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Documenting with Measured Drawings: Guidelines for Field Survey of Existing Buildings – prepared by Ilene R. Tyler

The documentation of structures can be accomplished through preparation of field-measured drawings. Such drawings allow the documenter to record notes and sketches based on direct observation. If done in an orderly manner, these field drawings provide the basis for preparation of hard line architectural drawings, or part of a comprehensive HABS documentation, or a component of a Historic Structure Report. The level of detail and quantity of sketches is dependent on the intended use and time available in the field.

Measured drawings are prepared in two steps. First, sketches are made at the site, including floor plans, elevations, and as many architectural details as can be reasonably be sketched during the field visit. It is highly recommended that the field sketches be drawn on graph paper with a grid of 1/8-inch squares, within a larger 1-inch grid, using a clipboard "desk." Each square of the grid can represent a given scaled area; for plans and elevations, a common scale is one square equals one square foot, or 1/8 inch = 1 foot.

Care must be taken to record information clearly, neatly, accurately and unambiguously. Guidelines established by the Historic American Buildings Survey (HABS) should generally be followed, particularly if the ultimate product will be submitted to HABS. These outline field-sketching methods describe several drafting techniques, and allow for uniformity of documents as well as clear reproduction capability. It is absolutely critical that the sketches are created in a manner that is readable by others.

When collecting dimensions for measured drawings, the most effective approach is for a team of two or three people to work together at the site. One person prepares the sketch drawings and one or two assistants read the dimensions from a tape measure. Measurements can be read off as running dimensions—that is, a long (e.g. 100-foot) tape measure should be held at one corner of the structure and distances to doors, windows, and other elements on one wall read without moving the tape. This technique avoids the compilation of errors that would likely occur if the tape were shifted for each measurement. Dimensions are placed on the sketches; using an alternate (red) color for dimensions makes the lines and numbers easier to distinguish from the line drawings. Materials and conditions, in an alternate (blue) color, can also be noted right on the same sketches.

The second step is creating hard line drawings from the field sketches. Traditional HABS drawings were, and still are, created by hand, drawing in ink on Mylar drafting film. Standards can be found through the HABS web site and should be followed explicitly if the ultimate goal is to submit the drawings to the archival collection in the Library of Congress. In recent years, HABS standards have expanded to include computer-generated drawings, referencing the same standards for detail and appearance. Views generally include floor plans,

elevations, architectural details, and construction elements, depending on the complexity and significance of the building.

Computer standards for hard line architectural drawings are based on individual office standards and specific project requirements, as well as a reflection of specific computer drawing software. As this is constantly in flux, it is inappropriate to specify layering or line weight requirements. Visual goals similar to hand drawing are generally codified in these selections. Making hard line architectural drawings look good, and at the same time communicating essential information, is the obvious objective.

Physical Investigation and Field Survey:

Field survey is an important part of the physical investigation for a Historic Structures Report and other preservation projects documenting existing conditions. Use all of your senses to "read" the building and absorb any subliminal messages from the site. Considered the following:

1. Identify the building's key elements, overall features and details from the exterior, and again at the interior, that contribute to the building's historic significance. Make mental and written notes of these key features to be further documented. A previously prepared survey worksheet is an immensely helpful tool to record key materials, features, and their condition.
2. Assess the building's structural condition (First question: is it safe?) and consider the integrity of the basic structure and materials that give the building its form and finished appearance. Note what appears unsafe, changed, or out-of-synch with the prototypical building type or era of construction.
3. Search for evidence of modifications and additions, attempting to confirm the date of original construction and sequence of changes. Ghosting from missing or moved elements, obvious infill areas, as well as changes in the exterior skin all provide clues to changes over time.
4. Sketch primary building facades and floor plans as a base for notations and measurements. Use basic grid paper on which to draw this information. Drawings need not be to scale as long as the essential information is captured. Assign room numbers and window and door numbers to create a logical system for an inventory of conditions. Some of the information is recorded separately from the drawings, using lists or schedules to organize the information.
5. Measure the overall building footprint to obtain basic information for scaling or estimating the cost of recommended work. Measure openings to consider modifications that may be required to meet building and accessibility requirements. Measure, or estimate, heights of overall building facades, prominent features (like a tower), and interior ceilings.

6. Photograph the building in context, overall exterior elevations, key and typical details, and areas where further investigation may be required. Photograph interiors, room-by-room, from diagonally opposing corners, as well as selected interior details. Use a photo log and/or sketch plans to identify photo locations for future reference. Methodical notations in the field take time, but are invaluable back in the office.
7. Conduct a room-by-room survey of interior conditions using previously prepared survey worksheets. Make sure each work sheet is labeled correctly with room name and/or number, date, surveyor's name, and building name. For larger buildings, it may be possible to combine groups of rooms that are similarly treated, e.g. a series of second floor bedrooms, on one worksheet.
8. Document the structural system (e.g. balloon frame or masonry bearing walls), mechanical systems (e.g. radiators or ductwork), electrical (e.g. wiring and light fixtures), and other systems (e.g. elevators or intercom systems) that may be relevant to the historic building. Consultants who specialize in these disciplines also may be part of the survey team, and these tasks can be delegated to them.
9. Sketch building details through window and door openings at full or half scale. Not only does this confirm wall thickness, but the relationship of frames within openings. Carefully consider how the framing is assembled, as well as how it was originally installed. Repair and replacement options depend heavily on this information, with details based on this survey information. Original drawings may be available to compare with surveyed conditions. Photograph sketched openings for later reference.
10. Key sketch details to area plans, schedules and survey worksheets. Compare different parts of the building for variations in details, as further evidence of changes or era of construction.

Photographic Techniques:

Digital photography has become an accepted standard in photographing existing conditions for historic resources of all types. A rule-of-thumb is to use the highest available image quality setting in a .jpg format, so details are viewable when using the zoom feature. (A suggested image quality minimum is at the "fine" level with an 8 mega-pixel camera.) Digital photography allows photos to be directly downloaded to computers. The digital images can be incorporated into computer drawings (computer-assisted drawing, or CAD) and replace or supplement drawn details. Digital photos can be used as part of the construction drawings, with arrows, notes, and dimensions applied directly to them.

The use of digital cameras combined with notebook computers enables architects to work on CAD drawings directly at a project site, saving time and increasing the accuracy of their work. The resulting computer drawings can be sent as .DWG or .PDF files to offices anywhere in the world instantaneously and

returned in the same format. The primary limitations to this technique are battery life of the camera and the notebook.

Rectified photography is another relatively simple technique. Targets are placed on a structure at a set distance apart when photos are taken. The targets define the scale when used on a photograph of the structure and provide reference points for a superimposed grid. With this grid drawn over a photograph, measurements of a structure can be derived for any elevation perpendicular to the camera directly from the photo rather than from laborious on-site measuring. Obviously, such derived measurements are not as accurate as actual site measurements, but in many instances they are sufficiently precise for the intended purpose. To measure some features, such as large flat walls with repetitive punched openings, the technique actually may be preferable because of the difficulty of measuring repetitive building details that are out of reach. A drawback of rectified photography is that it can be used accurately only on flat elevations. Recesses or projections will change in scale and angled surfaces will be distorted unless separately photographed with the camera perpendicular to the angled surface.

Some architects and contractors use radar to locate building materials that cannot be seen by eye. For example, radar can show the location of metal anchors within masonry walls. Infrared sensing is a method of identifying energy performance of buildings, particularly with respect to areas of heat loss or water infiltration. Although a method of illustrating conditions, this system is not used to create background drawings.

High definition survey (HDS) is an emerging photographic tool used to create accurate computer drawings of existing conditions. Also known as 3D laser scanning, HDS uses a special digital camera to capture existing conditions of the built and natural environment in minute detail and produces point cloud images and 3D models containing millions of data images. As an example, the CloudWorx computer program by Leica “reads” the data and new drawings are created in AutoCAD or imported directly into Revit from the point cloud information. The information is dimensionally accurate in all directions, and images can be rotated to any angle for views not available by camera images alone, including sections through the building.

Checklist of Recommended Basic Tools and Supplies:

- ☐ Graph paper with field grid at 8 squares per inch, inside a 1-inch super grid. (Use QEA graph pads for consistent header but limited drawing area.) 8 ½ x 11 inch size is most convenient, but larger graph paper or folded prints may be preferable in specific cases.
- ☐ Measuring tools: 25 foot metal tape measure for general use, room dimensions, stiff enough for moderate heights; (optional 150 foot tape for exterior overall dimensions and site features; 6 foot folding rule for detail work).

- ☐ Writing implements: Colored pens in black, red, blue, and green; Permanent markers for baggies and samples; Colored pencils, which work better in wet conditions, so bring as backup to pens.
- ☐ Clipboard “desk” to support graph paper and worksheets.
- ☐ Magnets. Extension wand with magnetic tip for hard-to-reach metals.
- ☐ Camera. (Check batteries) and photo log blank sheets.

Checklist of Supplementary, or As-Needed, Tools and Supplies:

- ☐ Survey worksheets for field survey of exterior and interior conditions, reference guide for masonry conditions, window and/or door schedules, key floor plans, and exterior elevations.
- ☐ Laser measuring device. (Check batteries.)
- ☐ Flashlight. (Check batteries.) Also, headlamp or even portable lights, if you have power.
- ☐ Gloves. Remember, it’s often dirty for field surveying. Cheap garden gloves are usually adequate.
- ☐ X-acto blades and holder for scraping and taking paint samples. Chisel point blade best for cutting out samples with substrate intact from wood. Curved blade best for carving out craters to expose paint layers.
- ☐ Manila envelopes, very small size.
- ☐ Plastic baggies, small and medium sizes, for samples.
- ☐ Pry bar or crow bar, if selective removal or demolition is an option.
- ☐ Small screw driver or pen knife to test soundness of weathered wood.
- ☐ Binoculars.
- ☐ 10X Lupe or magnifying glass.
- ☐ Line level, site level, and carpenter’s level all have their purpose.
- ☐ Pitch and angle locator.
- ☐ Mirror on extension wand for hard-to-reach areas.
- ☐ Compass to confirm north orientation.
- ☐ Moisture meter for relative moisture levels in wood and masonry. Detects moisture content above absolute dry conditions.
- ☐ Contour gauge or profile comb.
- ☐ Bag to hold all of the above.