name>\HAZUSPLUSSRVR
Authentication Type: Database authentication
User name: hazuspuser
Password: gohazusplus_01
Database: CDMS

This will create a connection with the name as - Connection to \<you machine name>.sde. Right click and rename it to CDMS.sde for future purposes (or any name for your convenience).

5. In ArcCatalog, locate the database connection created in Step 4 and double click

6. Scroll to the table that you need to export and right click. Use the following menu option:
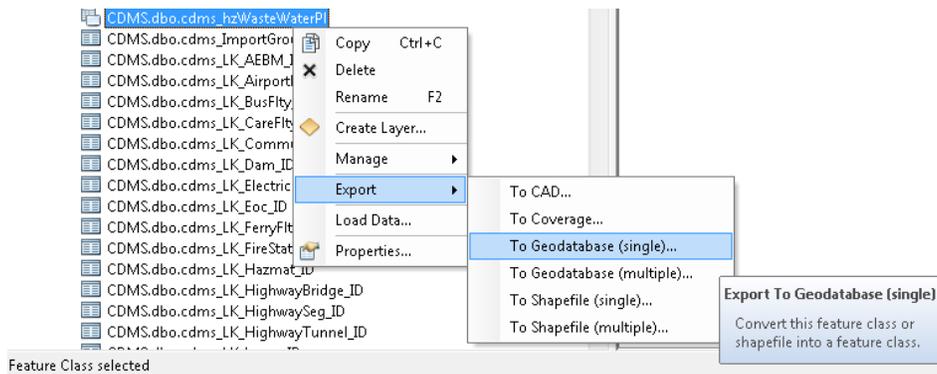
7. Choose the Export to Geodatabase (single)

8. Select the output (existing) .mdb file where you would like to export the selected life line data. Note, your Output Location does not need to match the screen shot. Select a location of your choice:
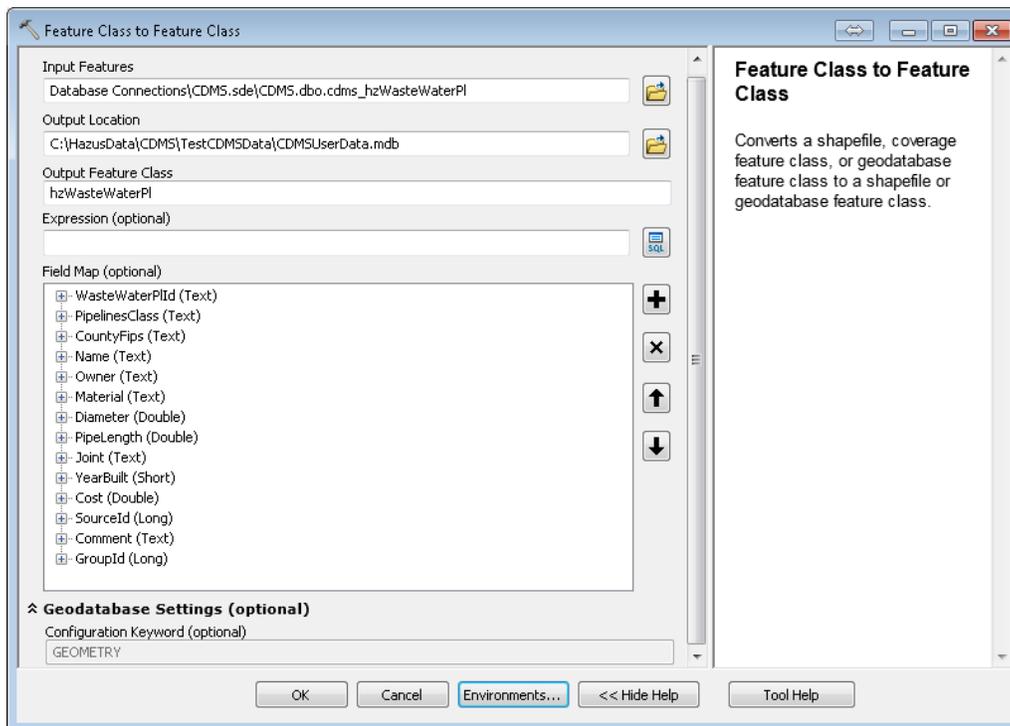
9. The geometry field can be exported by setting the Geodatabase environment setting as follows:
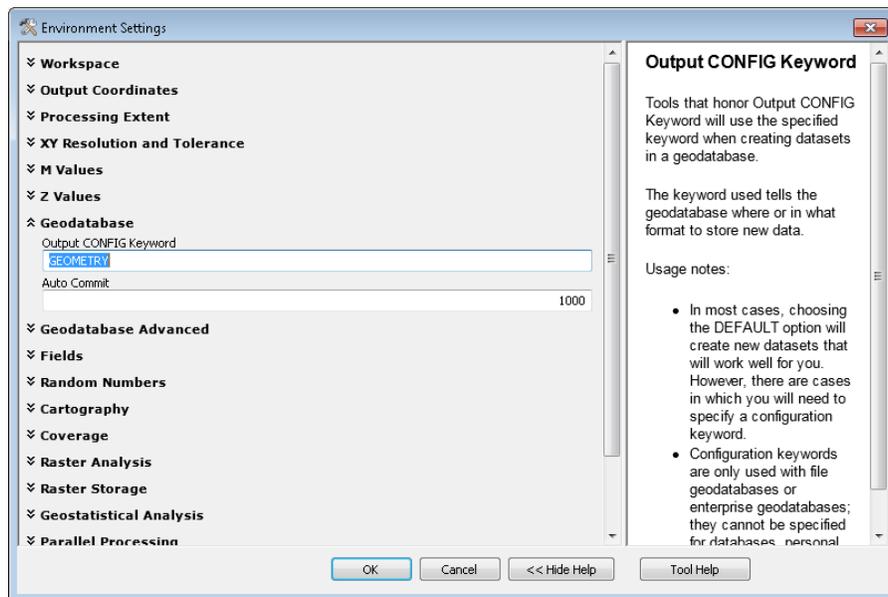
10. Click OK. The following message flashes /rotates on the right corner of the screen within ArcCatalog:
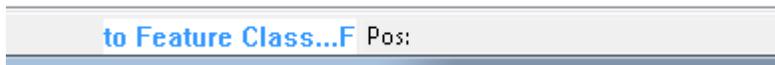
11. The following message appears when the file has been exported successfully. You can now open the .mdb into which the data was exported:

Appendix D

Fix methodology for MedianYearBuilt in hzDemographicsB and hzDemographicsT tables of state databases. An automated script (fixMedianYearBuilt.sql) was used in SQL Management Studio:

Hazus calculates depreciation on buildings using the following formula for each inundated Census Block:

Depreciation = Current Year (minus) MedianYearBuilt

For a large number of blocks, the value for Median Year Built was calculated using all fields. This resulted in many zero-values being included in the median calculation, and given the same weight as reasonable years (1900 CE or more recent). While some structures in the United States are several hundred years old, these are relatively rare, and non-existent prior to around 1700. Including zeros in the median calculation resulted in MedianYearBuilt values from 1700 CE or much earlier. Similarly, using very old MedianYearBuilt in the depreciation calculation above resulted in unreasonably high depreciation values.

Calculations contained in the script are detailed below and represent a consensus between FEMA, CDS, and IV&V:

1. Take the average MedianYearBuilt of all non-zero census blocks in a tract; update the tract-level MedianYearBuilt with that value
2. Propagate the tract-level MedianYearBuilt value to all zero-value census blocks with the tract
3. In the special case where all MedianYearBuild values in a block are zero, and the tract is also zero, compute the county-level average using all census tracts, then propagate that average to the tracts and blocks

Procedure used for data update:

1. In SSMS attach a <StateDB>; for example CA, WA, etc and use that <StateDB> (here: NC) in #2.
2. Execute the SQL script (or hit F5) to create the 4 database objects (DBOs).
3. To see the *apriori MedianYearBuilt status* for both tables execute (F5) the following two lines
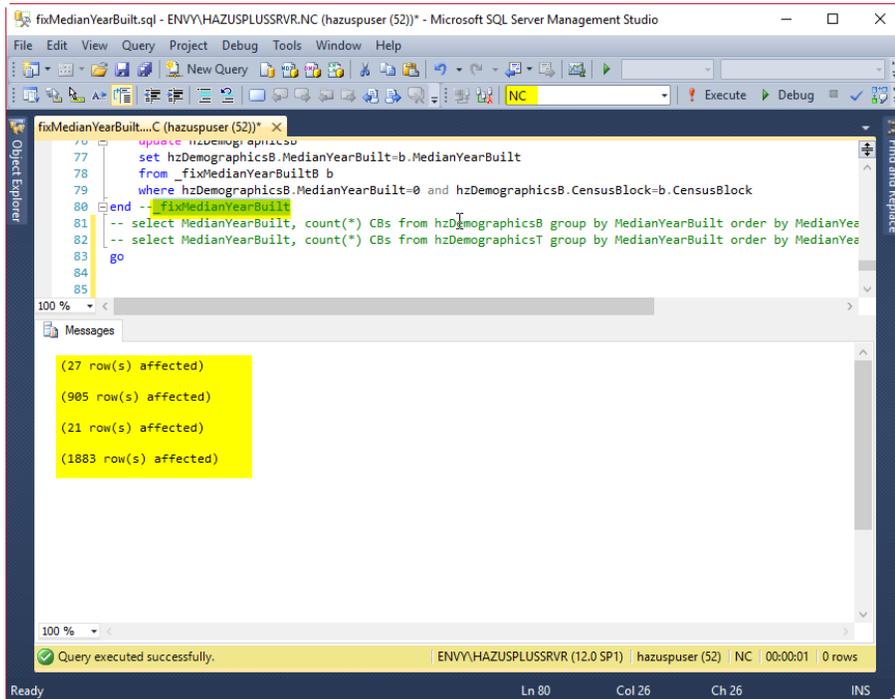
```
select MedianYearBuilt, count(*) CBs from hzDemographicsB
group by MedianYearBuilt order by MedianYearBuilt

select MedianYearBuilt, count(*) CTs from hzDemographicsT
group by MedianYearBuilt order by MedianYearBuilt
```
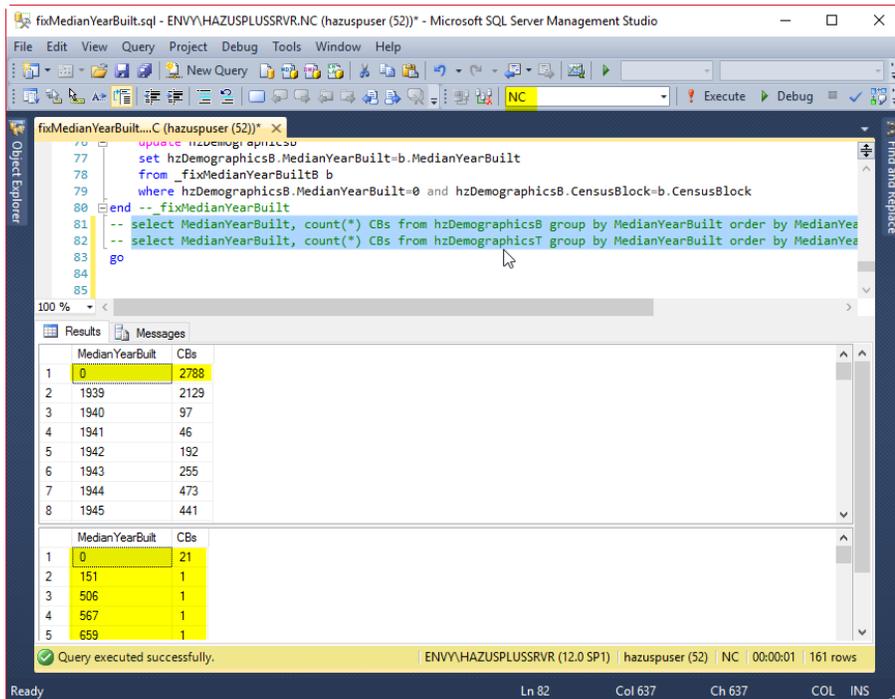
4. Execute the stored procedure _fixMedianYearBuilt by selecting it and hitting F5.

   Note: On 1st execution there will be very likely 4 non-0 updates. On subsequent (repeated) execution those 4 updates are going to affect 0 updates.

5. To see the *aposteriori MedianYearBuilt status* for both tables execute (F5) the same two lines

```
select MedianYearBuilt, count(*) CBs from hzDemographicsB
group by MedianYearBuilt order by MedianYearBuilt

select MedianYearBuilt, count(*) CTs from hzDemographicsT
group by MedianYearBuilt order by MedianYearBuilt
```


Note: Census Blocks and Tracts MedianYearBuilt are now realistic numbers.