



**US Army Corps
of Engineers** ®
Institute for
Water Resources



IWR-GeoFIT Geospatial Floodplain Inventory Tool

GIS Administration Manual

**BETA Version 1.1
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Foreword

This setup guide is intended to aide GIS professionals with the process of setting up and configuring geospatial data layers, maps, and option settings for use with the ***US Army Corps of Engineers Institute of Water Resources - Geospatial Floodplain Inventory Tool (IWR-GeoFIT)***. IWR-GeoFIT is designed to automate the business process of inventory collection and valuation of structures for individual flood damage feasibility studies. Each study that uses the application will therefore have unique sets of data that must be loaded onto the personal computers hosting a GeoFIT installation. As a general overview, the basic required data layers will be identical in structure for every study utilizing GeoFIT, however the data itself will vary in size, geographic location, spatial coordinate systems and attribution. This requires that a GIS professional be able understand what these requirements are and be able to translate any preliminary data from either electronic or hard copy sources into the standard spatial data formats defined by the GeoFIT system before GeoFIT can utilize project data properly.

Acknowledgments

Design and Development of IWR-GeoFIT was a team effort involving several public and private individuals. The New Orleans District Corps of Engineers (CE-MVN) economists including Keven Lovetro, Brian Maestri, Regina Ware, Lisa Leonard, Toni Baldini, Matt Napolitano and Allan Hebert helped to develop GeoFIT's predecessor with the support of CE-MVN's Enterprise GIS program. The predecessor, originally developed in 2004, was a mobile geographic inventory tool used to automate flood control feasibility studies within MVN's jurisdiction. Greg Gagliano, a private consultant with HDR Engineering was responsible for the initial development of New Orleans tool and the programming, documentation and technical design and development of IWR-GeoFIT. Stuart Davis and Lillian Almodovar of IWR were mainly responsible for researching the need to automate the structure inventory process Corps-wide and coordinating the efforts for redesign, development and deployment of IWR-GeoFIT. Christine Nelson and Judy Walker of URS Corporation along with previously mentioned MVN economists were responsible for the testing and bug reporting while working on inventory collection efforts in south Louisiana. At the time of deployment, David Moser is currently the chief economist for the Corps of Engineers and also gave IWR-GeoFIT its name.

US Army Corps of Engineers IWR-GeoFIT GIS Administration Guide

PREREQUISITES

GIS Software Requirements

FIGS is designed as a stand-alone application powered by ESRI ArcObjects for ArcView 9.1. Although the stand alone application only requires ArcGIS Engine, required data and file creation will require:

- ArcView 9.1
- Microsoft Access version 2000 or later

GIS Skill Requirements

Professionals attempting to setup project data should have an intermediate to advance knowledge of ESRI's ArcGIS 9.x software including experience with the following:

- Working with ESRI Personal Geodatabases
- Digitizing geographic features in ArcMap
- Attributing geographic features
- Conversion of vector datasets (*i.e. shapefile or CAD to Geodatabase*)
- Basic Raster Imagery processing
- Basic Cartography in ArcGIS
- Creation of ArcMap Document files (.mxd)
- Knowledge of spatial coordinate systems for local study areas and how to reproject data and/or assign them to data layers and map documents.
- Familiarity with ESRI Address Locators

GETTING STARTED

Resources

Before starting to build your project data for use with GeoFIT, it is important to be aware of available resources in the form of file templates and sample project data available in the GeoFIT installation directory. Under the %GeoFIT Application Directory%\data\ folder you will find the following *template* and *samples* sub directories. These folders contain the following files:

data\templates\

File Name	Description
GeoFITTemplate.mdb	Personal Geodatabase template containing all required datasets and feature classes for use with GeoFIT
GeoFITMap.mxd	Map Document loaded with required data layers and suggested symbology for each layer
GeoFITTemplate.mxt	Map Template loaded with required data layers and suggested symbology for each layer. Creates a new document.
GeoFITTemplateLocator.loc	Address Locator pointing to a suggested street address layer within GeoFITTemplate.mdb

***A separate download of sample Data includes: Personal Geodatabase (.mdb), ArcMap Document (.mxd), Address Locator (.loc), Raster Imagery (.sid)**

Folder Name	Description
Smallville\	Contains sample data, locator and map document from a fictional sample project in South Louisiana.
Smallville\Smallville.mdb	Smallville project Geodatabase before field collection
Smallville\Smallville_VALUES.mdb	Smallville project Geodatabase after field collection and values are assigned. This dataset is ready for HEC-FDA export.

Project File Setup

The First preliminary step before identifying and gathering project-specific data is to create your required project files based on template data, store them in a working directory and configure the files for use with your data.

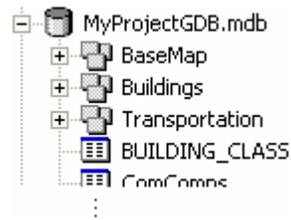
1. Create Project Folder and Copy Template Files

It is highly recommended that you create a project-specific working directory in which your project files will be copied and updated, preferably on a file-server or PC that has a regular back-up system in place in order to prevent accidental or catastrophic loss of data. Once a folder is created, begin your project by copying the template data files: **GeoFITTemplate.mdb** and **GeoFITMap.mxd** into the folder. It is suggested that you rename these files to something better identifying your project. An existing naming convention for your organization will work fine but if one does not exist, filenames containing project name or project name abbreviations are suggested. This will prevent having several files named "GeoFITTemplate" floating around on your network. After these files are copied over and renamed, you are now ready to start configuring your files in preparation for loading project data.

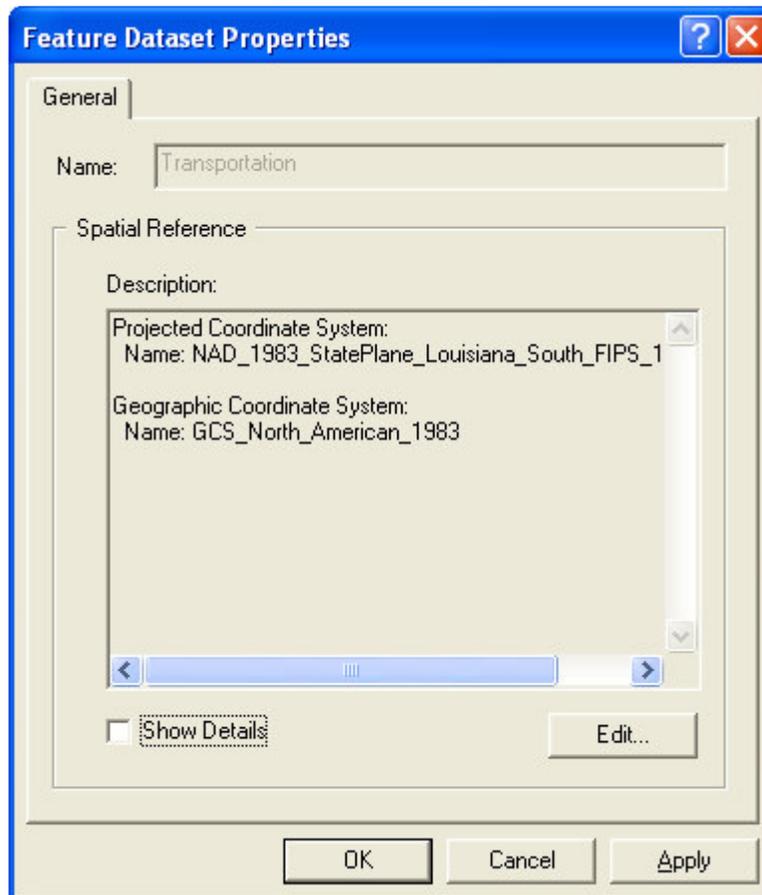
2. Set Geodatabase Coordinate System

You are now ready to modify your Geodatabase for accepting data but will first need to change the coordinate system of the template datasets to match the coordinate system in which your data will be stored in. By default, the coordinate systems used by the template are set to State Plane Zone 1702 – Louisiana South. The step-by-step procedures for modifying the coordinate systems are as follows:

- a. Open **ESRI ArcCatalog**, browse to the location of your project Geodatabase created in Project File Setup step 1 and expand the view by clicking on the plus icon as shown:



- b. Right Click on the **BaseMap** dataset and select the **Properties..** item from the context Menu to bring up the Feature Dataset Properties window as shown:



- c. Click the **Edit..** button to select the appropriate coordinate system for your project, **Apply** to update the dataset, and **OK** to close the Dataset Properties window.
- d. Repeat this procedure (a, b & c) for the **Buildings** and **Transportation** Datasets. The coordinate systems for each dataset do not have to be identical but it is suggested that at least the BaseMap and Buildings datasets use an identical spatial reference.

3. Configure ArcMap Document

Configure your ArcMap document in preparation for creating your project-specific map by pointing your data layers to the appropriate database location. This may be accomplished through the following steps:

- a. Open your project map copy of the **GeoFITMap.mxd** from your project directory by either double-clicking on the file or opening ArcMap and using the **File..Open..** option from the menu bar.
- b. After Opening the project map, you should see red exclamation points next to all map layers in the table of contents. These exclamation points are indicators that then data source for the indicated layer is invalid. Set the data sources by right clicking on the **Structures** layer, and selecting the **Data..Set Data Source** option from the context menu. After selecting this option an ArcCatalog data selection window will appear. Browse and select your project's personal Geodatabase then **|Buildings|Structures** to set the data layers source. At this point, the red exclamation point should disappear as well as all other exclamation points on the other data layers. Your project map and Geodatabase are now ready to accept and display your project data.

LOADING PROJECT DATA

Loading data involves creating new spatial data or transforming existing data for a particular project into the formats required by the GeoFIT Templates. This guide will not describe a step-by-step process for processing and loading data because each feasibility study project using GeoFIT will have its own unique data requirements, its own unique sources for data, and its own original data formats that require different conversion processes. This guide will however describe the datasets that are required by GeoFIT, the mandatory requirements for ensuring that your project data will be compliant with GeoFIT and highlight some common procedures for loading project data. For some datasets, data will need to be loaded into the project specific Geodatabase matching attributes to those described in the GeoFIT Geodatabase **Data Dictionary** found in the following section of this document. Other data layers are optional but a layer must be created within the project's ArcMap Document in order to be displayed on the project map.

Required Geodatabase Datasets

1. SURVEYAREAS

The combined dataset of all project survey areas make up the entire study area in which structure inventory field collection will take place. Survey areas can be setup as a way to organize a field collection effort and to keep different survey crews from duplicating individual structure inventories within a study area. GeoFIT only allows structures in one survey area to be inventoried at a time. When a GeoFIT project is loaded, a single survey area must be selected which will be tagged as the "active area". All sampled structures within the active area can have its attributes edited but structures outside of the survey area will exist in a read-only mode until another survey area is selected.

Each survey area exists as a sub-area polygon that is usually divided along ground features such as major highways, topographic or hydrologic features. Each survey is given a short name and an optional description for identification purposes. Only one survey area is required.

2. STRUCTURES

Individual Structure locations exist in the project Geodatabase as point features; one point representing an individual structure at the center point of a building footprint. Structure attributes can either be populated up front or collected in the field by field crew members using GeoFIT's data-entry forms.

Structures points may be created either by digitizing structures directly from imagery or often structure information is available from local government agencies and must be converted into the template structure format in order to be used by GeoFIT. Several attribute values may already exist in the raw format from which structure data is gathered for the project. These attributes often

include: building type, square footage, and street address information but any information available can be included before the field collection if such attribution is available.

If structure points are not available for a study area, structures may be digitized from imagery by using GeoFIT's **Create New Structure on Map** tool on the main form's function toolbar. Once all project datasets are configured and all other data layers besides structures are created, structures may be digitized with GeoFIT if project imagery is added to the project map and the project is configured to work with GeoFIT (see **Configuring GeoFIT with Project Data**). To digitize structures:

- a. Click on the  icon to activate the Create New Structure on Map tool on the function toolbar. Once the tool is active, a pencil cursor will appear when hovering over the map.
- b. Simply click on the map location where it is desired for a new structure to be created. After clicking on the map location a structure-type options dialog will appear. Select the type of structure to be created from the options dialog.
- c. Click **OK** to create a new structure.
- d. Click **Cancel** to cancel the structure creation operation.

3. STREETS

Street Centerlines are used to display street centerlines and street names on the project map, to populate address dropdowns on the main form address location tool and data entry forms and to locate addresses through the creation of an address locator based on the centerline data. The streets dataset is unique among the required datasets in the fact that a standard format is not required. Street layer requirements are as follows:

- a. Must be a polyline feature class named *Streets*
- b. Must exist under the Transportation dataset in the project Geodatabase
- c. Map layers based off of the feature class must be placed under the group layer "Streets" in the project map document. Any symbology is acceptable and any number of layers may be used to represent different symbology at different scales. Only one layer is required.
- d. Must have separate fields containing street name and street suffix
- e. Must be able to create an address locator based on the *Streets* feature class
- f. Must create a "Street-Name" query in the Geodatabase described in detail in the following section

Required Layers

Each required dataset has an associated layer that must be included in the project map in order for GeoFIT to run properly. The GeoFIT template map document as well as the included .lyr layer files contain these required layers. File locations for these files are given in the above Resources section of this document. Layers for required datasets are:

1. Structures

Data source is **STRUCTURES** dataset. Individual Structures are symbolized in this layer by the values of three fields detailed in the following Data Dictionary section: **STRUCTURECAT**,

STRUCTURESUBCAT, and **UPDATABLE**. These three fields describe the type of structure that exists and whether or not the structure is included in a sample.

2. *Deleted*

Data source is **STRUCTURES** dataset. This layer represents structures that are marked as deleted in the dataset. Only structures marked as deleted are symbolized by a red "x" which will appear on top of the structure points symbolized in the Structures layer.

3. *Modified*

Data source is **STRUCTURES** dataset. This layer represents structures that have been modified in the field. GeoFIT will update the MODIFIED attribute field when a structure's data is updated and saved on the data entry form. Only structures marked as not-deleted and are modified are symbolized by a checkmark which will appear on top of the structure points symbolized in the Structures layer.

4. *Streets*

Data source is the **STREETS** dataset. This layer is a group layer. Any street layers with various symbology can be added under the STREETS group layer. The visibility of this group layer can be changed by users through the GeoFIT main form toolbar.

5. *Survey Areas*

Data source is the **SURVEYAREAS** dataset. This layer represents the individual survey areas with a predefined symbology. The active survey area will appear "selected" within the project map.

Setting Up Required "Street-Name" Query

Because the streets feature class does not require a standard attribution format, a saved Access query is required to identify street names to GeoFIT. The query must be saved as **V_STREETNAME** in the projects Geodatabase and must be setup to return three fields aliased as:

- **STREETNAME** - Displays the common name portion of a street address (ex. *Madison*). This portion may be combined with any directional prefixes (ex. *W Esplanade*).
- **STREETTYPE** - The suffix or road type portion of the street address (ex. *Ave*)
- **FULLNAME** - The entire street name usually the STREETNAME and STREETTYPE combined with a single space (ex. *W Esplanade Ave, Madison Avenue*).

To setup your query, techniques such as concatenation of field names and field name aliasing must be used. The following example "Street-Name" query returns the required field aliases from an attributed feature class *Streets* containing the fields: *DIRPRE* containing a directional prefix, *STREET_NAME* containing the name of the street and *ST_TYPE* containing the suffix or road type:

```
SELECT DISTINCT Trim(Streets.DIRPRE & ' ' & Streets.STREET_NAME) AS STREETNAME,  
Streets.ST_TYPE AS STREETTYPE, Trim(Streets.DIRPRE & ' ' &  
Trim(Streets.STREET_NAME & ' ' & Streets.ST_TYPE)) AS FULLNAME  
FROM Streets;
```

In the above example the function `Trim()` removes extra spaces from the beginning and end of a string field. The ampersand (&) character is used as a string concatenation character. To alias a string value, simply follow string variable or field names with the key word `AS` followed by a space the appropriate field alias name.

For more help with MS Access query creation and SQL you may want to utilize the following resources:

- Microsoft Developer Network's Access SQL Reference: <http://msdn2.microsoft.com/en-us/library/bb245491.aspx>
- W3 Schools Web Builder's Tutorials SQL Basics: <http://www.w3schools.com/sql/default.asp>
- Purchase O'Reilly Publishing's Learning SQL guide book: <http://www.oreilly.com/catalog/learningsql/>

Optional Datasets

Spatial datasets and layers that are not technically required for GeoFIT to function will almost always be present for a project. Optional datasets simply need to be symbolized and added as layers in the project ArcMap document. These layers do not have any symbology requirements other than the fact that the layer names cannot conflict with names of required layers in the project map. Optional datasets fall into two categories:

1. Aerial Imagery

Aerial Photography is only listed as an optional layer because it is technically not required in order for GeoFIT to function properly; however, aerial photography is usually a critical reference layer when identifying actual spatial locations of buildings. To include aerial photography in your GeoFIT project, simply add any required images as a raster layer or layers in the project ArcMap document.

Aerial photography is usually very large in terms of the size of electronic storage. Because GeoFIT is designed to be taken into the field on laptop computers, it is recommended that the imagery be processed using compression, clipping and mosaic techniques. Software such as Lizardtech's GeoExpress and ERDAS Imagine are common tools used by GIS professionals for this type of raster data processing.

2. Other Datasets

Any other raster or vector data layers can be added to the project map document to be displayed within GeoFIT during field collection or post-processing. Usually these layers include relevant reference data such as river miles, place names, political boundary lines, etc. It is recommended that visible scale ranges be set for each of these layers.

DATA DICTIONARY

Feature Class Table: STRUCTURES

Field Name	Data Type	Description	Domain
STRUCTUREID	Auto Number Integer	Primary Key	
SHAPE	Geometry	Field containing point geometry	
STRUCTURENAME	Text	Commercial Only. Common name of business or building	
STRUCTURECAT	Text	Commercial or residential discriminator	D_CATEGORY
STRUCTURESUBCAT	Text	Code describing further category divisions of commercial or residential structures.	D_SUBCAT
QUALITY	Short Integer	The overall quality of building design, amenities, and condition of material.	D_QUALITY
CONDITION	Short Integer	Residential Only. Condition of the structure in terms of damage or aging.	D_CONDITION
TYPE	Short Integer	Residential Only. Type of building in terms of residential occupancy.	D_TYPE
FOUNDATION	Text	Type of building foundation	D_FOUNDATION

ADDRESSNUMBER	Text	Structure street address; numbers only	
ADDRESSSTREET	Text	Structure street address; street name only	
ADDRESSTYPE	Text	Structure street address; street name suffix only (ex. ST, DR, RD, BLVD, AVE)	
AREA	Double	Structure "living area" in square feet	
HEIGHTABOVEGROUND	Double	Height above ground of first floor in feet	
GROUNDELEVATION	Double	Average ground elevation of structure.	
STRUCTUREVALUE	Double	Depreciated replacement cost assigned to structure	
EFFECTIVEAGE	Double	Effective age in years. Marshall & Swift /Boech ® Defines Effective age of a structure as: 1 [the structure's].... <i>age in years as compared with other buildings performing like functions. It is the actual age less any years that have been taken off by face-lifting, structural reconstruction, removal of functional inadequacies, etc.</i>	
PERIMETERSHAPE	Short Integer	Commercial Only. Code representing the level of irregularity associated with a building's perimeter.	D_PERIMETERSHAPE
FIREPLACE	Float	The number of fireplaces the structure contains	
FLOORS	Short Integer	Residential Only. Code describing the number of floors a structure contains	D_STORY
STORYHEIGHT	Double	Average story height of each floor in feet	
SURVEYID	Long Integer	FK to SURVEY Table. Links structure to information about its field collection survey	
COMMENTS	Text	Any comments about field collection of a structure, structure information not included in any other fields, etc.	
INACCESSABLE	Short Integer	Commercial-Industrial Only. Indicates whether a structure is Inaccessible and unable to be surveyed. True = Inaccessible; False = Accessible	
FIELDCREATED	Short Integer	Indicates whether or not a structure was created in the field by the GeoFIT system. True = Created in the Field by GeoFIT; False = Created up front before field collection begins	
UPDATEABLE	Short Integer	Indicates whether a structure is included in the sample or not. True = Sampled; False = Not Sampled	
DELETED	Short Integer	Indicates whether a structure has been marked as deleted in the field. GeoFIT does not allow structures to actually be deleted in the field. Instead, a field crew member can mark a structure as deleted removing them from the set of structures to be exported to MS/B for valuation and from those structures included in the HEC-FDA export. True = Deleted; False = Existing	
MODIFIED	Short Integer	Indicates whether or not a structure has been modified and its values saved in the field. True = Modified; False = Not modified	
SURVEYAREA	Text	FK to SURVEYAREAS. Indicates the Survey Area for which the structure belongs. This should be the area that the structure falls within Geographically.	
PHOTOFRAME	Text	The frame number for an optional structure digital photograph. This number/name should correspond to a file name.	
HOUSINGUNITS	Float	Residential Only. Number of Housing units the structure contains	
PARENTID	Long Integer	Commercial Only. The STRUCTUREID of a structure for which all values will be copied during export. This field should only be used in conditions similar to a multi-structure apartment complex where each structure has basic information that is <u>exactly</u> the same.	

ADDRESSCITY	Text	City associated with the structure's mailing address	
ADDRESSZIP	Long Integer	Zip code associated with a structure's mailing address	
STRUCTUREELEVATION	Double	First floor elevation of the structure. Equal to GROUNDELEVATION + HEIGHTABOVEGROUND	
FDASTATION	Long Integer	Station ID linking the structure to a single HEC-FDA hydrologic storage curve entered separately into HEC-FDA	
FDASTREAM	Text	Stream Name associated with associated HEC-FDA hydrologic storage curve	
FDAREACH	Text	Reach Name associated with associated HEC-FDA hydrologic storage curve	
FDAOCCTYPE	Text	The FDA Occupancy Type for a single residential structure. This is updated before FDA export and contains the occupancy type assigned to the structure. Commercial structures use the FDAOCCTYPE field in the OCCUPANCY Table for the assigned OCCUPANCY in the greatest percentage for a single commercial structure.	
COMSTORIES	Double	Commercial Only. Number of stories a commercial structure contains	
MANWIDTH	Double	Represents the width in feet of manufactured or mobile residential structures	D_MANWIDTH
MANLENGTH	Double	Represents the width in feet of manufactured or mobile residential structures	D_MANLENGTH Range(20-80)
MANHOUSESTYLE	Short Integer	The style of manufactured or mobile residential structures	D_MANHOUSESTYLE Range(8-72)

Feature Class Table: SURVEYAREA

Field Name	Data Type	Description	Domain
OBJECTID	Object ID	Primary Key	
SHAPE	Geometry	Field containing polygon geometry	
AREANAME	Text	Short name of survey area. Typically designated by single ASCII Character or letter. Links as Key to STRUCTURES.SURVEYAREA	
AREADISC	Text	Detailed name of area	
SHAPE_Length	Double	Auto-generated. Length of polygon Perimeter	
SHAPE_Area	Double	Auto-generated. Area of polygon	

Attribute Table: DAMAGECATEGORIES

-Used to assign HEC-FDA Damage Categories to groups of structures based on common attributes

Field Name	Data Type	Description	Domain
FDADAMAGECATID	Autonumber	Primary Key	
STRUCTURECAT	Text	Relates Damage category to the STRUCTURECAT field in the STRUCTURES FeatureClass. Determines Residential or Commercial	D_CATEGORY
STRUCTURESUBCAT	Text	Relates Damage category to the STRUCTURESUBCAT field in the STRUCTURES FeatureClass. This is the grouping filter attribute for Commercial structures.	D_SUBCAT
STRUCTURERESTYPE	Short Integer	Relates Damage category to the TYPE field in the STRUCTURES FeatureClass. This is the grouping filter attribute for Residential structures.	D_TYPE

FDADAMAGECAT	Text	The FDA Damage Category assigned to a particular structure group based on matching criteria
--------------	------	---------------------------------------------------------------------------------------------

Domain: D_CATEGORY

Code	Name	Comments
C	Commercial	Will be exported to Commercial Estimator
R	Residential	Will be exported to Residential Estimator

Domain: D_SUBCAT

Code	Name	Comments
M	Mobile Home	Residential Only
I	Industrial	Commercial Only
A	Agricultural	Commercial Only
G	General	

Domain: D_QUALITY

Code	Name	Comments
1	Low	These tend to be very plain buildings that conform to minimum building code requirements. Interiors are plain with little attention given to detail or finish. Typically, there are minimum mechanical and low-cost finishes throughout.
2	Fair	These buildings are the most commonly found and meet building code requirements. There is some ornamentation on the exterior with interiors having some trim items. Lighting and plumbing are adequate to service the occupants of the building.
3	Good	These are generally well designed buildings. Exterior walls usually have a mix of ornamental finishes. Interior walls are nicely finished and there are good quality floor covers. Lighting and plumbing include better quality fixtures.
4	Excellent	Usually, these buildings are specially designed, have high-cost materials and exhibit excellent workmanship. Both exteriors and interiors have custom and ornamental features. Lighting and plumbing include high-cost fixtures.

Domain: D_CONDITION

Code	Name	Comments
2	Badly Worn	
3	Average	
4	Good	
6	Excellent (New)	

Domain: D_TYPE

Code	Name	Comments
1	Single	
5	Duplex	
2	Low Rise (Multiple)	
6	Mobile Home	
3	Town House	

Domain: D_FOUNDATION

Code	Name	Comments
P	Pier	Structure with raised sub-floor usually on pilings
S	Slab	Structure with concrete slab foundation on ground. First floor is usually 0 – 2 feet off of ground.

Domain: D_PERIMETERSHAPE

Code	Value	Comments
1	Square	
2	Slightly Irregular	
3	Irregular	
4	Very Irregular	

Domain: D_STORY

Code	Value	Comments
1	One-Story	
2	Two-Story	
3	Three-Story	
4	Split-Level	A style of house in which the floor level of one part of the house is about half way between a floor and its ceiling of the other part of the house
5	1-1/2 Story	
7	2-1/2 Story	
9	3 1/2 Story	
12	Bi-Level	Houses where the foundation is not on level ground and may have multiple levels cut into side of grade or slope in ground.

Domain: D_MANHOUSESTYLE

Code	Value	Comments
13	Singlewide	
14	Doublewide	
15	Triplewide	
16	Quadwide	

SETTING DEFAULT VALUES

IWR-GeoFIT requires that certain fields have mandatory default values set for structure attributes before data can be collected in the field. These default values are defined both in the MS Access Table definition for STRUCTURES and in the Geodatabase interface for the related STRUCTURES feature class. When a record is created using manually using GeoFIT or through an Edit session in ArcMap, the default values will automatically be assigned to the new record. If data is imported using the load command in ArcCatalog, however, the default values will not be set creating an unstable condition for GeoFIT. After importing data in this fashion, the default values can be set by running a simple command from within Access. The default values will be assigned for any field containing a default value where the value is also set to null.

Set Default Values in Access

- 1. Open the project Geodatabase in Microsoft Access**
- 2. Open the Main Switch Board Form if its not already open**
- 3. Left-click the "Set Default Structure Values" button**
- 4. A message box will appearing asking you to confirm the choice to set default values.**

5. Click OK to update the values in the database.

SETTING COMPONENT OPTIONS

Structure components, which are individual building systems such as air conditioning, roofing, exterior walls exist as data driven records in relational tables in the project Geodatabase. These component values are modeled off of the MS/B Estimator applications and may change depending on different versions that are released by Marshall and Swift / Boech. In addition to structure components, GeoFIT also has a data driven set of Occupancy codes used to set the building occupancy (i.e. restaurant, health club, office, school) for commercial structures. These occupancy codes exist as records in a relational table

Both structure components and commercial occupancy codes have options that can be set by a project administrator for each individual study project or field collection effort. These options are can be set within the project Geodatabase modeled off of the **GeoFITTemplate.mdb** by opening the file with Microsoft Access and opening existing Access interface forms. A main switchboard containing links to the option forms can be accessed by opening the **SwitchBoard** form within your project database

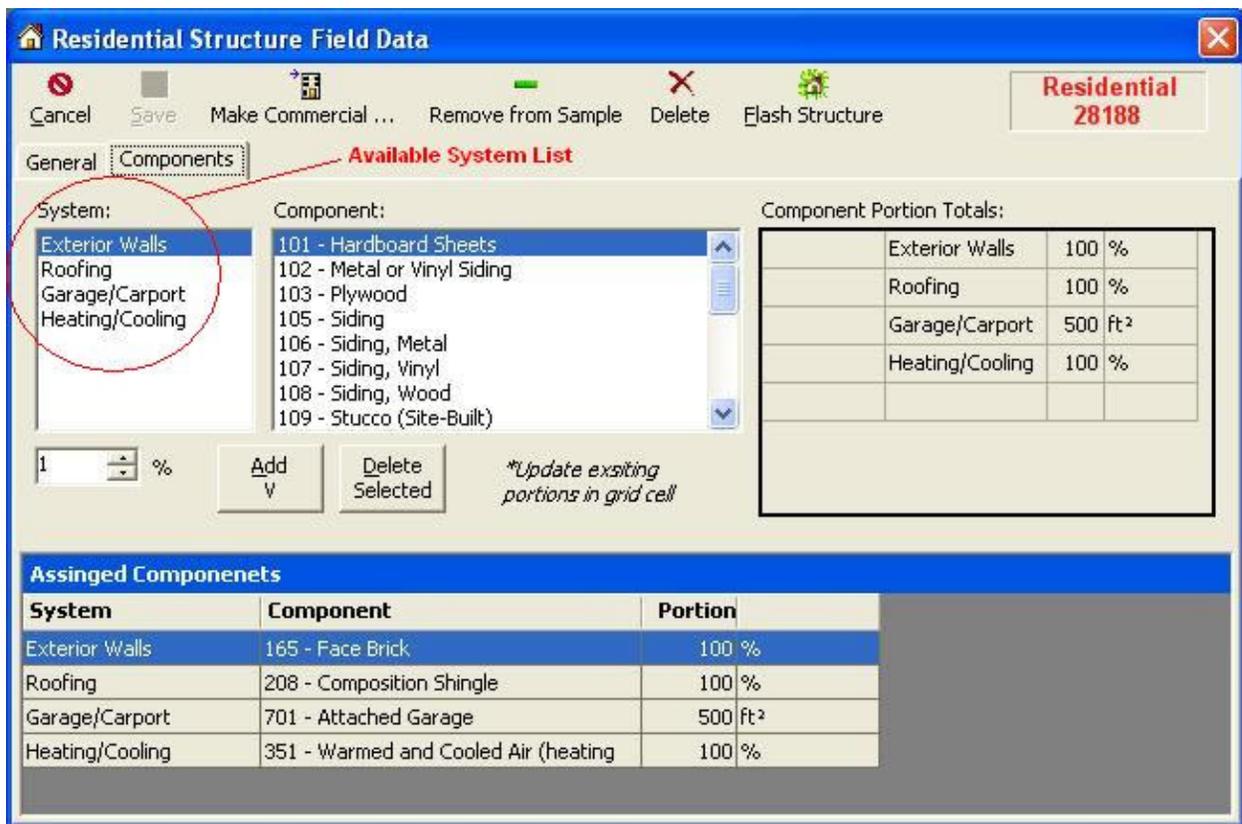
Component Options

1. Project Specific System Settings

Project Specific Component System Settings										
Include system	Required	System	Min Val	Max Val	Default Val	Unit Description (appears on form)	Select Components			
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Garage/Carport	30	5000	270	Size in square feet	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	Basement	100	10000	800	Size in square feet (Always Requires Total)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	Deck Porch	5	5000	50	Size in square feet	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Heating/Cooling	1	100	100	Percentage of total floor area served by that heating/cooling type	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Exterior Walls	1	100	100	Percentage of total wall area	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Roofing	1	100	100	Percentage of total roof area	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

System Settings can be modified by clicking on the **System Settings** button on the Switch Board. The form displays settings that can be easily modified by the project administrator. Each row on the tabular form includes options for an individual system. The system name is displayed under the column heading: **System**. System settings include:

- a. **Including/Excluding Systems:** Available systems for which components can be set will appear in the available list of systems on GeoFIT’s data collection form. This option is used when particular options may want to be left out of the field collection such as basements in an area where no basements are present. An unchecked system will not appear in the list of available systems



Data Entry Form Components Tab

- b. **Setting Min, Max and Default Values:** Each component has an associated unit and range of values of this unit that are acceptable by the GeoFIT data entry forms when setting component values. In addition, each system has a default value that will appear in the value box when units are not percentages. These values may be changed on the System Setting window by simply clicking on the corresponding text box to the right of the system name and typing in the desired values.
- c. **Select Commercial or Residential Components:** Component Options for each system may be accessed by clicking on the "C" button for editing Commercial components or the "R" button to edit Residential components from the System Settings window. The name of the category of components available for each system appears to the left of the "R" and "C" buttons; Commercial or Residential. If a category of component is not available for a particular system, that particular system is not available for a particular structure category and components will therefore not be available for editing.

2. Selecting Components

Commercial component category					
Include	Component Id	Component Name	Component Description	System Name	
<input type="checkbox"/>	601	Electric	Radiant type heating, either cable, panel or baseboard. Cable is commonly found installed in ceilings beneath a sprayed-on finish.	Heating/Cooling	Edit
<input type="checkbox"/>	602	Electric Wall	Individual electric unit in the wall capable of heating only small areas with or without a radiator.	Heating/Cooling	Edit
<input type="checkbox"/>	603	Forced Air Unit	Gas-fired or electric-powered unit that circulates the warm air with a motor driven fan.	Heating/Cooling	Edit
<input type="checkbox"/>	604	Hot Water	An exposed boiler and radiator or baseboard network, expansion tank and piping. The boiler is typically located in a basement or crawlspace.	Heating/Cooling	Edit
<input type="checkbox"/>	605	Hot Water, Radiant	Water is heated by circulating it over coils or through a boiler that circulates the water through a network of pipes.	Heating/Cooling	Edit
<input type="checkbox"/>	606	Space Heaters	Comprised of individual unit heaters, generally suspended from the ceiling of roof structure.	Heating/Cooling	Edit
<input type="checkbox"/>	607	Steam	Steam generated using a boiler and piped to radiators throughout the building by its own pressure.	Heating/Cooling	Edit
<input type="checkbox"/>	608	Steam Without Boiler	System using a radiator system receiving steam from an external source, such as a central plant.	Heating/Cooling	Edit

After clicking on the appropriate Commercial (C) or Residential (R) buttons, the **Select Components** window appears with the appropriate component category listed at the upper right-hand corner of the window. This window lists, in a tabular grid, all of the available components assigned to the system from which the window was launched on the **System Settings** window. The window lists the Component ID, Component Name, Description of the Component and the Name of the System that is currently selected in each table row. The window allows for 2 actions:

- a. **Including/Excluding Components:** Available systems for which components can be set will appear in the available list of systems on GeoFIT's data collection form. This option is used when particular options may want to be left out of the field collection such as basements in an area where no basements are present. An unchecked system will not appear in the list of available systems
- b. **Editing Components:** At the end of each component row, there is an edit button which will pull up a window allowing details of each component to be edited. This is shown in detail in the following section.

3. Component Editing

Commercial		
Id	Name	Description
601	Electric	Radiant type heating, either cable, panel or baseboard. Cable is commonly found installed in ceilings beneath a sprayed-on finish.

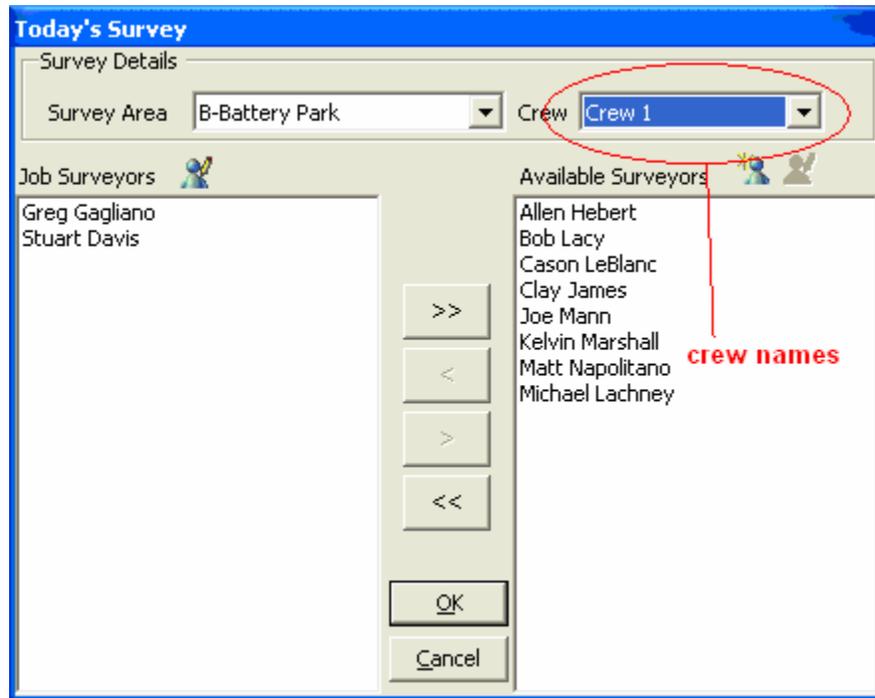
The Component Edit Window allows a single component's Name and Description to be edited. To edit simply type the new test values into the appropriately labeled text area. Changes are saved to the database automatically.

Regardless of the name or description used with GeoFIT, MS/B Estimators will only look at the Component ID when importing structure information. For example, if component 273 is called "Glass Elevator" in the Estimators and is changed to "Glass Lift" in GeoFIT it will still be valued the same. However, if item 273 is renamed "Vinyl Siding" in GeoFIT it will still be imported and valued as "Glass Elevator" in the Estimators.

CONFIGURING GeoFIT WITH PROJECT DATA

Administering Field Crews

GeoFIT is designed to work with different field crews working on one single inventory collection. In order to keep track of which structures were inventoried by which field crew, GeoFIT "tags" each structure saved with daily survey information. Daily survey data appears in GeoFIT immediately after a project is selected to work with. This window entitled "*Today's Survey*" allows the field crew to identify the daily surveyors and add new surveyors to the team. In addition they can select the name of the crew to which they belong and the survey area which they are about to inventory. Any structures inventoried after the daily survey information has been set will be tagged with the date as well as surveyor and crew name information. The interface does not allow crew names to be changed and must be created in the Access database by the GIS/database administrator.



GeoFIT "Today's Survey" Window

1. *Creating Field Crews in Access*
 - a. Open the project Geodatabase in Access.
 - b. Open the CREWMASTER TABLE.
 - c. On the new record row, enter the name of the crew under the CREWNAME Column. Repeat this step to enter all crew names. At least one crew is required.
 - d. A CrewID number will automatically be assigned.
2. *Editing Field Crews in Access*
 - a. Repeat steps a. & b. from *Creating Field Crews in Access*.
 - b. Select the row to be edited.
 - c. Double click on the CREWNAME field and type in the new name.
3. *Deleting Field Crews in Access*
 - a. Repeat steps a. & b. from *Creating Field Crews in Access*.

- b. Left-click the space immediately to the left of the CREWID to select the row to be deleted.
- c. Right-click on the row and select the *Delete Record* command from the context menu, press the *Delete* Key on the key board or left-click on the *Delete Record Button*  from the Access toolbar.

4. Creating Field Crews in ArcMap

- a. Open ArcMap and select *A New Empty Map* to work with.
- b. Click on the *Add Data Button*  from the ArcMap toolbar.
- c. Browse and select the project Geodatabase you wish to edit.
- d. Double-click the Geodatabase to drill-down, select the CREWMASTER table with and click the *Add* button. The CREWMASTER Table should not appear in the table of contents under the *Source* tab.
- e. Make the editor toolbar visible by selecting *View/Toolbars/Editor* from the ArcMap menu bar.
- f. Begin and edit session from the editor tool bar by selecting the  *Start Editing...* command from the Editor drop-down menu.
- g. After Edit Session has begun, right-click on the CREWMASTER table in the table of contents and select the *Open* command to open the *Attributes of CREWMASTER* window.
- h. In the blank row at the very bottom of the table, enter the name of the crew under the CREWNAME Column. A CREWID will automatically be assigned when focus is lost. Repeat this step to enter all crew names. At least one crew is required.
- i. After all crews are entered, save the edit session by left-clicking the  *Save Edits* command from the Editor drop-down menu.
- j. After saving, stop your edit session by left-clicking the  *Stop Editing* command from the Editor drop down menu.

5. Editing Field Crews in ArcMap

- a. Repeat steps a-g of from the *Creating Field Crews in ArcMap* section above
- b. Click on the CREWNAME field you wish to edit and simply type in the new crew names.
- c. When editing is complete, repeat steps h & I from the *Creating Field Crews in ArcMap* section above.

6. Deleting Field Crews in ArcMap

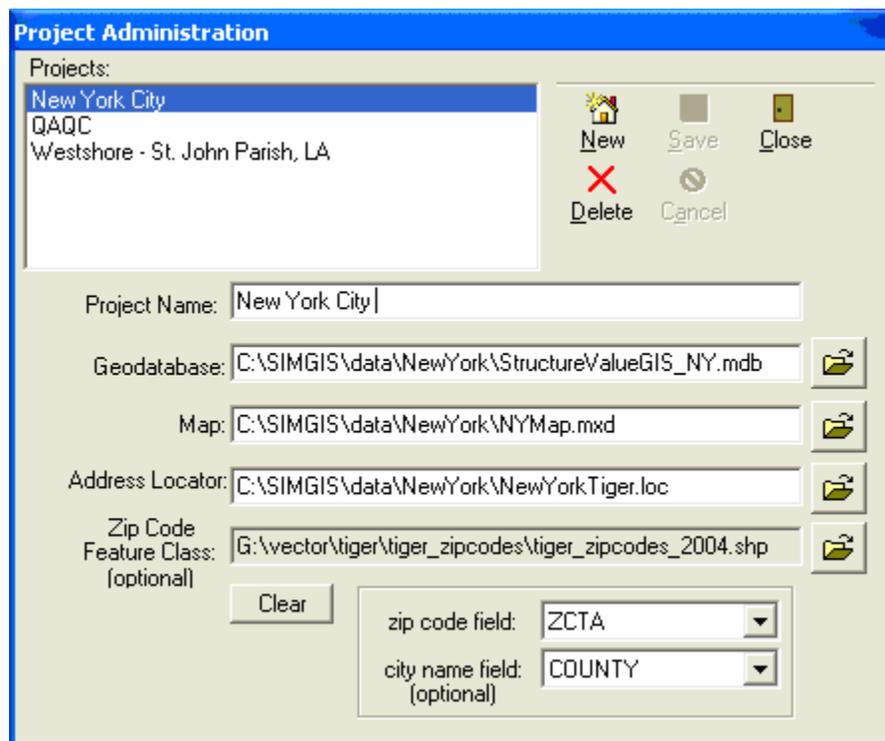
- a. Repeat steps a-g of from the *Creating Field Crews in ArcMap* section above
- b. Select the crew record rows in the table by clicking on the space immediately to the left of the CREWID field in the table. Hold down the left mouse button and drag up and down to select more than one row. When a row is selected, its background color will change to cyan.

- c. Press the Delete key on the keyboard to delete the selected crew records.
- d. When deleting is complete, repeat steps h & i from the *Creating Field Crews in ArcMap* section above.

Project Administration

Once project data is created and converted to the correct data format templates, the project must be "added" to GeoFIT. This is accomplished through the **Project Administration** Window within GeoFIT. The Project Administration Window allows a user or a system administrator to manage the projects which the GeoFIT application can work with.

Projects created in the Project Administration Window will appear in the [Project Selection Window](#) project list when the application loads. The Project Administration Window may be accessed through the [Main Menu Bar](#), or from the **Manage Projects** button on the Project Selection window. The main functions of project administration are: **Creating New Projects**, **Editing Attributes of Existing Projects**, and **Deleting Existing Projects** from the system.



GeoFIT "Project Administration" Window

1. Creating New Projects

All projects require a Project Name an ESRI Geodatabase, an ESRI Map Document, and an ESRI Address locator file. Optionally a Zip Code Layer can be selected so that new structures created in the field will automatically be assigned a zip code and place name based on its geographic location after zip code field and the optional city/town field is assigned. The following steps are required to create a new project:

- a. Click on the New Project  button on the toolbar.
- b. Type an appropriate name for the new project in the Project Name field.

- c. Enter the full file path to the ESRI Geodatabase file in the Geodatabase field. Clicking the  next to the Geodatabase field will allow a valid file to be selected from a Windows open file dialog. Valid Geodatabase files end in .mdb.
- d. Enter the full file path to the ESRI Map Document in the Map field. Clicking the  next to the Map field will allow a valid file to be selected from a Windows open file dialog. Valid ESRI Map Document files end in .mxd.
- e. Enter the full file path to the ESRI Address locator file in the Address Locator field. Clicking the  next to the Address Locator field will allow a valid file to be selected from a Windows open file dialog. Valid Geodatabase files end in .loc.
- f. (Optional) Click the  next to the Zip Code Feature Class field to browse and select a valid feature class from a Windows open file dialog. Valid feature class files can be either an Access Geodatabase ending in .mdb or an ESRI Shapefile ending in .shp. If a Geodatabase is selected, a valid polygon feature class within the Geodatabase must also be selected from a separate selection dialog that will appear after the Geodatabase is selected. Once a zip code feature class is selected, the zip code field and city field drop down lists will be populated from the attribute field names in the selected feature class. If a zip code feature class is selected, a zip code field is required to be selected where as a city name is optional.

- g. Click the Save  button to Save the project. Once Saved, the project will now be listed in the projects list and the under the available projects in the Project Selection Windows.

- h. Clicking the Cancel  button will cancel the new project creation.

2. Editing Attributes of Existing Projects

Editing existing project components is similar to creating new projects except an existing project name must be selected from the projects list before editing can occur. Once a project is selected, the existing values for that project will be populated in the appropriate fields. The Save button will not be enabled for editing an existing project until a value is changed.

- a. Select an existing project from the project list.
- b. Repeat steps b-f from the preceding *Creating New Projects* task

3. Deleting Existing Projects

- a. Select an existing project from the project list.
- b. Click on the Delete  button to delete the project.
- c. Clicking the Cancel  button will revert the edited field values back to what they were before the last save.

Once a project is deleted it will no longer appear in the project list or in the available projects drop-down on the Project Selection Window.

***Note:** Deleting a project will not delete any of the project data off of the system but will simply make the project unavailable to the GeoFIT application.

FIELD COLLECTION POST-PROCESSING

After project data is loaded and the project is configured to work with GeoFIT, field crews can now begin to collect data in the field once GeoFIT is loaded onto the field laptop(s) or mobile computer(s). Upon completion of the field collection effort, some post-processing must be completed by a GIS administrator before data is ready to be valued by Marshall & Swift Estimators. These steps are optional depending on how GeoFIT is used and if Marshall and Swift exportation is to be performed.

1. *Merging Multiple Databases*

The current Beta version release of GeoFIT does not have include an automated process or tool for merging Multiple copies of a GeoFIT project Geodatabase together into a Master database upon completion of the field collection process. Because of the complexity of this task, this guide will only highlight the steps involved in how to accomplish such a merge but will not explain all of the complex SQL and ArcGIS data processing that may be involved. It is recommended that an administrator performing these tasks has an intermediate to advanced level of experience working with update SQL commands in Access and a beginning intermediate level of experience updating and editing data with ArcMap and ArcCatalog. This document will only list the step-by-step procedures involved with accomplishing a successful merge of the database. The in alpha numeric order are:

- a. Choose one field crew Geodatabase from the set and copy this out as your Master database. This is the database from which all other databases will copy their data over to.
- b. Choose a second field crew Geodatabase separate from the Master to begin copying data over. Run a query on the field crew's STRUCTURES table to select only the structures where FIELDCREATED field is false and the structure were modified by the indicated field crew (CREWID) for which this database belongs in the SURVEY table. Import this query as a table in the Master Geodatabase giving it an alternate name so it does not conflict with the STRUCTURES table in the Master Geodatabase(*ex. STRUCTURES imported as STRUCTURES_2.*).
- c. Import the following tables into the master database from this second field database again giving them alternative names in the master database *Make sure not to import any table relationships.*
 - i. CREWMASTER
 - ii. SURVEY
 - iii. STRUC_COMPONENTS
 - iv. STRUC_OCCUPANCY
 - v. SURVEYORSURVEYXREF

** for explanation purposes, the 2nd individual field crew tables will be referred to in this section with the suffix **_2** to distinguish these tables from the master Geodatabase tables with the same name. The listed group of tables imported will be referred to as the "Field Tables" as opposed to the "Master Tables" from the Master database.*

- d. Verify that the CREWID numbers are the same in CREWMASTER_2 and CREWMASTER. If these CREWID do not match, update the CREWMASTER table to include the CREWNAMES used in the CREWMASTER_2 table. If CREWMASTER needs to be updated to include crews from CREWMASTER_2, there is a chance that the CREWID number in CREWMASTER will not match those in CREWMASTER_2. If this is the case, update SURVEY_2.CREWID values to reference to the appropriate CREWID in the CREWMASTER table instead of the CREWMASTER_2 table with the same CREWNAME.
- e. Verify that the SURVEYORID numbers are the same in SURVEYOR_2 and SURVEYOR. If these SURVEYORID do not match, update the SURVEYOR table to include the Surveyors used in the SURVEYOR_2 table. If SURVEYOR needs to be updated to include surveyors from SURVEYOR_2, there is a chance that the SURVEYORID number in SURVEYOR will not match those in SURVEYOR_2. If this is the case, update SURVEYORSURVEYXREF_2.SURVEYORID values to reference to the appropriate SURVEYORID in the SURVEYOR table instead of the SURVEYOR_2 table with the same surveyor information.
- f. Delete all STRUC_COMPONENTS_2 where matching STRUCTUREIDS are not found in the STRUCTURES_2 table.
- g. Delete all STRUC_OCCUPANCY_2 where matching STRUCTUREIDS are not found in the STRUCTURES_2 table.
- h. Create a long integer ORIGID field in both the SURVEY and SURVEY_2 tables. Make sure that all ORIGID values in SURVEY are null. In the SURVEY_2 table, copy the SURVEYID Field to the ORIGID for each record. Import the survey records from SURVEY_2 into the SURVEY table. When records are inserted, new SURVEYID's will be assigned to the records from SURVEY_2 however the ORIGID field will contain the SURVEYIDs that were originally used
- i. Update the SURVEYID in STRUCTURES_2 to match the STRUCTUREID in SURVEY Where ORIGID is equal to STRUCTURES_2.SURVEYID
- j. Delete all STRUC_COMPONENTS records where matching STRUCTUREIDS are found in the STRUCTURES_2 table.
- k. Delete all STRUC_OCCUPANCY records where matching STRUCTUREIDS are found in the STRUCTURES_2 table.
- l. Copy the values for all attribute fields with the exception of the SHAPE and STRUCTUREID fields from STRUCTURES_2 to STRUCTURES where STRUCTUREID fields are equal. Because only the structures not created in the field have been copied over at this point, each structure record in STRUCTURES_2 should have a matching record in the STRUCTURES table.
- m. Append records from STRUC_COMPONENTS_2 into STRUC_COMPONENTS
- n. Append records from STRUC_OCCUPANCY_2 into STRUC_OCCUPANCY
- o. Delete all Field Crew tables ending in _2. Structures not created in the field are now imported into the Master Geodatabase from the first field crew. The next step begins the process of importing structures created in the field.
- p. Open a new ArcMap document and add a new layer from structures feature class in the second field crew database that was used in steps b-o above.

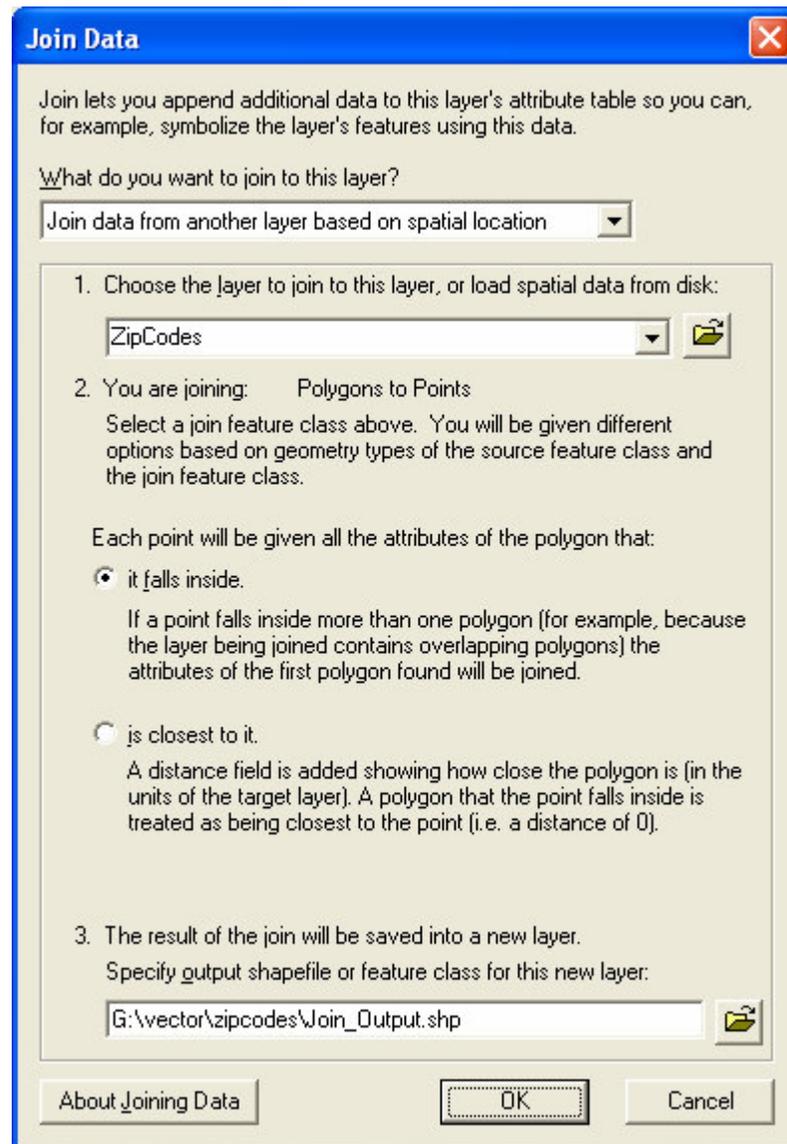
- q. Run an attribute selection on the structures where the FIELDCREATED attribute is true and the SURVEID matches a SURVEY record where SURVEY.CREWID identifies a CREWMASTER record that belongs to this field crew. Upon completion, you should have a selected subset of structures modified by the crew for which this field database belongs and only the structures where the structures were created in the field.
- r. Create a long integer ORIGID number in the STRUCTURES table and calculate the STRUCTURES.ORIGID to be equal to the STRUCTUREID table for the selected records only.
- s. Export the selected records out to a new feature class in the Master database giving the feature class an alternate name different from the STRUCTURES table in the Master such as STRUCTURES_2. Again, STRUCTURES_2 will be used to refer to this table in the Master Geodatabase.
- t. Repeat steps b-i.
- u. Open ArcCatalog and import the point features from the STRUCTURES_2 feature class into the STRUCTURES feature class. The field created structures will now have a newly assigned STRUCTUREID in the Master Geodatabase.
- v. Update the STRUCTUREID field for all records in the STRUC_COMPONENTS_2 table to the STRUCTURES_2.STRUCTUREID field where STRUC_COMPONENTS_2.STRUCTUREID is equal to STRUCTURES_2.ORIGID.
- w. Update the STRUCTUREID field for all records in the STRUC_OCCUPANCY_2 table to the STRUCTURES_2.STRUCTUREID field where STRUC_OCCUPANCY_2.STRUCTUREID is equal to STRUCTURES_2.ORIGID.
- x. Repeat steps m-o
- y. Repeat steps a- x for each field Geodatabase that differs from the field Geodatabase used to create the Master Geodatabase.

2. Assigning Zip Codes & City Names

Once a master project database is available, Zip Codes and City Names must be assigned if an optional data zip code layer was not used during project administration. All structures to be valued by MS/B Estimators must have these two values assigned before an export file is created. Usually these attributes can be assigned in batch using a spatial join. In order to do so, spatially correct data layers with zip codes and/or city names must be spatially joined to the structure features and appropriate attribution values copied over to the structure attributes ADDRESSCITY and ADDRESSZIP. A spatial join inside of ArcMap will create a new feature class joining the attributes of the 2 layers together. This new feature class will then be joined back to the original structures feature class using the original STRUCTUREID and the values can then be copied over using a field calculation. The steps necessary to populate zip code or city name values spatially using ArcMap are as follows:

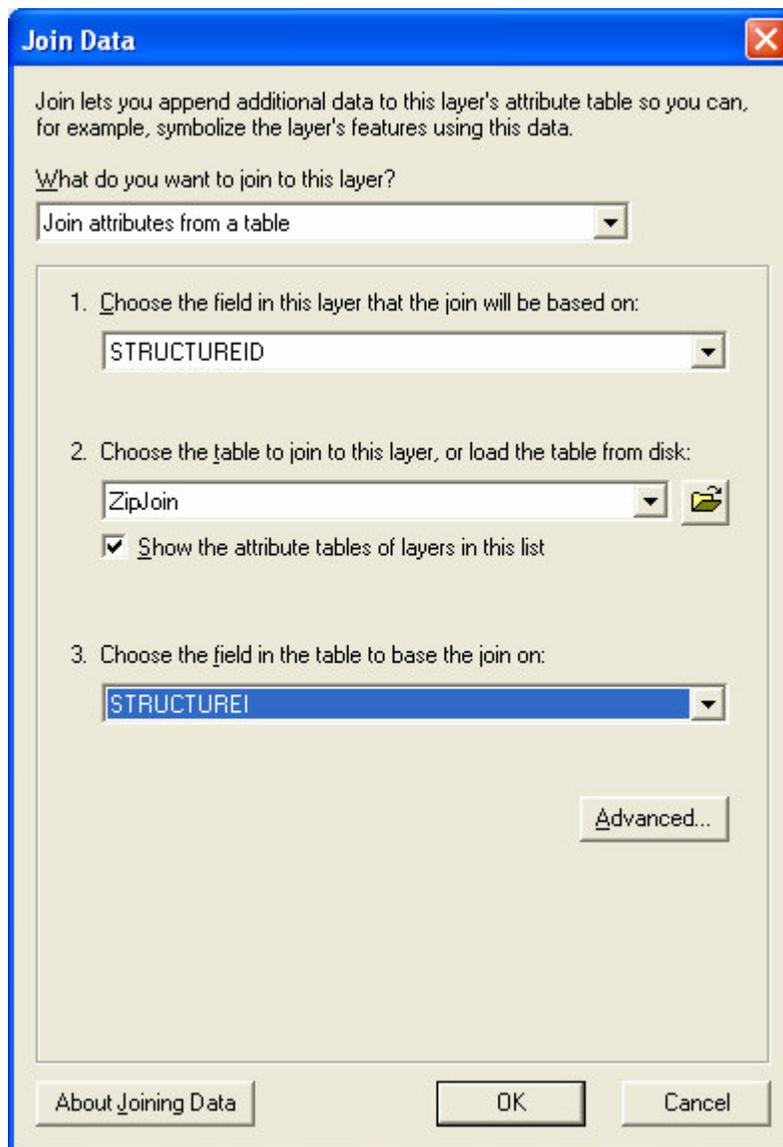
- a. Open ArcMap and select *A New Empty Map* to work with.
- b. Click on the *Add Data Button*  from the ArcMap toolbar.

- c. Browse and select the project Geodatabase where your inventoried structures are located.
- d. Double-click the Geodatabase to drill-down, select the Buildings\STRUCTURES feature class icon and click the *Add* button. A new STRUCTURES layer should not appear in the table of contents.
- e. Click on the *Add Data Button*  from the ArcMap toolbar.
- f. Browse and add the datalayer containing zipcode and/or city locations.
- g. Right-click on the STRUCTURES layer and select Joins and Relates..Join.. to open the Join Data window.



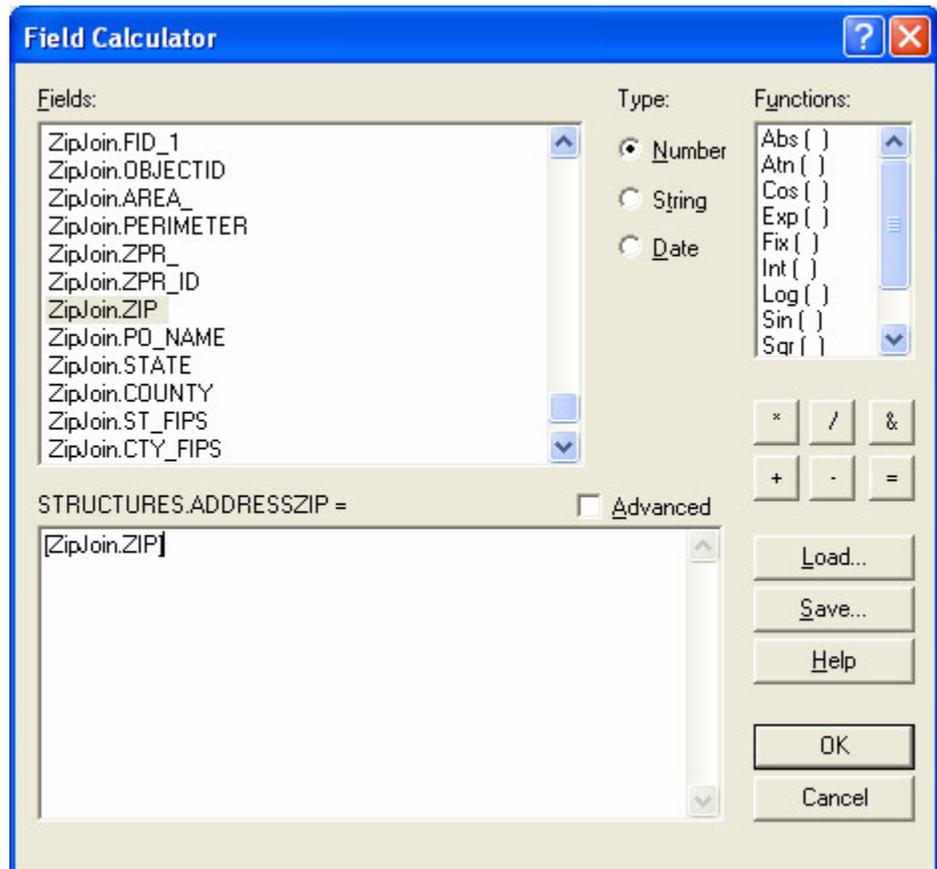
- h. Inside of the Join Data window, follow steps 1., 2. and 3. to create your spatial join.

- i. Select *Join data from another layer based on spatial location* from the *What do you want to join to this layer?* drop down list.
 - ii. Choose your zipcode/city layer from the drop down list in step 1.
 - iii. Select the type of special join you wish to create in step 2. These options will vary depending on the type of geometries used in your join. Select the appropriate options for your individual dataset used.
 - iv. Save the joined features out to a shapefile or feature class noting the location of this dataset. The newly saved data will now contain structure points with attribute values from both layers.
- i. Create an attribute join between the Structures layer and the newly created structure join layer created in step i.
 - j. Right-click on the STRUCTURES layer and select Joins and Relates..Join.. to open the Join Data window.



- k. Inside of the Join Data window, follow steps 1., 2. and 3. to create your attribute join:
 - i. Select *Join attributes from a table* from the *What do you want to join to this layer?* drop down list.
 - ii. Choose the STRUCTUREIF field from the attribute drop down list in step 1.
 - iii. Select the layer that was automatically added to your map pointing to your newly created joined structures created in step h.
 - iv. Select the field that contains the original Structure ID from the join feature. If this layer was saved out as a shapefile, the STRUCTUREID field will have been renamed to STRUCTUREI because of field name length constraints in shapefiles.
 - v. Click OK to create the join

- I. Now that the join is created, use a field calculation to copy the attribute values over to the ADDRESSZIPCODE and/or ADDRESSCITY fields.
 - i. Right-click on the STRUCTURES layer in the table of contents window and select *Open Table* from the pop-up menu to open the attribute table view.
 - ii. In the attribute table, right click on the column header of the ADDRESSZIP or ADDRESSFIELD you wish to update from the join attributes and select the *Calculate Values...* option to open the field calculator button. If an edit session has not begun, you may get a warning message. Creating an edit session is not necessary and you may click the *Yes* button to continue.
 - iii. In the Field Calculator window, simply double click the name of the field from which you will copy the values from to place the field name into the STRUCTURES.ADDRESS[FieldName] = box and click OK. The value to be copied from will be prefixed with the name of the join table separated by a period in the field list. After clicking OK, matching values from the join table will be copied over to the appropriate address field.



VALUATION POST-PROCESSING

Once data is exported to Marshall and Swift Estimators, structure values are calculated and imported back into the project Geodatabase, the final step in the structure inventory collection and valuation process is to export the structure inventory. Before the structure data can be exported, certain steps must be completed.

1. Assigning Structure Elevations

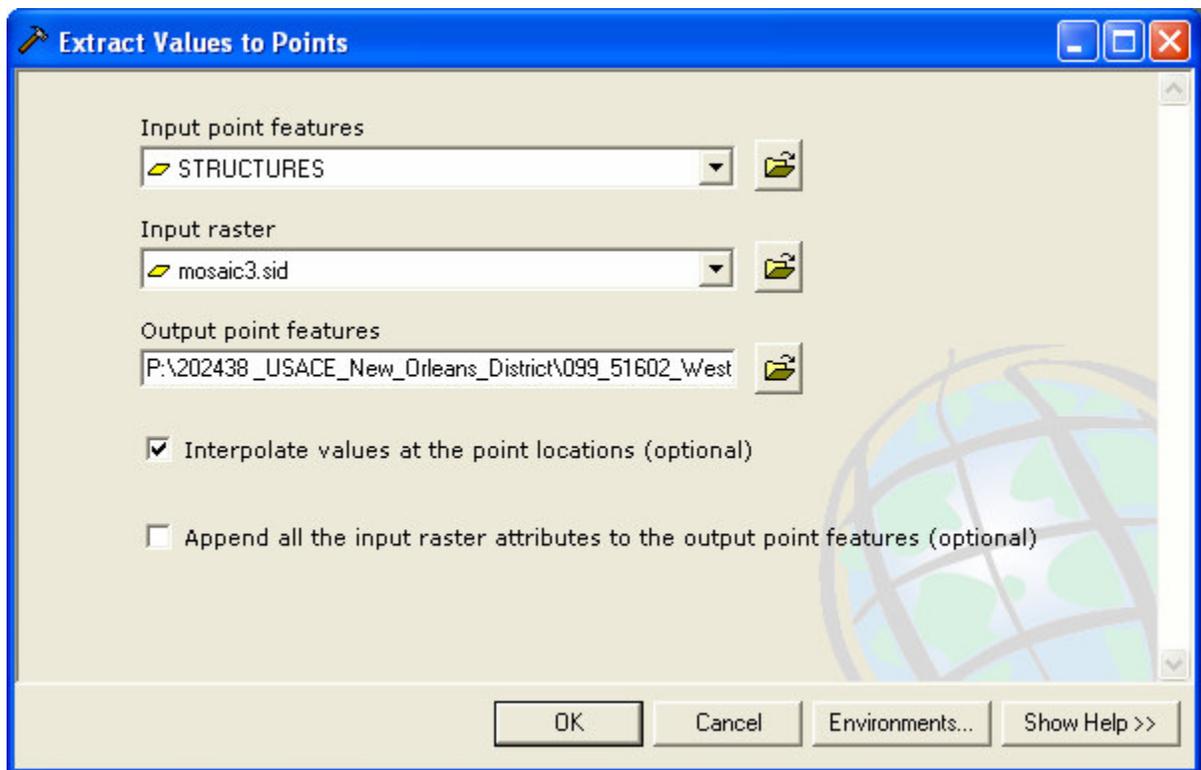
The first required step before creating a HEC-FDA export of a project structure inventory is to assure that each structure is assigned a first floor elevation stored in the STRUCTUREELEVATION field of each structure. It is not important how these elevations are assigned, only that they are assigned. The values are not able to be edited manual by field crews using the interface form but will be displayed if one is assigned. Therefore an administrator must populate the values of these fields using ArcGIS editing or direct MS Access editing techniques. If values are not assigned for individual structures, it is often common to use a digital elevation model (DEM) in order to assign ground elevations to a structure. DEM to file extraction can be completed with a valid Spatial Analyst Extension license within ArcGIS.

a. Importing Ground Elevations from Elevation Models

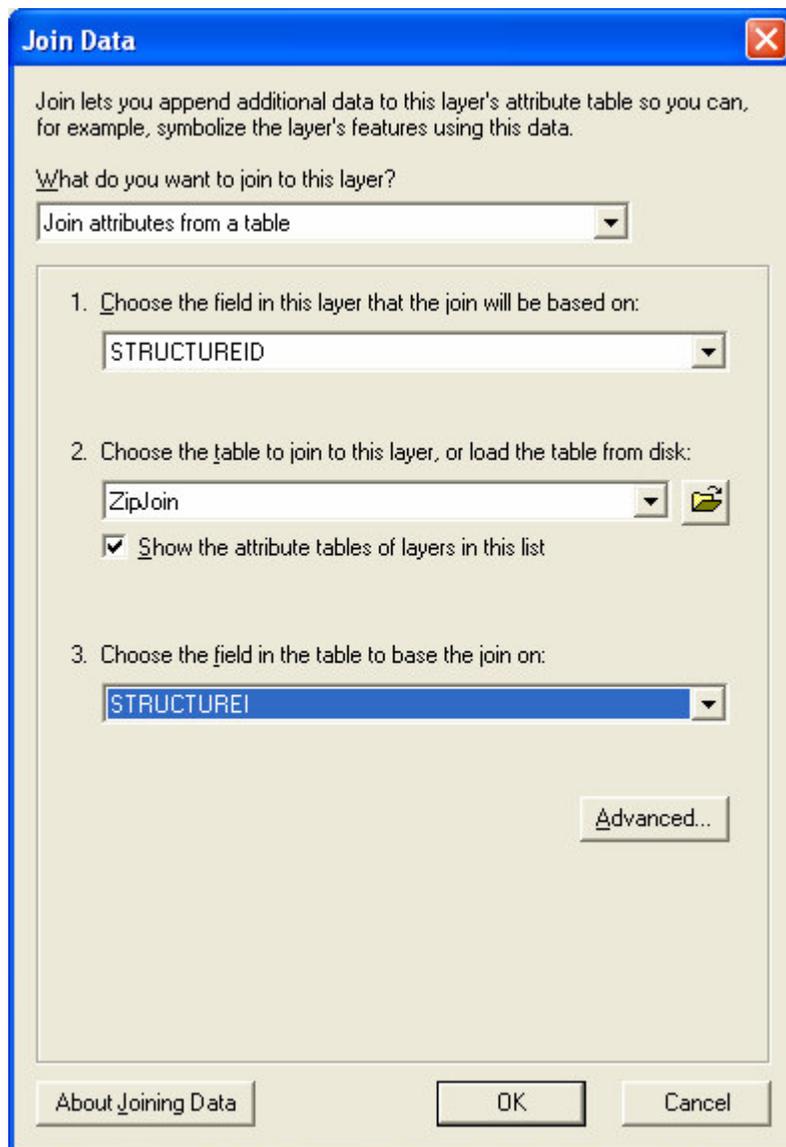
The Following steps assume that a valid Spatial Analyst (SA) License is available, the SA extension is enabled and a DEM has been created and has been saved in georeferenced raster format:

- i. Open ArcMap and select *A New Empty Map* to work with.
- ii. Click on the *Add Data Button*  from the ArcMap toolbar.
- iii. Browse and select the project Geodatabase where your inventoried structures are located.
- iv. Double-click the Geodatabase to drill-down, select the Buildings\STRUCTURES feature class icon and click the *Add* button. A new STRUCTURES layer should not appear in the table of contents.
- v. Click on the *Add Data Button*  from the ArcMap toolbar.
- vi. Browse and add the raster dataset containing the DEM covering your project area.
- vii. Open the ArcToolBox window and locate the *Extract Values To Points* tool from the Spatial Analyst Tools/Extraction Toolset. Double click the tool to open the *Extract Values To Points* Interface.
 - NONE — The value of the cell center will be used. This is the default.
 - INTERPOLATE — The value of the cell will be calculated from the adjacent cells with valid values using bilinear interpolation. NoData will be ignored in the interpolation unless all adjacent cells are NoData.
- viii. In the *Input point features* drop down box select the STRUCTURES layer from the list.
- ix. In the *Input raster* drop down box select the raster dataset of the layer containing your DEM.
- x. In the Output point features type or select a path to a new feature class or shape file where the structure points with extracted DEM values will be located.

- xii. Choose the Interpolation option by checking or unchecking the *Interpolate values at the point locations* option. The second option listed to include all raster attributes is not necessary and can be left unchecked.
- Unchecked — The value of the cell center will be used. This is the default.
 - Checked — The value of the cell will be calculated from the adjacent cells with valid values using bilinear interpolation. NoData will be ignored in the interpolation unless all adjacent cells are NoData.
- xiii. Click OK to begin your Extraction. The new feature class created will now contain structures with a copy of your extracted raster pixel values. These pixel values will be the elevation of the points in the vertical units for your model.



- xiii. Create an attribute join between the Structures layer and the newly created extracted values point layer created in step xiii.
1. Right-click on the STRUCTURES layer and select Joins and Relates..Join.. to open the Join Data window.



2. Inside of the Join Data window, follow steps 1., 2. and 3. to create your attribute join.
3. Select Join attributes from a table from the What do you want to join to this layer? drop down list.
4. Choose the STRUCTUREID field from the attribute drop down list in step
5. Select the layer that was automatically added to your map pointing to your newly created joined structures created in step h.
6. Select the field that contains the original Structure ID from the join feature. If this layer was saved out as a shapefile, the STRUCTUREID field will have been renamed to STRUCTUREI because of field name length constraints in shapefiles.
7. Click OK to create the join

- xiv. Now that the join is created, use a field calculation to copy the attribute values over to the GROUNDELEVATION fields
 1. Right-click on the STRUCTURES layer in the table of contents window and select Open Table from the pop-up menu to open the attribute table view.
 2. In the attribute table, right click on the column header of the GROUNDELEVATION from the join attributes and select the Calculate Values... option to open the field calculator button. If an edit session has not begun , you may get a warning message. Creating n edit session is not necessary and you may click the Yes button to continue.
 3. In the Field Calculator window, simply double click the name of the field from which you will copy the values from to place the field name into the STRUCTURES.GROUNDELEVATION = box and click OK. The value to be copied from will be named RASTERVALU if a shape file is used. After clicking OK, matching values from the join table will be copied over to the GROUNDELEVATION field.

b. Calculating Structure Elevations – A structure’s elevation are simply the sum of the ground elevation and the height above ground. Height above ground is a value that is entered in the field by field crew members. After ground elevations and height above ground values are set, The sum of these elevations can be calculated in the STRUCTUREELEVATION field in ArcMap as follows:

- i. Open ArcMap and select *A New Empty Map* to work with.
- ii. Click on the *Add Data Button*  from the ArcMap toolbar.
- iii. Browse and select the project Geodatabase where your inventoried structures are located.
- iv. Double-click the Geodatabase to drill-down, select the Buildings\STRUCTURES feature class icon and click the *Add* button. A new STRUCTURES layer should not appear in the table of contents.
- v. Right-click on the STRUCTURES layer in the table of contents window and select *Open Table* from the pop-up menu to open the attribute table view.
- vi. In the attribute table, right click on the column header of the STRUCTUREELEVATION field and select the *Calculate Values...* option to open the field calculator button. If an edit session has not begun , you may get a warning message. Creating n edit session is not necessary and you may click the *Yes* button to continue.
- vii. In the Field Calculator window, type in [GROUNDELEVATION] + [HEIGHTABOVEGROUND] in the STRUCTUREELEVATION = box and click OK. The value to be copied from will be prefixed with the name of the join table separated by a period in the field list. After clicking OK, the sum of the two elevation fields will be added to the STRUCTUREELEVATIONFIELD.

2. Assigning Hydrologic StationIDs & Streams to Structures

The second layer of data that needs to be updated before a HEC-FDA export can be created is to assign each structure with a single hydrologic station ID number and stream name matching the hydrologic engineering data entered into HEC-FDA separately from the structure inventory data for an individual project. More can be found about entering hydrologic engineering data into HEC-FDA in chapter 5 of the HEC-FDA user documentation at the following URL: <http://www.hec.usace.army.mil/software/hec-fda/documentation/ch5.pdf> . At the present time there is no set method to assign this information but a GIS may be used to assign these values spatially using one of 2 methods:

- a. *creating regions affected by single stations assigned to an individual stream*
- b. *assigning structures to the closest cross-section feature*

For both of these methods, the step-by-step procedures are identical to the procedure used to assign Zipcodes in part 2. of the FIELD COLLECTION POST-PROCESSING section. The fields to be updated are FDATASTREAM, containing the stream name and FDATASTATION containing the station ID.

3. *Linking structures to HEC-FDA Damage Categories*

HEC-FDA uses Study Damage Categories to assign price indexes for groups similar structures. Geo-FIT requires specific categories for residential but custom categories for each MS/B occupancy code in the project database. These categories names must be stored with each occupancy code in the OCCUPANCY Table. More can be found about setting up HEC-FDA damage categories section 6-2 of the HEC-FDA documentation at the following URL: <http://www.hec.usace.army.mil/software/hec-fda/documentation/ch6.pdf>

HEC-FDA Study Damage Categories Form

a. *Residential Categories*

These categories must be setup in HEC-FDA for a successful HEC-FDA structure import.

- i. *1STY-SLAB*: assigned to all one-story residential structures with slab foundations
- ii. *1STY-PIER*: assigned to all one-story residential structures with pier foundations
- iii. *2STY-SLAB*: assigned to all residential structures having more than 1 floor with slab foundations
- iv. *2STY-PIER*: assigned to all residential structures having more than 1 floor with pier foundations
- v. *MOBHOM*: assigned to all mobile homes

b. Assigning Commercial Occupancy Categories

There is no set commercial damage categories but each commercial structure is assigned the damage category that is tied to the structures assigned occupancy code. To assign the damage category to the occupancy code:

- i. Open the project Geodatabase in MS Access and open the OCCUPANCY Table.
- ii. For each occupancy record in the table, type in the damage category to be "mapped" to the occupancy record in the FDACODE field. Damage category names can be used more than once.

REFERENCES

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http://www.swiftestimator.com/pdf/SE_CE_Program_Reference.pdf