Substantial Damage Estimator Best Practices

Approaches for Using FEMA's Substantial Damage Estimator Tool

Prepared for:

Federal Emergency Management Agency
500 C Street, SW
Washington, D.C. 20472

May 11, 2012

Table of Contents

1. Introduction

This document provides suggested approaches for dealing with some of the challenging situations users may encounter while using the FEMA developed Substantial Damage Estimator (SDE). SDE is designed to help Federal, State, and local officials manage data collection and assessment of substantial damage. Often the complexity of field conditions, limited access to technology, or inspection work in the field present situations that require additional organization and planning. This document contains suggested solutions to some common situations SDE users may encounter. The information and methods can be used by Federal, State, and local officials when developing SDE-based inventories of potentially substantially damaged residential and non-residential structures. The guidance is organized into three phases of SDE management: 1. Planning Data Collection, 2. Field Work, and 3. Data Management.

2. Planning for Data Collection

2.1 Pre-Populating the SDE Database

Problem:

Inspectors would like to pre-populate the SDE Tool with community data to save time and improve accuracy when entering individual assessment data. Having a complete inventory of properties within a community's regulatory floodplain allows for rapid data collection and more immediate use of damage assessments to develop recovery priorities. Users can also readily import previous SDE assessment data and manage their database across multiple events.

Suggested Solution:

SDE includes an Enterprise Import function which allows the user to add multiple properties to the tool at one time. This can be a very useful function for large numbers of assessments. By creating an XLS, CSV, XML, or MDB file outside of the tool, the user creates a table of multiple properties, identifying key information requirements that will populate fields within SDE during the import. During import, the user will assign columns within their table to specific fields within SDE. This import process is easier if column headers describing the fields are the same as the SDE fields. If users have access to pre-existing databases of property data, these databases can often be easily adapted for importing to SDE.

Note: Data can only be imported by using SDE assessments or the Enterprise Import function.

Procedure:

- Identify pre-existing inventories, databases or sources for information
- Collect or compile information into a single spreadsheet (XLS, CSV, XML, or MDB file)
- The user may choose to import up to 24 pre-defined data fields, such as owner name, address, city, county, state, etc.
- The user will need to perform a one-time "mapping" function to assign a link between data fields in the import data and the existing data fields in the SDE Tool.

- Each field within the file that the user intends to import data for must be chosen from the SDE drop-down menu. For example, the address field in the import data may be titled "OwnerCommunity" while in SDE the target data field is titled "City." The user maps the link between two data fields in separate databases to ensure that the import data populates the correct data field in SDE.
- If a field within the file requires parsing (i.e., separation of data within a single field) the method in which it should be parsed must also be chosen from a SDE drop-down menu. For example, if a user enters the full name for the owner in one field within the file to be imported, the tool requires the user to identify the parsing as "[First] [Last]" in either the Owner's First Name or Owner's Last Name fields, so that the data may be imported properly into the correct fields.

2.2 Use of Community Address, Tax, Plat, Survey Map, or Location Data

Problem:

Inspection teams must be able to:

- Locate areas and structures to be inspected on a map
- Tie available community structure data to the structures that are found in the field

If structures being inspected lack posted addresses the inspectors will still require an address, tax parcel, survey plat, or other map to cross-reference. This is true even when SDE users have pre-loaded structure data. Without a cross-reference map that allows the inspectors to verify a structure name or address, the pre-loaded data has limited value in the field. Even aerial imagery or topographic maps will have limited value for identifying specific structures without some means of tying the community data to the maps. Cross-reference data may also useful for referencing structures without posted addresses (see Section 3.1 for further guidance on unmarked addresses).

Suggested Solution:

The SDE manager should determine if structure information is readily available and how that data can be used in the field to verify structure locations.

Procedure:

- Check these potential sources of data:
  - Community or county engineer
  - Community or county surveyor
  - Community floodplain manager
  - County tax assessor
  - State surveyor

Aerial photographs, county highway maps, and local street maps without addresses can also be useful for the inspection teams to orient themselves in areas unfamiliar to them.

- Search for:
  - Maps with structure addresses
  - Subdivision or individual lot plat maps
  - Tax parcel identification numbers and a reference map
- Verify, prior to the start of field work, that the data will be sufficient to help the inspectors find inspection areas and structures

2.3 Collection of Data Not Required by SDE

Problem:

Based on the local features of the structures in the inspection areas, the inspectors may need to record relevant data that do not match an existing data field in the SDE tool.

Suggested Solution:

Before starting data collection, the SDE manager should determine whether the inspectors will need to collect data that is not normally collected in SDE. For example, the unit cost for elevated structures may vary based on the height of the structure above the ground. This data is not required by SDE, but should be recorded by the inspectors in an agreed-upon data field in the SDE tool so that post-data-collection processing and quality assurance (QA) reviews can be completed based on the correct parameters.

Procedure:

- The inspectors can record data such as structure elevation in the "Residence Information" data field in the Structure Information portion of the *Structure/Damage/NFIP Info* (or second) tab of the SDE.
- The "Residence Information" data field allows free-form text entries, and therefore, the SDE manager and the inspectors need to agree on the format and level of detail (e.g., no decimals vs. two decimal places) of the data recorded in that field.

2.4 SDE Data Entry for a 1.5-Story Residential Structure

Problem:

The current SDE does not include an option to select a 1.5-story residential structure.

A typical 1.5-story structure includes a full aboveground lower (or first) level with the main living space (kitchen, bathroom, and bedroom) and an upper level that is less than a complete story. This structure type may or may not have a basement. The upper level may also have less floor space and may be finished with bedrooms and a bathroom or left unfinished for storage. The ceilings are lower, and the floor-to-ceiling height varies because the upper level is built directly under the roof, which slopes downward from the peak toward the walls (and forms part

of the ceiling). The floor space of the upper level is approximately one-third less than the lower level.

Suggested Solution:
Users should select a 2-story structure for inspections involving a 1.5-story residential structure because the additional floor space and features (electrical, HVAC, insulation, drywall, and plumbing) will be closer to those of a 2-story structure than a 1-story structure. Users should also enter the data into the SDE square-foot calculator tool using the dimensions for the lower floor and a value of 1.5 for the number of stories. Using a value of 1.5 instead of 2 for the number of stories will yield a total square footage that is closer to the true square footage.

Procedure:

- Select "Two or More Stories" in the "Story" data field in the Structure Attributes portion of the *Structure/Damage/NFIP Info* (or second) tab of the SDE.
- Enter the dimensions of the lower floor and use 1.5 for the number of stories in the SDE square footage calculator.

2.5 Selecting a Best Fit Structure Use for Non-Residential Structures

Problem:

The list of non-residential structure uses in SDE does not contain all the structure uses in an inspection area.

The list for non-residential structure uses is limited to 22 structure uses and based on the number of stories. While the list could easily exceed 100 different uses, such a large list of non-residential structure uses is overwhelming and impractical for most SDE users, especially those without a background in non-residential construction or inspection. The current list strikes a balance between too many and too few structure uses while offering a reasonable range of structure heights (number of stories) and functions. Furthermore, the list of elements and the element percentages as part of the entire structure do not vary significantly for the non-residential structure uses beyond those contained on the current lists.

Suggested Solution:

Users should select the structure use that best fits the structure being inspected. Consider the structure use (whether it is more like a factory, a warehouse, or an office building), the building materials (schools and hospitals have different construction materials than a warehouse), and the variations in quality (warehouses and factories are usually of a lower quality construction than an office building or a house of worship). As an example, the current lists of non-residential structure uses for a school have the option of either a one-story elementary school or a two- to four-story high school. The best choice for a two-story middle school would be a high school because of its additional features (larger gym, larger auditorium, pool), as well as the number of stories. Similarly, the best choice for a medical office would be an office building rather than a hospital.

Procedure:

- As suggested above, select the structure use that best fits the structure being inspected.

2.6 Data Collection Triage

Problem:

The SDE manager and the inspectors need to plan the areas to be inspected and the sequence of inspections to ensure a complete and efficiently conducted inventory. In addition, the inspectors need to know which areas or structures will require them to obtain access by permission or an appointment.

Suggested Solution:

Before starting data collection, the SDE manager should assess all areas to be inventoried and determine a general schedule of inspections, which areas have accessibility issues, and areas that require permission or appointments for access. The manager should drive through the damaged areas in the floodplain to estimate the number of structures requiring inspection, the areas with a high concentration of damaged structures, and areas either requiring permission or appointments for inspections or that have physical limitations that could delay or slow down inspections. This will also benefit the overall inventory work by providing the inspectors with alternative inspection areas if planned locations are inaccessible due to temporary hazards or debris clean-up.

Procedure:

- Schedule of Inspections:
  - Drive through the damaged areas of the floodplain to determine the quantity and types of structures to be inspected, level of damage, and health and safety issues (weakened floors, contaminated water, mosquitos, snakes, downed power lines, etc.)
  - Develop a schedule of inspections by neighborhoods and target dates. Target dates may need to be revised based on the progress of the inspection team
  - Consider the accessibility of the inspection areas
  - Determine priority inspection areas (if any)
  - Limit inspections to areas within the designated floodplain (per the NFIP requirements)
  - Notify police, Emergency Management Agency staff, and other local officials of inspection areas and the proposed schedule
- Areas with Accessibility Issues:
  - Areas with physical limitations
    - Inundated or debris-covered roads

        - Roads with missing or damaged bridges or other crossings
        - Downed power lines
        - Debris clean-up activities
        - Areas requiring off-road access
        - Islands requiring access by boat
    - Areas requiring permission or appointments. These areas may require anywhere from a few hours to a few days advance coordination to gain access.
        - Private residential developments, gated communities, individual gated lots
        - Businesses
        - Industrial facilities or parks
        - Local, State, or Federal government facilities
        - The SDE manager needs to know the number of structures to be inspected at closed locations so that an adequate number of inspection teams can be sent to the site
    - Inspections for these areas should be delayed until later in the inspection schedule or until the SDE manager can verify that safe and reasonably clear access is available again

3. Field Work

3.1 Lack of Posted or Marked Addresses

Problem:

In some rural areas, users may encounter structures without posted addresses, owner names, or visible tax data. For structures in this category, a procedure is required to identify the structure when attaching GPS data and structure photographs to the assessment. Trying to attach structure photographs or GPS coordinates to a specific structure later on after many inspections have been completed is extremely difficult, and errors could require a return visit to the field to either verify data or recollect data for structures previously inventoried.

Suggested Solution:

In SDE, you can use temporary ID numbers for damaged structures, allowing you to complete inspections and organize your structure database until more complete structure information is available. A properly managed temporary structure identification system consists of three separate data for a specific structure: photographs, GPS coordinates, and a temporary ID number. This lets the SDE manager, inspectors, and other local officials know that they are discussing the same structure in the post-data-collection environment. The temporary ID numbers should be entered in the “Street Number” data field, under Building Address on the *Address* (or first) tab. Once more detailed information is available, users can replace the temporary ID number with the correct structure address.

Procedure:

- Organize inspection staff into teams

- Deploy each team to a defined geographic area
- Assign a range of ID numbers to each inspection team before starting field work
  - For example, Team 1 could use the 1000 series of numbers for all structures they encounter without posted addresses. The first structure would be recorded as "Structure 1001 plus the street name" and the next as "Structure 1002" and so forth. Team 2 would use "Structure 2001 and the street name" for their first structure followed by "Structure 2002," while Team 3 would use the 3001 series, etc.
- Photograph each structure
- Record available street names, etc.
- Record accurate GPS coordinates for each structure

See the "Suggested Solution" under Section 3.4 regarding the use of a dry-erase board in the structure photograph with either the structure address or temporary ID number to further cross-reference the structure to the recorded data.

3.2 GPS Data

Problem:

There are no SDE guidelines for the level of accuracy of GPS coordinate data obtained during SDE inspections. The GPS coordinate data (latitude and longitude) must be accurate enough so that someone other than the original inspector can locate the structure on a GIS map or in the field.

Suggested Solutions:

Recommended Level of Accuracy:

The GPS coordinate data (latitude and longitude) should be accurate to 4 decimal places and 10 feet (or 3 meters) horizontally, with a 95-percent level of accuracy. These criteria will facilitate importing and plotting these data on local maps, shareware maps, or fee-based maps available from commercial sources or the Internet. This level of accuracy is needed so that the recorded GPS data are valid for only one structure, and anyone using those coordinates will be able to locate the same structure. Less accurate coordinate data may encompass larger areas that include multiple lots and structures even though the data was obtained on an individual lot.

A sample reading of GPS data would look like this:

Latitude: 32.6336, Longitude: -91.0555

Equipment:

To achieve the above-mentioned level of accuracy, the GPS data should be collected using a Wide Area Augmentation System (WAAS)-enabled, high-sensitivity GPS unit. WAAS corrects for GPS signal errors caused by ionospheric disturbances, timing, and satellite orbit errors.

Note of Caution:
Motor vehicle GPS units, some hand-held navigation systems, smart phones, computer tablets, or digital cameras with a GPS receiver may not be WAAS-enabled, and local officials and inspectors should not attempt to use these GPS units to record lot-specific coordinate data. The GPS data obtained from non-WAAS units have been found to have limited, inconsistent, and sometimes unreliable data, resulting in GPS coordinate data that could be anywhere from one lot to several thousand feet away from the actual data collection point.

Procedure:

It is recommended that users without a WAAS GPS unit should follow the same procedures to calibrate the GPS unit and verify the data.

- Verify the calibration of the GPS units
  - All inspectors should gather in one location each morning to obtain and verify GPS coordinates for that location on each hand-held unit
  - GPS readings should agree within four decimal points for the same location
  - This verification should be done on a daily basis
  - GPS units that do not match the coordinates obtained by other GPS units during the daily test should be recalibrated
- Potential issue when capturing GPS coordinate data:
  - Dense foliage or a thick tree canopy near a structure may limit the number of satellites in range of the GPS unit, and therefore impair the accuracy of the GPS data. When dense foliage or a thick tree canopy is present, the inspectors should either move to a different part of the property that has a clear line-of-sight to the sky to obtain the GPS data or obtain multiple GPS readings at various locations around the structure (possibly at the four corners) to verify that the readings are consistent.

3.3 Digital Photograph Standards

Problem:

There are no guidelines for the size and resolution of digital photographs attached to SDE assessments.

Suggested Solution:

Digital photographs should be 640 pixels wide by 480 pixels high (640 x 480), and each individual photograph file size should be 3 megabytes or less. SDE photographs should be obtained in JPG or JPEG (Joint Photographic Experts Group) format because it shows a good level of detail for curbside photographs and has a smaller file size than other digital photograph formats.

High resolution photographs may adversely affect the operating speed of the SDE, especially if input in large quantities. The higher (or better) the resolution of the photograph, the larger the

digital file attached to the inspection. The larger the digital files and the more photographs attached per inspection, the larger the SDE database becomes, and the slower the tool may operate when either attaching photographs to inspections or moving between assessments. For communities with a large number of inspections, it is recommended that lower resolution photographs be collected. Although individual photograph sizes may not seem large, their collective size will grow as more assessments are added and the inventory increases.

Procedure:

- Review the manufacturer instructions for the digital camera to learn how to set the image resolution and size
- Set the digital image to (640 x 480)
- Every day, verify that the resolution has not changed, especially if the camera ran out of power while it was being used

3.4 Obtaining Digital Photographs for Structures in a SDE Inventory

Problem:

After returning from the field, it may be determined that the digital photographs are not usable due to being too dark, washed out by sunlight, or obtained too far from the structures. Images may also not be usable due to dense foliage on the top, front, or sides of a structure that obscures structure features, rendering it undistinguishable from other similar structures nearby.

Suggested Solutions:

Inspectors should try to frame the photograph so that the structure fills a majority of the frame and is readily recognizable to the structure owner or anyone else who views the structure from the point where the photograph was taken. Photographs taken from curbside or the driveway of the structure are recommended. The purpose of obtaining one or two photographs per structure is to provide a reference for the structure being inspected, not to record all of the damage.

Depending on the preferences of the SDE manager, a white dry-erase board with the actual or temporary structure number plus the street name and suffix (such as Street, Boulevard, Road) can be held in one of the lower corners of the photograph when it is taken. This will provide a cross-reference between the photograph and the SDE assessment.

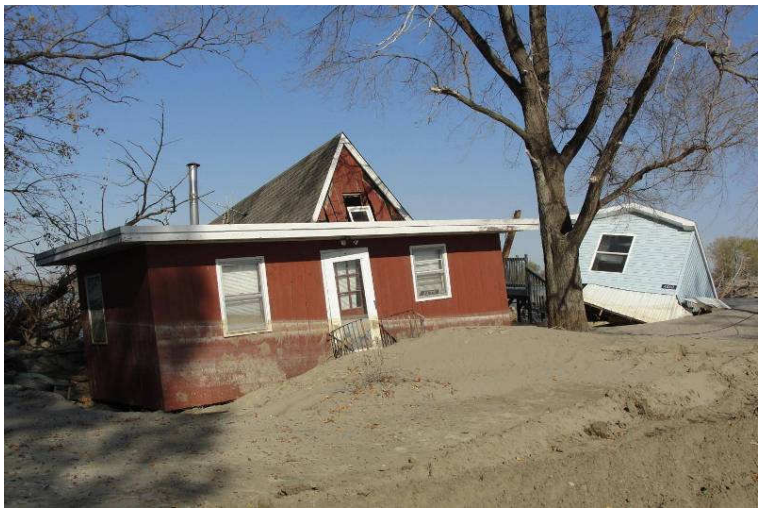
Procedure:

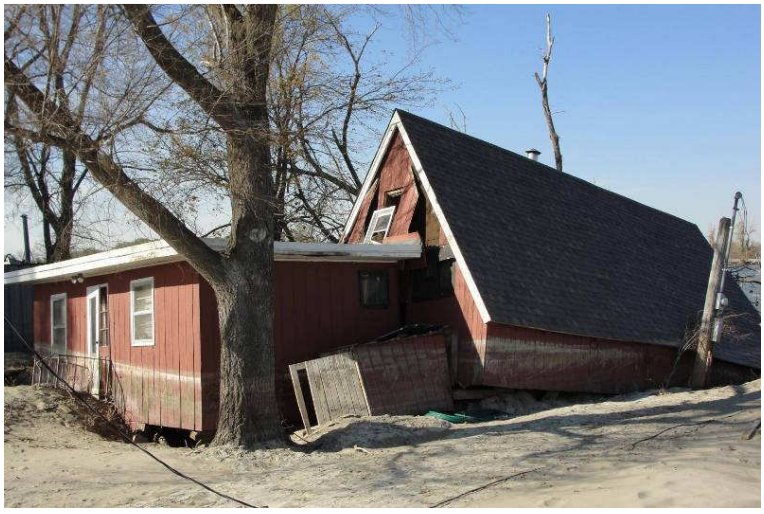
- The inspectors should try to obtain corner views of the structure to show two sides in each view. In this manner, all four of the sides for a rectangular-shaped structure can be obtained with only two photographs.
- When heavy vegetation is present, take additional photographs or close-up shots where the structure outline extends beyond the edges of the photograph. Taking photographs of more than one side of the structure may also help.
- For elevated structures, inspectors should try to get an object or person, such as a vehicle, another inspector, or a nearby structure sitting at ground level, in the

photograph to provide a perspective on the relative height of the structure above ground.

- If a high water mark on the structure or a debris line on an adjacent fence or vegetation is visible, inspectors should try to capture it in the photograph.
- If bright sunshine is a problem, take the photograph from a different angle.
- As a routine procedure, **the inspectors should review the photographs before leaving the structure to ensure that the photographs are clear and show the correct structure.** This will avoid the need to return to the site later to obtain better photographs.

The following sample photographs show two views of the same structure from different corners while also showing a high water mark, structure displacement, and some of the damage.





3.5 Calibration Inspections and Estimating Percent Damage

Problem:

The inspectors need to understand the SDE requirements as well as the expectations of the SDE manager for the inspections and data collection. In addition, the inspectors need to understand how to estimate the percent damage for both residential and non-residential elements.

Suggested Solution:

The SDE manager should review two or three structures in the field with all the inspectors on the first day with the sole purpose of showing the inspectors the data that needs to be recorded. The manager should also hand out and review the contents of Appendices E and F from FEMA P-784, *Substantial Damage Estimator (SDE) User's Manual and Workbook, Using the SDE Software Program to Perform Substantial Damage Determinations* (July 2010). Appendix E contains a resource guide for estimating percent damage categories by element using SDE for residential structures, and Appendix F contains a similar resource for estimating percent damage by element for non-residential structures.

Procedure:

- Review the field safety requirements, site access procedures, SDE assessment, data evaluation, and data entry.
- Review the data to be ignored (structure color, lack of maintenance, contents damage, etc.) for SDE data collection.
- The residential and non-residential elements should be pointed out on the calibration structures.
- Explain to the survey teams that the percent damage per element should be entered in increments of 5 to 10 percent.
- After the initial two or three structures are evaluated as a group, each team should collect data for three to five structures on its own. Encourage each two-person team to rotate activities so that each member understands the data collection and data entry objectives for the inventory work. Team members can take turns identifying structure element percent damage and structure dimensions, recording data, taking photographs, and obtaining GPS coordinates.
- The data from all the inspection teams from the first day should be reviewed as a group exercise to identify data issues and consistency, verify completeness, review estimates of percent damage, and evaluate photograph quality.
- Stress to the teams that the data collection and data entry is a team effort and that everyone will approach it differently based on his or her own experience. This is not a competition to see which team completes the most inspections.

- Each inspection team should review another team's data entries for consistency and quality to obtain a better understanding of the data requirements and potential data consistency issues.

The first 3 days are critical to overall SDE inventory quality and SDE manager and inspectors must all be "on the same page." Inconsistency and problems with data collection can quickly multiply and create a large problem requiring hours to days of revisions to the SDE data if the initial issues are not found and corrected within the first few days.

4. Data Management

4.1 Resetting the SDE Tool for a New Database

Problem:

Users may want a separate database, clear of all data from previous inspections, when starting a new day or week or when changing from one inspection area (neighborhood, subdivision, or community) to another without uninstalling the SDE tool on host computer.

Suggested Solution:

Users can copy a blank database into the SDE file folder on the host computer so that all previous data are cleared.

Procedure:

- When SDE is first installed on the host computer, the user should navigate to the location of the SDE application on the hard drive (e.g., C:\Users\james_smith\Documents\SDE).
  - Find the database file named "dbSubstantialDamageEstimator.mdb."
  - Right click on this file and select copy.
  - Browse to a new location (user's choice) in either the file folders or on the desktop. Right click and select paste to save a copy of the bank database.
  - This approach will provide a blank version of the database that the user can re-use as needed without having to uninstall and reinstall SDE. It is important to note that the version of the database saved with the installation files should always be named dbSubstantialDamageEstimator.mdb, but the blank database can be named differently.
- Before using a blank SDE database, users should save and export a copy of the previous SDE database by using the SDE export function.

4.2 SDE Data Quality Assurance Reviews

Problem:

The SDE data are missing or incomplete, the GPS coordinates are not accurate, the data are inconsistent between teams, and photographs are unusable.

Suggested Solution:

As soon as the data comes in from the field, the SDE manager should run some QA checks to ensure that the data are usable. This is especially critical during the first 3 days of inspections and data collection to minimize the impact of poor or incomplete data on the SDE inventory.

Procedure:

- Plot all of the GPS coordinates on a geo-referenced map or GIS overlay to verify that the coordinates match the inspection area.
- Review photographs for legibility and consistency with SDE manager preferences.
- Confirm agreement between the photograph and the structure information (e.g., an assessment for a two-story residential structure must have a photograph showing the same).
- Review the entire database for duplicate records from the current or previous days.
- Verify that the correct unit cost data and depreciation percentage based on structure type were entered into the tool.
- Verify that the correct community name and National Flood Insurance Program information were entered into the tool and are consistent for all assessments within the same community.
- Verify that the user has entered reasonable percent damages based on the duration and depth of flooding above the first floor for the inventory area.
- Verify that all data requested by the SDE manager has been entered and is consistent where applicable (e.g., check that the street name is spelled the same for all entries on that street).