THE HISTORIC AMERICAN BUILDINGS SURVEY & INTERPRETIVE DRAWING:

USING DIGITAL TOOLS TO FACILITATE COMPREHENSIVE HERITAGE DOCUMENTATION

by

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INTRODUCTION

The objective behind this study is to gain new insight into the practice of heritage documentation as seen through the lens of the Historic American Buildings Survey (HABS) and its sister programs, the Historic American Engineering Record (HAER) and Historic American Landscape Survey (HALS). Through that lens, specific focus was placed on how HABS/HAER/HALS has traditionally defined heritage documentation discourse through the production and use of measured drawings. In particular, this study seeks to identify how a specific type of drawing, the interpretive drawing, was incorporated as part of a measured drawing set; how the interpretive drawing was defined, used, and created; and how the use of contemporary digital tools could facilitate the production of interpretative drawings as analyzed through the production of said interpretive drawings in three case studies.

HABS and the other Heritage Documentation Programs (HDP) were chosen because of the influential methodology for heritage documentation they initiated. This particular methodology, since the creation of the first HDP program HABS, supports a rigorous and disciplined nature for how documenters engage with the physical structure throughout the recording process. By abiding to such an intense documentation routine that promotes hands-on engagement with a historic structure, a deeper understanding of the historic fabric is achieved and thus is reflected in an accurate set of documentation for the HDP archive. In addition to documentation methodology, the Heritage Documentation Programs advocate for professional and public edification, manifold heritage awareness, the preservation of America’s built heritage, and for the promotion of scholarly research in the heritage field. The substantial HDP archive produced from such virtuous tenets has grown into one of the most widely used and respected collections in the Library of Congress today.
The focus of this thesis on measured drawings was born out of my own interest as an architectural designer in how drawings communicate ideas about space, form and experience. The interpretive drawing, or a drawing type that successfully correlates unique pieces of information together in a scholarly, curated manner, is just as much about the final product as it is about its process of creation. Acknowledging this duality positioned me to explore different tools and mechanisms that would both facilitate the process of interpreting and encourage sophisticated, accessible methods of production.

The significance of the study is that it explores an approach to heritage documentation through measured drawing that attempts to balance the use of available resources for documentation production in the digital era without compromising significant and essential themes of historic documentation. The three case studies allowed me to investigate a different approach to interpretation of data due to their unique qualities and thus, a different application of digital tools is used for each one. The results and conclusions of the written investigation and of the case studies are to add to the growing discourse surrounding documentation of historic fabric in the digital age.
Chapter 1: Context
Documentation in the context of historic preservation typically refers to a record, or proof, of existence. The spectrum of data that is recorded varies depending on the intention of the documenter and scope of project, but in all cases it is an identifier of an existing situation or set of conditions. The document, therefore, holds an immensely important place in our understanding of heritage: it is the tangible proof with which to legitimize cause, action, and interpretation. The document may also serve as the only existing indication of an event or physical object, in which case its importance becomes elevated further as the only representative of the recorded data. It may also serve as a record of practice pertaining to a specific period in history, where the act or technique of documentation becomes equally as important as the content the document displays. Given the diverse usefulness and applications of the document, then, its existence in any effort of preservation of the built environment should be the absolute minimum requirement, should nothing else be done.

Typically, the historic built environment is recorded through photographs, drawings, and written reports. Each of these three recording methods has its advantages, but fundamentally there exists a divide between how graphic and written documents communicate information. As John Burns, the editor/author of *Recording Historic Structures* states, a “fundamental principle of architectural, engineering, and landscape documentation is that words alone cannot adequately record and explain historic structures,” understanding that the two must work in tandem for comprehensive recording. A measured drawing may quickly, and accurately, convey the physical relationship of building components and their construction better than a written sequence of descriptors, while a researched historic report would be the more suitable choice for contextualizing disparate and intangible events in a given project’s timeline. When documentation is done correctly, its usefulness has multiple audiences and applications.

Academic study is perhaps the most versatile of applications for heritage documentation. The analysis of a given structure through its plans, sections and elevations may give insight into cultural preferences of a particular region or era. Spatial organization directly ties into either the functionality of the structure or the intention of the designer; either way, through studying the tectonic relationships in existing structures these intentions are revealed. The subjects of study too can persuade public recognition of previously overlooked sites, for instance in the study of the vernacular. An informed academic investigation into a set of documents can expand beyond pure academia and influence how an intervention (a modification or removal of physical fabric) should or should not occur in a historic context. Conversely, the intention of a planned intervention may determine the specific type of documentation to be undertaken before doing so. Documentation of an exist-
ing structure can also serve as insurance for any future alterations or damages to the structure. The document acts as the back-up record and source for period reconstruction should the need arise. It can also be the official record of existing conditions before a dramatic rehabilitation is carried out, or, in a less desirable way, act as the final record of a structure before it is demolished.
The National Park Service through its Heritage Documentation Programs (HDP) administers one of the largest archives of architectural documentation in the world and the largest in the United States. The Historic American Buildings Survey (HABS), the Historic American Engineering Record (HAER), and the Historic American Landscape Survey (HALS) together have documented nearly 40,000 sites across the nation, “encompassing over 60,000 measured drawings, 250,000 large-format photographs, and untold pages of history.” The special collection, housed in the Library of Congress Prints and Photographs Division, covers a vast array of project types through each program and is characterized by its standardized material and clarity of presentation. Easy accessibility to the collection is made possible through the Prints and Photographs Online Catalog, where the measured drawings, photographs, written reports and supplementary materials of most projects have been digitized and are generally copyright free.

The original and oldest of the Heritage documentation Programs is the Historic American Buildings Survey. Established in 1933 as a relief program under the Civil Works Administration, HABS sought to create work for unemployed architects through the creation of an archive that focused heavily on measured drawings. From the initial memorandum proposal by Charles E. Peterson, an architect part of the National Park Service, the scope of the archive was to include a complete “resume of the builder’s art,” ranging from the monumental to the vernacular. Included in the vision of the program was an acute attention to detail and standardization of the material produced, a critical foresight on Peterson’s part, for that attention to legibility would evolve as the basis for the archive’s integrity in the years following. In 1934 a tripartite agreement between the National Park Service, the American Institute of Architects, and the Library of Congress was formed, and the following year the Historic Sites and Buildings Act of 1935 was passed, legitimizing HABS and providing the basis for making the program a permanent part of the Park Service.

In 1969, the Historic American Engineering Record was established as a companion program to HABS. HAER was intended to focus specifically on industrial heritage and documenting the nuances of industrial processes, which was spurred by the rapidly disappearing industrial landscapes of the mid-20th century. The recording of industrial heritage constituted a need for a slightly different documentation methodology than HABS, however; describing projects in the state they existed in at the time of documentation (as was the process of HABS) often did not cover the complexity of factories or mills, and so a different, multi-disciplinary approach was taken in the type of materials submitted for HAER.
Both the HABS and HAER programs have undertaken surveys where historic landscapes were critical to the site or industrial process. Typically these were in the form of site plans with landscape elements noted in relationship to buildings, or, in the case of HAER, drawings which focused on the relationship between the industrial process and the natural resources of the site in which the project occupied or used as part of its process. Extensive surveying of the plant life associated with the landscape or any botanical analysis was not typically addressed in either HABS/HAER surveys unless a landscape architect with specialized knowledge was part of the recording teams. It was not until 2000 when the Historic American Landscape Survey (HALS) was established that historic gardens, estates, urban streetscapes, and cultural landscapes received the same sort of awareness and appropriate attention to the documentation needs of their subjects that HABS and HAER had enjoyed. HALS was officially made a permanent federal program in 2010 and employs the same material types of documentation (measured drawings, photographs, and written reports) that its predecessors require.
The primary goal of the contemporary HABS, HAER, and HALS programs is to, in the words of the current HABS Chief Catherine Lavoie, “provide a record for future generations.”¹ This goal can be expanded upon through four generally acknowledged initiatives, as stated succinctly in a 2012 webinar “HABS/HAER/HALS Webinar: In Pursuit of the Complete Resume of the Builder’s Art,” available on the National Park Services’ website:²

1) Create an archive of America’s architectural, engineering, and landscape heritage; provide a clearinghouse for documentation to the Library of Congress;

2) Create standard-setting documentation and guidelines for recording;

3) Field test new recording methods and technologies;

4) Educate the next generation of recorders and preservationists

The importance of an archive for preserving architectural heritage cannot be emphasized enough in the case of HABS, HAER and HALS. Preservation through documentation creates a physical legacy for future examination of culture as communicated by the built environment. The success of this legacy, however, hinges upon the reliability and clarity of the documents within the archive, which are determined by universally understood standards of conducting the documentation process and its consequent outputs.³ Creating standard-setting documentation and guidelines for recording, then, positions Heritage Documentation Programs as a powerful player in the conversation of contemporary preservation practice.

Since the archive of HABS, HAER and HALS material includes different types of materials, namely measured drawings, photographs, written historical reports, and field notes, a disciplined approach to standardization was critical to the coherency of the collection early on. The need for specifications of “uniform and reliable sheets [of drawings]” was written into the 1933 HABS proposal by Peterson, and is further indicated in the first published procedural guidebook, “Specifications for the Measurement and Recording of Historic American Buildings and Structural Remains.” An excerpt from the Specifications on recorded drawings states:
The quality of paper, dimensions, and arrangement of these sheets have been determined by the National Advisory Committee with particular reference to the permanency of the record, convenience of filing the drawings in the Library of Congress, and the necessity of making them available for consultation by students, and for reproduction.4

The specifications continue to describe how the character of the drawings should be “complete, clear, accurate, and in sufficient detail to serve as a basis for the reconstruction of the building if it be destroyed,” and that “uniformity in methods of presentation enhances the value of Survey drawings.”5 The significance of these first specifications and subsequent procedural publications by HABS and the HDP is that they were and are the requisite guidelines for which documentation is accepted into the archives. The evolution of these procedural publications reflected the changing standards of production, such as in the codification of graphic techniques or widely produced material types of paper after World War II, or more dramatically in the 1980s with the introduction of Computer Aided Design and Drafting and the resulting effects it had on drawing production.6 A seminal publication, Recording Historic Structures, first published in 1970 by HABS and authored by Harley J. McKee, summarized the early individual publications prior to the book as an instructional booklet for students and others interested in heritage documentation. Recording Historic Structures has since then been published as a first edition in 1989 and a second recent edition in 2003, updating to reflect changes in technique and principles.

The Secretary of the Interior’s Guidelines for Architectural and Engineering Documentation, established in 1983 as a guideline specifically for mediating mitigation documentation, solidified HABS documentation methodology as the criterion for how documentation should be executed and produced (in this case, with particular implications of how federal enterprises impacting historic fabric should be documented).7 Documenting to the Secretary of the Interior’s Guidelines for Architectural and Engineering Documentation archival standards ensures that each record meets accepted definitions of content, quality, materials, and presentation. The content “shall adequately explicate and illustrate what is significant or valuable about the historic building, site, structure, object or landscape being documented,” and “be prepared accurately from reliable sources with limitations clearly stated to permit independent verification of the information,” concluding that the verification be in the form of field notes.8 The materials of documentation must also be reproducible and standard in size, with the content clearly and concisely produced in presentation.9 By utilizing standardization in documentation, the records become part of a universal language that can transcend professions and user groups to make the data as accessible as possible.
By adopting the established methodology employed by HABS documentation procedures, the Standards and Guidelines endorse a careful and particular practice of examining heritage sites. Field measuring and recording via field sketchbook teaches about the explicit physicality of an architectural, engineering or landscape site. The idea that one must be in the presence of the artifact under scrutiny ensures that the recorder has the personal experience in and around the structure. Field measuring and sketching also demands that the recorder be diligent about what data they record and how that data bests represents the defining characteristics of the site in question. In the words of David Woodcock, an architect and long-time educator of heritage documentation practice, field measurement gives the recorder “the ability to analyze and interpret evidence presented by the subject buildings, recognizing anomalies in design and details that provide evidence of later and earlier work.”

The recorder is not just a draftsman, photographer, or historian, but rather a detective deducing and reasoning during field research, providing a curated piece of documentation that enhances the value and application of the survey within the archive. The HDP methodology then filters into the discourse of heritage documentation given its prominence as an archive and steward of practice.

Testing field documentation techniques and technologies is essential to the effective practice of data gathering and recording. The rapid technological development in the 20th century provided a cornucopia of new techniques for data acquisition, but not every new evolution resulted in efficient or practical use in heritage documentation. The primary and perhaps most rudimentary technique that the HDP champions is field measuring and field notes sketched in notebooks. Field notebooks are considered the primary source of information that justifies the accompanying measured drawings, and they also aid in the analysis undertaken in the written historical report. Drawing in field notebooks additionally encourages the recorder to understand proportional and organizational relationships found within a given detail or spatial configuration; the act of repeating this sketching exercise reinforces the knowledge gained through continued practice.
Photography too is an integral part of heritage documentation, either as a stand-alone record or as a supplementary one. HABS, HAER, and HALS use large-format black and white photography as part of their survey records. These photographs may be the only graphic piece of documentation included in a survey or as a companion to the measured drawing set. The particulars of stand-alone photography procedure and archival stability as defined by the HDP are not the focus of this thesis, so instead the use of photography in the aid of drawing production will be discussed. Fairly early in the HABS history, photogrammetry, or the use of photographs to obtain measurements, was used to capture data from a site. The key to photogrammetry is to record some dimensional information in the field of view of the photograph, where that dimensional information, the camera position and distance from the subject, and particular optics of the camera are noted as the survey control. Stereophotogrammetry is the most accurate and widely used type of photogrammetry, as stated in Recording Historic Structures. Paired photographs, or stereopairs, are produced at successive camera positions, normally on the axes-parallel to the subject. “Stereographs are placed in a plotting instrument to produce an optical model that is scalable in three dimensions,” however it is a highly specialized technique and a costly endeavor as specialized cameras and equipment is needed. HABS took advantage of photogrammetry, however, in the mid-1950s, and the technology enabled

Figure 1.2: Example drawing using photogrammetry. Lamsam, Julsing J. “Plan Showing Location of Camera Stations - Pueblo of Tesuque, Central Portion, Tesuque River Vicinity, Tesuque, Santa Fe County, NM. HABS NM,25-TESP,1- (sheet 3 of 9).” 1972. http://www.loc.gov/pictures/item/nm0100.
the documentation of previously unattainable projects such as Independence Hall in Philadelphia, Pennsylvania, and the George Washington and Abraham Lincoln Memorials in Washington, D.C. An advantage of photogrammetry is its ability to record measurements that are too large, irregular, inaccessible, or dangerous to measure by hand. Reverse perspective analysis, or analytical photogrammetry, can be used to produce drawings of structures using existing photographs, if some dimensional information is known in the photographs and the placement and distance of the existing photograph from its subject. This type of photogrammetry has been especially useful in preparing drawings for structures that have been damaged or ruined, and can aid in the reconstruction of those structures in drawn form. With the advent of digital photography, details of a site can be quickly captured and documentation objectives established. CAD drawings can be produced from digital photography and written reports can be supplemented with them. While digital photography is not considered archival, its use in the creation of the final archival record has become increasingly relied upon in recent years.

The methodology employed by HABS/HAER/HALS programs encourages a particular, first-hand approach and analysis of heritage subjects. As an extremely visible and influential program, its methodology impacts greatly upon heritage documentation discourse in the public and private realm.
Chapter 1 Endnotes

8  Catherine Lavoie, “Providing the Building Blocks: The HABS Program Today,” 85.
10 Catherine Lavoie, “The Role of HABS in the Field of Architectural Documentation,” 23.
14 Lavoie, “The Role of HABS in the Field of Architectural Documentation,” 23.
16 “Secretary of the Interior’s Guidelines for Architectural and Engineering Documentation; Notice of Revisions,” 43162.
Field documentation guides for HABS, HAER and HALS can be found through the nps.gov website. The HABS Guide to Field Documentation addresses how to produce floor plans, elevations, and details “to help develop basic note taking and delineation skills.” The Guide recommends a typical team of three people: two to take measurements and the third to record the measurements. Necessary equipment includes: metal measuring tapes in 35’ and 50’ (or 100’) lengths; ideally one tape for each team member (fiberglass and cloth tapes stretch over long distances and are therefore unreliable), 17” x 22” graph paper (bond), eight divisions per inch, non-reproducible grid, oversized clipboard, pencils (HB or harder) and erasers, molding comb/profile gauge (fine-toothed), and a digital camera.


Burns, Recording Historic Structures, 112–115.


Burns, Recording Historic Structures, 115.
Chapter 2: HABS History & Drawing Evolution
The history of HABS is as much a history of how the United States has recognized its relationship to heritage as it is a history of drawing evolution during the last century. Drawings of the early Survey directly correspond to the drawing methods espoused by the Ecole des Beaux Arts, while later surveys of the mid-century reflect the changes in the profession due to the clean aesthetic of modernism, the standardization of graphic standards, and of the evolving methods of physical production. HABS drawing sets are artifacts of the era in which they were produced, expressing the intentions, sometimes directly or indirectly, of the delineator, the survey project manager, the chief of the program, and of the mood of the era. The following HABS history has been recorded in depth through multiple sources, so for the purposes of this thesis the history will be streamlined and divided into three parts: 1) HABS Early History, 1930s, 2) Mid-century HABS, and 3) HABS 1980s to Present.

In one of his many written accounts of the beginning formation of HABS, Charles E. Peterson states in one version he wrote in 1983: “It seems worth remembering that HABS was a program designed by architects for architects.” And so it is worth remembering, given the catalyst for the program’s genesis developed from the need to find work relief for unemployed architects during the Great Depression. Over one weekend in November 1933, Peterson wrote the proposal for the Historic American Buildings Survey, and within the following two weeks, the Civil Works Administration set aside roughly half a million dollars for the program to hire 1200 people, 1100 of them being architects. The program was not only to employ architects, but also to establish an archive of American built heritage through drawn documentation. The need for recording historic structures during that time can best be described in Peterson’s own words from his proposal:

The plan I propose is to enlist a qualified group of architects and draftsmen to study, measure and draw up the plans, elevations and details of the important antique buildings of the United States. Our architectural heritage of buildings from the last four centuries diminishes daily at an alarming rate. The ravages of fire and the natural elements together with the demolition and alterations caused by real estate “improvements” form an inexorable tide of destruction destined to wipe out the great majority of the buildings which knew the beginning and first flourish of the nation. The comparatively few structures which can be saved by extra-ordinary effort and presented as exhibition houses and museums or altered and used for residences or minor commercial uses comprise only a minor percentage of the interesting and important architectural specimens which remain from the old days. It is the responsibility of the American people that if the great number of our antique buildings must disappear through economic causes, they should not pass into unrecorded oblivion.
HABS was formed during a period dominated by Academic Eclecticism, aligning itself with the movement that was then thought to be the best expression of national character, which was the Colonial Revival movement. Interest in the preservation of artifacts, history and buildings began to take hold of the country, particularly since it was perceived that this Colonial fabric was rapidly disappearing due to expansion of industry and development. Organizations such as the Association for the Preservation of Virginia Antiquities, the Society for the Preservation of New England Antiquities, and Colonial Williamsburg encouraged interpretation of American history and heritage, while New York's Architects Emergency Committee produced drawings for publications such as *Great Georgian Houses of America* (1933). Unlike these more regional approaches, HABS was the first attempt to document at the national level, made possible through President Franklin D. Roosevelt's “New Deal” Administration.

Another ambition of the program was to represent American heritage on a national level, as well as to represent more than traditionally “significant” heritage, such as structures associated with famous patrons, but to include the vernacular. “The list of building types should be almost a complete resume of the builders’ art. It should include public buildings, churches, residences, bridges, forts, barns, shops, rural outbuildings, and any other kind of structure of which there are good specimens extant.” Peterson also emphasized that buildings should be selected for HABS documentation based on academic interest, not necessarily on commercial interest in historic models for new buildings, which had driven previous studies of historic American architecture during the Colonial Revival. The structure of the HABS program consisted of four parts:

1) A master list, or archive, of American buildings, significant for their historic or architectural value, available through the Library of Congress.

2) A collection of measured drawings on standard and uniform sheets, with the field notebooks as part of the collection.

3) A collection of large-format photographs, available through the Library of Congress.

4) A collection of historical notes, or writings, submitted with the graphic material.
The primary material of the archive was the measured drawings, with the written notes as supplementary material, collected along the way by the architects throughout their field research. The inclusion of photographs had the dual nature of aiding the archive with additional graphic documents but also to employ unemployed photographers during the depression. The suggestion, and then combination, of these four parts also demonstrated a specific methodology behind how to document a structure, emphasizing the physical and graphic qualities of a site before the written.

The character of the early HABS drawings generally consists of a compact page, full of intricate drawings of floor plans, sections, elevations, ornamental details, dimensions, and copious amounts of explanatory notes. This graphic quality had two major influences that preceded and informed the early HABS program, which were 18th and 19th century American and English pattern books, and the tradition of the Ecole des Beaux Arts. Pattern books, or builder’s guides, such as Asher Benjamin’s *Country Builder’s Assistant* (1797), presented stylistic details and plans of structures in a particular fashion (such as classical or colonial), and were disseminated between building tradesman, drastically impacting the way drawings were represented. The effects of the Ecole des Beaux Arts, or the French National School for the Arts, greatly permeated throughout the architecture profession of the early 20th century, influencing both methodology and output. The school emphasized training through drawing, particularly through drawing historic precedents in detail so as to educate the student by making them personally familiar with proportion and dimensions of the intricate details they drew. The style of drawing also emphasized the ornamental, weaving together complex sheets of plans, elevations, and details with ornamental text and decorative elements. During the early HABS era, there was little difference between working drawings of new buildings and the drawings produced for the survey, given the amount of intense detail included on the sheets, as can be seen in publications of the time from *Architectural Forum and submissions to the influential White Pine Series of Architectural Monographs* (1914-1940).
Figure 2.2: Fernbach, Richard Berthold. "Livezey House, Livezey Lane & Wissahickon Creek, Philadelphia, Philadelphia County, PA. HABS PA,51-GERM,91- (sheet 12 of 12)." 1935.

Figure 2.3: Chase, Volney, and John W. Stenhouse. "Lyles House, Livingston Road, Fort Washington, Prince George's County, MD. HABS MD,17-BROCK,2- (sheet 1 of 5)." 1934.

Figure 2.4: Sumner, G.A. "Samuel Des Marest House, River Road, New Milford, Bergen County, NJ. HABS NJ,2-NEMIL,2- (sheet 15 of 27)." 1934.

Figure 2.5: Tabor, Jr., Clarence H. "Samuel Des Marest House, River Road, New Milford, Bergen County, NJ. HABS NJ,2-NEMIL,2- (sheet 2 of 27)." 1934.
The drawings of 1930s HABS proved ideal for describing small buildings in detail, showing the small variations which differentiated one period from the next and one region from another. The pre-1860 structures being recorded were mostly uniform in size and construction, easily fitting on the 60” x 80” horizontal sheets at ¼” = 1’0” scale. The style of the Beaux Arts tradition of drawing allowed for the variation in construction to emerge through its vigorous dimensioning and noting of details, but beyond being the prevailing style within the profession and an indicator of the delineator’s skill, there was no larger purpose for fashioning a drawing in this particular way. The draftsmen were architects who intimately understood the structures they were describing and enjoyed a sort of freedom in representation that allowed them to indicate what features were most important of a project. This freedom can be seen in some of the early drawings, where the use of conjecture was incorporated into the drawing set.

HABS recording teams were given a limited set of instructions which primarily focused on basic procedure for production, discouraging conjecture and emphasizing drawing “as-is” structures. Often, however, these instructions were disregarded, and a number of sheets were created based off of old photographs, oral histories, or because the draftsman were so acquainted with the construction techniques that they felt their conjectural drawings were plausible, even if they may not be accurate. This idea, that draftsmen were using drawings as a tool for interpretation as well as for graphic portrayals of information, is one that calls into question the intention of the pioneers of the survey.
During World War II HABS was inoperative and remained so only to be officially reinstated in 1957 in congruence with the start of the National Park Service Mission 66 Program in 1956. Projects within the National Park Service still operated and drawings were done to HABS specifications, but during the war years and early postwar years, the program mostly relied on donations from private sources, preservation groups, and universities. The desire to “complete the survey” still burned during the postwar period. Mission 66 was a 10-year program designed to reinvigorate and upgrade National Park facilities in time for the 50th anniversary in 1966. HABS was a crucial planning tool for the reborn Mission 66 National Park Service and funding provided by Mission 66 HABS could expand its geographic survey conditions beyond the limitations of the 1930s and also record projects younger than the original 1860s cut-off date.1

The 1950s saw a significant shift in the drawings compared with the 1930s surveys. A handful of factors aided in this shift. One was the standardization and codification of graphic standards, and the introduction of mechanical lettering. The first appearance of Harley J. McKee’s *Recording Historic Structures* helped to standardize more completely the production of HABS drawings submitted. Students replaced professional architects as primary draftsman, but they too also reflected the severe change in architectural academic pedagogy, showcasing the shift to Modernism and its approach to recording. This style favored the un-cluttered, single view “salon” drawing that centered its image on a clean, white background. These types of drawings were not any less meticulous or accurate, but they restricted the types of detail, dimensions and notes expressed on a sheet. They were, in effect, more illustrative and “publication-ready,” indicating that these drawings served more purpose than typical architectural and historical needs.2 Historians, regularly employed on HABS survey teams in this period, too reflected an interest in the modernist agenda, focusing less on the anonymous craftsman but instead on the “great architects” such as H.H. Richardson, Louis Sullivan, Frank Lloyd Wright, and the like. There was also a disconnect in how the historian and the draftsman managed their workflow, where in some surveys the drawings had to be completed before the historic research was finished, to the occasional surprise that sufficient original drawings existed or that the structure was not as significant as previously thought.3

Production methods in how the drawings were produced and how data was gathered also evolved during mid-century HABS. The requirement for all archival drawings dictated that they be made with ink on bond paper. This method was timely and unforgiving, so the use of DuPonts “Cronaflex” was introduced to help mitigate the problem. A photographic negative was produced of a pencil drawing on bond paper; this negative was then contact-printed in a vacuum frame onto a
sensitized, polyester plastic sheet to make the master positive, which had the appearance of an ink
drawing. Reproductions would be made from the negative, without handling the original pencil
drawing. The Cronaflex method became standard in the early 60s until ink-on-mylar replaced it as
procedure in the later half of the decade. HABS experimented with different archival plastic papers
and bond paper for the historical report to be written on in this period as well. Photogrammetry
was also introduced in this period, enabling the capturing of large-scale projects such as
Independence Hall, but also provided an effective method for quickly documenting a project
destined for demolition. The stereo photographs could be stored for years and drawings made
from them at any time, insuring the measured data could be captured even if the resources for
translating that information at the time did not exist. Aerial photographs in conjunction with
photogrammetry was also were utilized, such as in the recording of Native American pueblos in
the southwest.

The Beaux Arts style of the early HABS draw-
ings were ever more distant from architectural
practice in the 1960s. Instead of drawing details
of classical column capitals or cornice ornamenta-
tion, students were drafting spandrel panels
and curtain wall details. The need, then, for a
more rigorous standardization process ensued
and the drawings of HABS from the 60s and
70s indicated as such with a clear and uniform treatment. Where the drawings of the 1930s leaned
towards a compositionally pleasing sheet with elaborate detail, the 60s and 70s drawings leaned
toward an emphasis on the meticulous. However a craft of sorts developed in the 70s working
within the limits of the clean, clutter-free salon drawing. Fine-line drawings became the artistic
endeavor, with draftsman finessing over the delicateness of lines, even so far as to dilute the ink on
final drawings to create a depth of interest. The consequences of this unique labor were that it did
not reproduce clearly and was so dropped. The format of the sheets, too, had to evolve, given that
the limitations of its smaller original sizes were not suitable for documenting the scope of larger
structures.
Figure 2.7: Benson, Perry. "Joseph Conrad Farm, Barn, State Route 183 & Bright School Road (Penn Township), Mount Pleasant, Berks County, PA. HABS PA.6-MTPLES.V.6B- (sheet 4 of 5)," 1976. http://www.loc.gov/pictures/item/pa0133.sheet.00004a/resource/.
As HABS entered the 1980s, the types of drawings produced began to encompass a blended, comprehensive approach to style and production methods were used that reflected technological development of the time. These drawings did not necessarily identify with any specific stylistic movement, but they did remain highly illustrative and “clean” for publication. A return to the detailing and notating of the early HABS drawings was encouraged, as the introduction of Computer Aided Design (CAD) allowed for more extensive data management; the aesthetic of the output drawings, however, had both intended and unintended priorities. Besides the introduction of CADD, other technological advances aided in the collection of data and production of drawings: digital photogrammetry, three-dimensional laser scanning, and digital photography.

Two important program developments also occurred in the early 80s, when HABS celebrated its 50th anniversary in 1983. That year, both the Secretary of the Interior’s Standards for Architectural and Engineering Documentation and the Charles E. Peterson Prize were introduced. The Standards were in direct response to how government agencies should handle state and local documentation projects related to the National Historic Preservation Act of 1966’s Section 106 and 110 mitigation requirements. They were to be used in tandem with the individual Guidelines supplied by both HABS and HAER. The Charles E. Peterson Prize, a student competition awarding the greatest set of drawings done to HABS specifications, encouraged documentation participation at the university level.

The first in-house use of CAD was implemented for the recording of the Lincoln, Washington and Jefferson memorials in 1991. The process was refined through trial and error, as the conversation between hand measuring and digital precision drawing was ironed out. CAD allowed for intense precision, up to 1/64th of an inch, whereas hand drafting had a greater margin of error; however, drawing in CAD software at full scale created a shift of focus on minute detail that did not necessarily exist in scaled hand drawings. Drawing at full scale, though, gave a single base file a vast amount of information that could be curated and edited when framed on the final plot. The digital files could also be continuously edited and updated by more than one person, allowing for a completely different type of workflow between teams. Layers of information imbedded in the files could be turned on and off, further giving the draftsman agency in how and what information they portrayed in the final drawings. Larger size buildings, such as the three Memorials, necessitated the plots be printed on size-E sheets (34” x 44”) which CAD software could easily produce. CAD software was used in conjunction with newly developed digital photogrammetry software to capture hard-to-access details in the Memorials. Photographs of the monuments were mounted on a digi-
In recent years, the use of digital photography and 3D laser scanning has escalated and become regularly used in the documentation process. 3D scanning, where a device records three-dimensional coordinates as “point clouds” of data through the use of a laser, is appropriate for large and sculptural objects. The point cloud data generated by the scanning device is then processed digitally by creating surfaces between the coordinates of the points. In 2001, HABS embarked on a huge documentation survey for the Statue of Liberty in which 3D laser scanning was used. Digital photography too has become extremely valuable in the recording process within the past decade. CAD drawing files can be created by incorporating digital photography as a base that a drawing can then be created from. This is commonly done with smaller details of a structure that can be photographed straight on, with little perspective distortion, and then be scaled correctly in CAD software. While digital photography is not considered archival, digital photographs help to streamline the drawing process, can help in the initial stages of survey planning, and even be used for presentations.
The digitizing of HABS/HAER/HALS surveys starting in 1999 for the Library of Congress's online catalogue revolutionized public access to the archive. The original drawings were scanned at 400 dots per inch (dpi) and the photographic negatives at 500 to 1,000 dpi; these high-resolution images are made available through the Library of Congress’s Prints and Photographs Online Catalogue as uncompressed TIFF files for users to see and download. Online access to the HABS/HAER/HALS collections enabled anyone with internet access the ability to consume the collection, expanding the audience for the collection beyond specialist interest to universally anyone, with K-12 groups in particular having taken advantage of the online collection.

Chapter 2 Endnotes


8. There is one paragraph in the 1935 Guidelines that addresses conjecture: “No conjectural restorations will be shown in place of existing conditions. Definite facts regarding the original condition of a remodeled building derived from photographs, old drawings, the memory of eye-witnesses or other apparently dependable sources, may be shown as supplemental drawings. The source of such information will be briefly noted on the sheet.” Historic American Buildings Survey, The Specifications for the Measurement and Recording of Historic American Buildings and Structural Remains, 18.


16  Ibid.
20  Ibid., 240.
21  http://www.loc.gov/pictures/collection/hh/
22  Burns, Recording Historic Structures, 25.
Chapter 3: Standards, Quality & Program Comparisons
The rigorous and high standard of recording is one of the main contributing factors to make the HABS, HAER and HALS program so compelling. The Secretary of Interior Guidelines for Architectural and Engineering Documentation, together with each program’s periodically updated and circulated procedural guidelines, ensures the integrity of the items accepted into the Library of Congress comply with a professionally accepted and researched level. Conforming to these standards enables a universally acknowledged language of legibility and explanation, promoting the program’s goal of national and global accessibility to its archive. Beyond the products produced (drawings, photographs, written reports) however, the standards and guidelines are pedagogic in nature, stressing not only a particular method of physical recording but also an attempt at defining significance in heritage sites being recorded. As the word “significance” is a hot, contested idea in the preservation community, the nature of these standards codifying significance is essential to the Heritage Documentation Program’s placement in heritage documentation discourse. The Secretary of Interior Guidelines will be discussed in detail within the following chapter, along with the guidelines for producing drawings published by both HABS and its sister program HAER, and a comparison between the two program’s intentions for drawn documentation.

The Secretary of Interior Standards supplies a set of standards and subsequent guidelines to establish the content, quality, material and presentation of an architectural or engineering project. The standards, originally established in 1983, were updated in 2003 to reflect a streamlined understanding of content, to modify material sizes to reflect industry standard, and to include landscapes as per the establishment of HALS in 2000.

The standards describe the general principles of HABS/HAER/HALS, and the guidelines supplied recommend accepted procedure for meeting those standards. Quality dictates that all documentation be prepared accurately from reliable sources on materials that are readily reproducible, durable and in standard sizes, presented clearly and concisely. The standard for content states that: “documentation shall adequately explicate and illustrate what is significant or valuable about the historic building, site, structure, object or landscape being documented.” The guidelines then divide content into Level I, Level II, and Level III types as defined by the significance of the project being documented and the consequent level of documentation required.
## Standards of the Historic American Building Survey/Historic American Engineering Record/Historic American Landscape Survey

Secretary of the Interior’s Guidelines for Architectural and Engineering Documentation; Notice of Revisions, 68 Federal Register 139 (July 21, 2003), 43159-43161.

### Standards Requirements

**1. Content**

- "Documentation shall adequately duplicate and illustrate what is significant or valuable about the historic building, site, structure, object or landscape being documented."

**2. Quality**

- "Documentation shall be prepared accurately from reliable sources with limitations clearly stated to permit independent verification of the information."

**3. Materials**

- "Documentation shall be prepared on materials that are readily reproducible, durable and in standard sizes."

**4. Presentation**

- "Documentation shall be clearly and concisely produced."

### Levels

<table>
<thead>
<tr>
<th>Levels</th>
<th>I</th>
<th>II</th>
<th>III</th>
<th>I</th>
<th>II</th>
<th>III</th>
<th>I</th>
<th>II</th>
<th>III</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>A. Measured Drawing</strong></td>
<td>Full set of measured drawings</td>
<td>Selective drawings</td>
<td>Sketch plan</td>
<td>Measured drawings are to be produced from recorded, accurate measurements - field notes as verification.</td>
<td>Ink on archivally stable material</td>
<td>Ink on trans-lucent material</td>
<td>Ink on bond paper</td>
<td>Adequate dimensions on all sheets</td>
<td></td>
</tr>
<tr>
<td><strong>B. Photography</strong></td>
<td>Large-format negatives of exterior and interior views</td>
<td>Color transparency; one identical B&amp;W negative for each large-format color transparency</td>
<td>Photocopies of select existing drawings or historic views</td>
<td>Photographs shall clearly depict the appearance of the property and areas of significance. All views are to be perspective-corrected and fully captioned.</td>
<td>Prints shall accompany all negatives</td>
<td>Must be archivally processed, no resin-coated paper</td>
<td>Duplicate photos with a scale stick</td>
<td>Minimum of one photo with a scale stick with principal facade</td>
<td></td>
</tr>
<tr>
<td><strong>C. Written Data</strong></td>
<td>History and description in narrative long-format</td>
<td>History and description in short-format</td>
<td>Based on primary sources</td>
<td>Secondary sources may be adequate</td>
<td>Clean copy for photocopying</td>
<td>Produced on archival bond paper</td>
<td>Typewritten or laser printed on bond, following accepted rules of grammar.</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>D. Other Media</strong></td>
<td>Other media can and have been used. Contact HABS/HAER/HAALS office before employing a media other than those specified above.</td>
<td></td>
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### Inspection

- Inspection by HABS/HAER/HAALS office staff. Documentation not meeting HABS/HAER/HAALS standards will be refused.

### Comments

- Kind and amount of documentation should be appropriate to the nature and significance of the building, site, structure or object being documented.

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Level I:

Level I projects are typically projects with subjects that are nationally significant and would meet the requirements of a National Historic Landmark. Level I projects would include: a full set of measured drawings depicting historic or existing conditions; large-format photographs of exterior and interior views, original drawings, and/or historic views; and a comprehensive written historical and descriptive report. HABS Level I drawing sets usually depict existing conditions through site plans, floor plans, elevations, sections and construction details, focusing on the particular aspects of the building that pertain to its assigned significance.

Level II

Level II projects differ from Level I in that they can rely on copyright-free reproductions of existing drawings, instead of new sets of as-built drawings as would be created for Level I. The chosen existing drawings must still meet HABS/HAER/HALS requirements for quality and presentation, and while they are not as suitable as as-built drawings, they are “adequate” in many cases for documentation purposes. New, as-built drawings may be done as well, depending on the scope of the project. The same requirements for photography and written data apply to Level II projects as they do to Level I.

Level III

Level III projects require no set(s) of measured drawings, only sketch plans if their inclusion helps explain a structure, site or landscape. Large-format photographs should include both interior and exterior views, with a short-format written historical report to supplement.
The location of the original Marie Thérèse House has, in the last few decades, the other planters' class and race prejudice. Furthermore, as mentioned above, road off Highway 494 about one mile northwest of Bermuda.

Unlike the Marie Thérèse House, most Norman roof truss systems have a roof ridge beam that runs the length gallery, and in the rear, over the two cabinet rooms and the loggia.
3.1 Level III: Example

Roaring Creek Friends Meeting House, Numedia, PA

0 Drawings
31 Photographs
3 Data Pages [2pg written report, 1pg photo captions]
Roaring Creek Friends Meeting House

Location: Meeting House Road, Numedia, Columbia County, Pennsylvania.

Significance: Roaring Creek Meeting House, built in 1795, is of interest for both its log construction and its two-cell design with unequally sized meeting rooms for men and women. The latter was indicative of an early English Quaker pattern of meeting, and was generally not incorporated into American Friends’ meeting house designs of this period. Log meeting houses were often built during the period of early settlement within the Delaware Valley, but were quickly replaced with more permanent construction. Roaring Creek and nearby Catawissa are the only extant log meeting houses built under the care of the Philadelphia Yearly Meeting. Roaring Creek’s rustic construction and out-dated plan may be indicative of its “frontier” location, far removed from the direct influence of the Philadelphia Yearly Meeting.

Description: Roaring Creek Meeting House is a single-story, four-bay-by-two-bay structure built of hewn logs, with chinking and corner boards. It measures 30’-4” x 36’-5”, rests upon a rubble stone foundation, and has a side-gable roof covered with wood shingles. This two-cell structure is unequally divided on the interior into apartments, with the larger, western section constituting three of the four bays across the front and rear. The principal entry is the center bay of the western section and has an opening for a carriage door to the rear. In the eastern section, there is a single door to the floor, with a window opening in the rear. The doors are both single-men entries with plain, door-jamb surrounds and plank doors. The carriage door to the rear is similar, but set slightly higher to accommodate the interior facing bench and has no exterior hardware. A large, batten door appears in the western gable end to provide access to the attic. There are no porches or stoops, only a simple set of stairs provide access to the principal, western front entry. The meeting house is lit by six-over-six-light sash all around, with batten shutters. There are no extant chimneys.

The interior plan features two apartments of unequal size separated by a retractable wood partitioned space. The partition is located just east of the entrance, three doorways, and consists of a series of three wood panels with the center panel sliding to open. A doorway to the center allows for passage between the apartments. The log walls and the ceiling are covered with planking. The facing benches are located along the rear (north) wall and consist of a single tier with two rows of benches.

There is a varnished benches and a simple set of stairs provide access to the principal, western front entry.

History: Roaring Creek Meeting House was built in 1795.1 A meeting for worship was established at Roaring Creek by Exeter Monthly Meeting in 1786. In 1796, a preparatory meeting was set up by Catawissa Monthly Meeting, and the current meeting house was erected. In 1814, a monthly meeting was established here, a reestablishment of Catawissa Monthly Meeting. Elias Hicks is said to have spoken at this meeting house.2 In 1916, it was reported that meeting were only being held once a month. With membership in decline, the meeting was laid down and an indulged meeting established. It is currently served by the meeting and maintained by the local garden club. A meeting for worship is held here once a year, in June, local Friends meet at Millville.

At the time of the separation into Hicksite and Orthodox factions in 1827, the original Roaring Creek Preparative Meeting was laid down and the meeting house retained by the Hicksite meeting.

Sources:

Philadelphia Quarterly Meeting, Minutes, Friends Historical Library, Swarthmore College, Swarthmore College, Pennsylvania.

Historian: Catherine C. Lavoie, 2001

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1 Philadelphia Quarterly Meeting, Minutes, 8mo. 1795. A historical marker on site, however, reads 1796. The discrepancy may reflect the start of construction versus the year of actual completion.

2 Elias Hicks was the leader of the “Hicksite” Friends that formed from a schism that divided the Friends into Hicksite and Orthodox groups in 1827. The schism was ostensibly based upon differences in biblical interpretations presented by early Friends versus those being offered by Evangelical Christians, but also fell out along economic lines, with the more rural and traditional Friends forming the Hicksite contingent, and the more urban and wealthy forming the Orthodox.
3.1 Level II: Example

Coincoin-Prudhomme House, near Bermuda, LA

7 Drawings
6 Photographs
17 Data Pages [16pg Written Report, 1pg Photo Captions]
For nail terminology, refer to Jay D. Edwards, and Tom Wells, foundations, of the original Maison de Marie Therese. reading of the Coincoin-Prudhomme House, and then recording the confirmed after the 1794 map was superimposed over the topographical map, shutters on at least the cabinet rooms, which were taken down and are of the two-cell base module, a full-length gallery was enclosed on each of a salle (the larger room) and a chamber (the smaller room). To the rear and is located at the center of the roof ridge on the eastern façade.

On the old homestead sight, probably upon the existing foundations. Gabriel St Anne Prudhomme (known as St. Anne Prudhomme), in daughter, Marie Therese Victorie St. Anne, in 1805. John B. Jean Baptiste (John B.) Prudhomme, who had married Ailhaud’s sons.5

Ailhaud’s influence allowed them to remain relatively safe from land and probably, his influence allowed them to remain relatively safe from the Creole community in and around Natchitoches, particularly John B. Prudhomme, who had married Ailhaud’s sons.5

As noted above, all the exposed ceiling beams in the decorative molding.

On the northeastern façade, there are two windows openings in the former loggia. The window that opens into the southwest cabinet has a double-sash window that is covered with a screen that is nailed into the framing. The commercial-grade lumber. On the southwestern façade there are a single-faced surround composed of commercial-grade lumber. The doorframe made with commercial-grade wood lumber. The doorways on the northeast façade. The doorway that leads into the

Ibid. Book 10, 42.

COINCOIN-PRUDHOMME HOUSE

Architect, and Catherine C. Lavoie, HABS Senior Historian. Oversight of the historical survey is made of a single-face of commercial-grade lumber.

In many areas the plaster and paint have deteriorated with four-over-four lights, and is placed into a simple frame that is a rudimentary survey, the house appears to be contemporary to the late 1790s. The Natchitoches Times. 20: 1 (2001), and

The Forgotten Natchitoches Mills, Gary.


6. Decorative Features: As noted above, all the exposed ceiling beams in the decorative molding.

3. Wall and Ceiling Finish: The interior walls are bousillage rendered with commercial-grade lumber nailed together and braced with commercial-grade lumber. The door and windows are made of commercial-grade lumber. The doorframe made with commercial-grade wood lumber. The doorways on the northeast façade. The doorway that leads into the

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Ibid. Book 10, 42.
3.1 Level I: Example

The Woodlands, Philadelphia, PA

48 Drawings
116 Photographs
111 Data Pages [98PG Written Report, 13PG Photo Captions]
3.1 **LEVEL I: EXAMPLE**

**THE WOODLANDS, PHILADELPHIA, PA**

48 **DRAWINGS**  
116 **PHOTOGRAPHS**  
111 **DATA PAGES** [98PG WRITTEN REPORT,  
13PG PHOTO CAPTIONS]
3.1 **LEVEL I: EXAMPLE**

**THE WOODLANDS, PHILADELPHIA, PA**

**48 DRAWINGS**

**116 PHOTOGRAPHS**

**111 DATA PAGES** [98PG WRITTEN REPORT, 13PG PHOTO CAPTIONS]
Selection of the type of level any HABS/HAER/HALS survey is subjected to primarily responds directly to the planning objectives of the project. An approach to documentation would be different for a mitigation project than it would be for easement purposes, similarly different for a survey of a historic district versus one for an estate. Economic factors, personnel, and time are also major factors in the planning objectives, as the three levels directly reflect in the decreasing scope of work required for each level of significance. However in all cases, any and all information conveyed through the documentation must be derived from researched sources, whether its primary sources for the written report or from accurately recorded measurements contained in the field notebooks. The emphasis here is to avoid potentially wrongful hypothesis or misleading information, with the intention of the survey being as unbiased and objective as possible.\(^5\) Materials beyond drawings, photographs and written reports, such as film, can and have been submitted at the discretion of the HABS/HAER/HALS offices.\(^6\)

What is so striking about the breakdown of these three levels is the inherent value the Secretary of Interior Standards places on not only the significance of the subjects recorded, but the significance and usefulness of the output produced. The most extensive change in materials from level to level is the extent and use of the drawing; while the first two levels may utilize drawings, the Level III surveys all but suggest the inclusion of the medium. Partly this can be attributed to the cost (both monetary and timely) of crafting a successful and articulate drawing set to the admittedly laborious standards. The labor-intensive nature of drafting was sufficient for the origins of HABS as a relief program, but in the post CWA-era, the expense is not ideal nor the goal of the program. However, it would be misleading to then grant the written and photographic portions as a somehow more descriptive medium, or more appropriate method of recordation, or to believe that either the photographic or written portions were any less laborious; yet, when limited resources are available, as is generally the case for the levels that are not Level I, the photograph is the chosen graphic representative of the project. Shortly before the Secretary of Interior Standards were created in 1983, John Burns’ essay *Recording Historic Buildings: New Philosophies, New Techniques, New Technologies* discusses how the Standards would introduce two concepts:
First, the kind and amount of documentation should be appropriate to the nature and significance of the building. Second, the documentation should concentrate on the features of a building which give it its significance. Fewer ‘complete’ drawings will be produced; photographs will be substituted for drawings whenever possible. The drawings that are produced will have more information packed into them: more given dimensions and annotations and denser sheet composition, similar to the drawings of the 1930s. The drawings will concentrate on features that cannot be adequately described in words or photographed. Fewer measured drawings will mean an increased dependence on photographs for graphic documentation.\(^7\)

Chapter 3 of this thesis will dive deeper into drawing as a method for communication and how its dynamic medium may prove more efficient and effective at documenting than the division of the three Levels may suggest.
3.2 HABS Drawing Guidelines

“This document defines the methodology and the process for the documentation of historic buildings and structures by means of architectural measured drawings, according to the standards of the Historic American Buildings Survey (HABS).”

Each Heritage Documentation Program supplies their own published guidelines for each of the disciplines required for a completed survey (drawings, photography, and written reports). The most recent edition from 2008 of the HABS Guidelines: Recording Historic Structures and Sites with HABS Measured Drawings, is organized into five sections:

1. Project Planning
2. Field Notes
3. Sketching and Measuring Structures
4. Drawing Production
5. Drawing Set Organization, Layout, and Plotting

Each section describes in detail the technical requirements for compiling and producing a HABS standard drawing and drawing set. The thoroughness of the guidelines provides the survey team an appropriate methodology of producing measured drawings that adhere to HABS’ standards and of those of the Secretary of Interior.

As mentioned in earlier passages, HABS has produced guidelines for drawing production since its first publication created in 1933. Over the program’s 75 plus year existence, the guidebooks have become a compilation of the thousands of student and professional architects and engineers’ developed techniques. Since then, these guidelines have evolved to reflect changing technological and ideological practices, but have consistently maintained a strict adherence to the idea of illustrating and explaining a project’s significance through accuracy and uniformity. However, “while technological advances have streamlined the collection, production and presentation of graphic information, many of the methods used in 1933 are still employed by the architects of today.” For
instance, within its own fourteen-year evolution over three iterations (1994, 2001, 2008), *HABS Guidelines: Recording Historic Structures and Sites with HABS Measured Drawings* reflects how the nature of CAD production expanded from the 1990s to 2000s. The 1994 publication only explains the procedures of drawing producing with pencil and ink on mylar, while the 2001 version does the same in the body of the document but includes an appendix of CAD procedure, when finally CAD becomes incorporated into the body of text in the 2008 version.
What is of particular interest in the HABS Measured Drawing Guidelines for this thesis is when the language begins to describe the use of “interpretive drawings.” Focusing on the HABS Guidelines: Recording Historic Structures and Sites with HABS Measured Drawings publications specifically, all three iterations describe in detail the sketching and producing (of final drawings) site plans, plans, elevations, sections, details, axonometrics, and perspective drawings. However, both the 1994 and 2001 versions additionally describe “site development,” or “evidence of changes in form.” This section is greatly important because it is HABS supplying explicit guidance for creating drawings that suggest data beyond the essential characteristics of the physical entity, or indirectly the idea of an interpretive drawing. While conveying the building evolution through time was a technique done throughout HABS’ history, here the guidelines are prescribing a particular method for including these drawings within a drawing set. Below is an excerpt describing such methods:

7.2.0. BUILDINGS EXHIBITING EVIDENCE OF MAJOR CHANGES IN FORM AT SPECIFIC POINTS IN TIME

7.2.1 Careful research into records and photographs, knowledge of the history of construction technology, and an eye for differences in massing, space configuration and style will aid the analysis of these structures. The resulting information is usually best represented in the following way:

1) The construction phases are drawn separately from existing conditions;
2) The representations are schematic, focusing on the major changes in form with less emphasis on detail;
3) The scale is reduced;
4) Use idealized forms, but retain as much dimensional accuracy as possible. Do not simply trace design drawings unless their translation into built forms can be confirmed;
5) If possible, use a reduced number of line weights; a heavy line weight and poché can emphasize the historic form, while a lighter line weight or dashed line will reference the current form;
6) Annotate the drawings.

These drawings are to be placed at the end of the set.


With the publication of the 2008 version of the HABS Guidelines, the previous two iterations were dramatically streamlined and economized, condensing the 81 page guidebook from 2001 down to only 22 pages in the 2008 version. In doing so, the “site development” sections were completely stripped and instead became part of the section directly relating to “interpretive drawings.” This concept of the interpretive drawing is first addressed in the publication’s introduction:

HABS drawings are considered "as-built" drawings. As such, they illustrate the existing condition of a building at the time of documentation, including additions, alterations, and demolitions which have occurred since the building was first constructed. Where sufficient knowledge exists concerning the sequence of changes to a building over time, it may be useful to provide appropriate notation on the drawings. Alternatively, delineators may wish to produce additional interpretive drawings illustrating the building at an earlier date, in order to more fully explain its historic significance.⁴
The idea and definition of the interpretive drawing is explained further under the “Drawing Production” section of the guidelines:

4.10.0 INTERPRETIVE DRAWINGS

4.10.1 Interpretive drawings can be useful for helping to understand a building. Examples include drawings which show the building restored to a certain date, drawings which document the changes to the building over time, or drawings which explain an important circulation pattern through the building. Where relevant, sources for historical information should be cited on the drawings.\(^5\)

The inclusion of this subsection is a substantial development in the pedagogical nature of the HABS program and its place in heritage documentation discourse. Firstly, its inclusion directly acknowledges the idea of interpretation within heritage documentation, and thereby acknowledges a paradigm shift in heritage documentation discourse towards the interpretation of non-traditional or intangible value associated with a project (circulation, evolutionary change, etc.). Secondly, the ambiguous nature of the subsection is distinctly different from its predecessors in that no explicit instructions are given to accomplish the interpretive drawing. Perhaps this ambiguous nature is also a nod towards the notion that the subject, or building in the case of HABS, should let its significant features be the focus of the documentation, instead of a prescribed approach that may not identify or portray those features in the best way. The idea that the building should “speak to” the documentation teams has been suggested by multiple sources as an appropriate guiding factor to determine significance, and the ambiguity of the interpretation inclusion suggests “that the traditional, two-dimensional plan, elevation, and section format was not appropriate for capturing the significance of all building and site types; the final drawing appearance should be determined by the teams using drawing methods they felt were appropriate for the resource.”\(^6\)
Interpretive drawings are certainly not foreign to the Heritage Documentation Programs, (even if they were newly recognized by HABS in 2008) and are particularly utilized within the Historic American Engineering Record. Where HABS recording techniques of architectural structures succeeded, that same approach often failed to capture the significance of machinery or the engineering features of America’s industrial sites. By the late 1960s, the preservation field became aware of the special documentary needs of industrial structures and landscapes, and specifically within HABS, projects like the Dudley and Son Company Shop in Wilkinsonville, Massachusetts (Figure 3.10), recorded in 1967, included the placement of workstations and machinery in relation to the plan of the building.\(^1\) This shift lead to the 1969 establishment of HAER, through a tripartite agreement with the American Society of Civil Engineers (ASCE), the Library of Congress, and the National Park Service, and modeled after the Historic American Buildings Survey format.

HAER surveys include measured drawings, large-format photography, and written historical reports, although their application of the media is typically much different than that of HABS. As is often described in literature on HAER documentation, a more diverse or multi-disciplinary approach to recordation was necessary to identify and document the significance of an engineering site. The range of industrial sites documented for HAER includes: extractive industries (iron mines, non-metallic minerals, etc.), bulk product industries (agriculture and rural industries, chemical industries, food processing, etc.), manufacturing industries, utilities infrastructure, power sources (human and animal power, water wheels, wind turbines, electric motors, etc.), transportation, communications, bridges/trestles/aqueducts, building technology (foundations, floor systems, roof systems, mechanical and electrical systems, etc.), and specialized structures and objects such as dams, tunnels, hydraulic works, thermal structures, materials storage, workers housing, and amusement sites.\(^2\)

The objectives of a HAER recording team generally have four aspects they focus on, as summarized by John R. Bowie in his article “Documentation of America’s Industrial Heritage: The Historic American Engineering Record.”

1) The relationship of structures to a site and the site’s unique environmental attributes,
2) The engineering and industrial processes utilized and their significance,
3) The development of the related company(ies) under its principals,
4) The actual recordation of the structures themselves.\(^3\)
The first three points complete the comprehensive understanding of the site and supplement the existing conditions recorded in the fourth point. However, with most industrial sites, in recording the mechanical and engineering processes the use of the interpretive drawing is crucial, in that it can represent hidden, missing, or intangible features of that process. Documenting the industrial process can also further explain the intention behind the design of the building as most industrial spaces were designed for the specific function of processes. In *Recording Historic Structures*, the section dedicated to techniques of recording industrial processes authored by Richard K. Anderson, Jr., begins with a thorough definition of interpretive drawings as understood by HAER:

An interpretive drawing cross-references and integrates material by putting together details that may otherwise appear separately in accompanying written data, photographs, or standard measured drawings. Interpretive drawings help the user to see significant relationships and features impossible to present effectively with other documentary media. Characteristics that invite this treatment may be structural details, a manufacturing or materials-handling process, the organization of machinery or other elements within a building or site, or the operative principles behind a particular engineering device or system. Interpretive drawings should be made when no other type of presentation is as efficient in terms of content conveyed, cost to produce, or time required for a user to study.4

Typical drawing techniques for these interpretive drawings can employ the use of isometric and perspective drawings to depict spatial relationships and functional relationships of and to different components; schematic flow charts or diagrams for showing physical movement of objects and parts; and cut-away drawings where the removal of certain parts reveal the function of others.5 While these drawings may allow a certain freedom of expressing relationships, they still maintain a vigorous attention to technical detail. Line weights and shading techniques must be used to distinguish clarity in the relationships expressed in a drawing, while a curatorial eye must be used so as not to strain a composition with too much cross-referencing and annotation.

The use of conjecture in describing missing or severely decayed features can be an important aspect of the HAER interpretive drawing, so long as the conjecture is based in research and noted clearly on the sheet. Additionally, some drawings, for instance in the use of perspective drawings, are not to scale and therefore not measurable; the acceptance of these drawings comes into play if the perspective drawing describes information that the written and photographic mediums cannot.
The primary objective of the HAER survey is that it both explains and records information, and the method of documentation must reflect that agenda even if it involves the use of studied conjecture.

The characteristics of landscapes recorded by the Historic American Landscape Survey too require that the methods of documentation revolve around the specific features of significance being recorded. HALS fol-

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Figure 3.10: Keune, Russell V. "D. T. Dudley & Son Company, Main Shop, Providence Road, Wilkinsonville, Worcester County, MA. HABS MASS,14-WILK,1A- (sheet 1 of 4)," 1967. http://www.loc.gov/pictures/resource/hhh.ma0580.sheet.00001a/.


allows the same system of surveying as its sister pro-
grams HABS and HAER, in that surveys incorpo-
rate measured drawings, large-format photography, and written historical reports. As the HABS and
HAER programs reached the end of the past cen-
tury, the increasingly growing amount of drawings focusing on landscape elements, in conjunction with increasingly refined approaches to landscape preservation, precipitated the creation of the HALS program in 2000 and formally made a perma-
nent federal program in 2010 through a tripartite agreement between the National Park Service, the
American Society of Landscape Architects (ASLA), and the Library of Congress. The same rigorous
standards, determination of significance, and planning objects of HABS/HAER projects apply to
HALS projects.

As HALS documents historic landscape, the scope of the area being covered, the relationship of the built structures to the natural or manmade features, and natural elements of geography heavily determine the content of the surveys. Similarly to HABS and HAER, the details recorded within a HALS survey directly correlates with the planning objects of the survey. As published in the NPS brochure “HALS 101: The Historic American Landscape Survey,” measured documentation:

...Requires varying levels of detail depending on their ultimate use. Drawings that are intended to provide the basis for landscape restoration will require extensive dimensions and annotations to record the necessary historical and conditional information, while drawings intended for maintenance purposes may require little more than material or plant indications and dimensions for calculating gross areas requiring treatment. Mea-
sured drawings produced as mitigation may be the last recordation of a landscape slated for demolition or alteration, making recordation of a site’s entire set of salient features important for future generations.
Similarly to HAER, HALS measured drawings often need to rely on interpretive drawings to convey the evolution of vegetation growth of a site over time, the natural phenomena occurring on the site such as water-tables and soil systems, or perspectival depictions of the spatial relationships of gardens, parkways, monuments, and other types of landscape that would otherwise not be understood in conventional plans or elevations. The HALS Guidelines for Drawing, in addition to providing technical advice on how to produce drawings such as plans, sections, isometrics, cut-aways, and details for drawing hardscapes and vegetation, even go so far as to offer suggestions for additional interpretive drawings:

3.3.14 Additional Drawings

Additional drawing methods that can be explored for depicting a landscape are:

- Analysis Mapping Plans which delineate certain analytical data relevant to the site (such as topographical/slope analysis, watershed analysis, or cultural assessments.) Analysis mapping may rely heavily upon GIS data or other analytical mapping techniques.

- Mass/Space Plan A plan which graphically delineates vegetation or other site features and the spaces devoid of such features. These plans typically show the organization of spaces within a site.

- Site Evolution Plans A series of plans which show the changes in a landscape over time.

- Material Schedules A plan which delineates the locations of specific materials used on a site. This plan would typically include a graphic key indicating specific material locations.

- Seasonal Color Plans A series or individual plan which delineates the location of certain seasonal colors of vegetation. Delineators should use the Munsell Book of Color for demarcating different color areas on the plan.7
From highlighting the drawing practices of HABS/HAER/HALS, it is evidently clear that two-thirds of the National Park Service Heritage Documentation Programs are intimately familiar with the notion of interpretation within the field of heritage documentation. HABS, the matriarch of the three programs, has only in recent years recognized through its drawing guidelines an interpretive approach to documentation, officially suggesting that interpretation should be part of its documentation practice where relevant. By the means of this official recognition, the question then becomes how HABS can incorporate the idea of the interpretive drawing within its already established and respected recording methodology, and have the interpretive drawing be an equal contributor alongside the program's more traditional drawing techniques. Both HAER and HALS, since their inception, have recognized that their approach to measured drawings needed to exist within the doctrine of HABS but also step outside it in order to accomplish their goal of comprehensive documentation of the significant features of their subjects. HAER especially has demonstrated quite masterfully the successes of balancing interpretation and technique to explain industrial process. Preservation ideology has since advanced the idea of what is significant and valuable in architectural heritage by including non-traditional, intangible, or culturally associated ideas of value as equally as important as the physicality of the object, and HABS interpretive drawings are the program's opportunity to mirror itself to contemporary heritage preservation ideology. The following chapter will discuss in detail how HABS can and should utilize the interpretive drawing to further its goals of accessible, uniform, and accurate documentation of America's built heritage.

Figure 3.18: Melrose, Betsy. "Soil and Constructed Water Systems - Marsh-Billings-Rockefeller National Historical Park, 54 Elm Street, Woodstock, Windsor County, VT. HALS VT-1 (sheet 5 of 19)." 2002.

Figure 3.19: Driapsa, David J. "Contextual Plan, Macro Scale, Waterworks Analysis - North Family, Mount Lebanon Shaker Village, 202 Shaker Road, New Lebanon, Columbia County, NY. HALS NY-7 (sheet 6 of 29)." 2009.

Figure 3.20: Grosse, Alan. "Brethren's Workshop Area Waterworks - North Family, Mount Lebanon Shaker Village, 202 Shaker Road, New Lebanon, Columbia County, NY. HALS NY-7 (sheet 26 of 29)." 2009.

Chapter 3 Endnotes


2. As per the Standards: “The selection of the appropriate documentation level will vary from one project to the next. For mitigation documentation projects, this level will be selected by the National Park Service Regional Office and communicated to the agency responsible for completing the documentation.” “Secretary of the Interior’s Guidelines for Architectural and Engineering Documentation; Notice of Revisions,” 43161.

3. Level I standard of documentation can also be applied to projects without this national level of significance. For instance, a private owner may want to complete a fully comprehensive drawing and photograph set before rehabilitation and may include this in a survey, as long as they adhere to HABS/HAER/HALS archival standards.

4. While these are the official guidelines of each Level of significance and are used as guides for practitioners, current in-house practices suggest that any existing drawings be included as figures in the written history or field notes.

5. The Standards state quite plainly “no part of the measured drawings shall be produced from hypothesis or non-measurement related activities.” The quality standards also dictate that the written data be based on primary sources, with the exception of adequate secondary sources for Level III projects. Important to note here is also that if there is any questionability of a source, “a frank assessment of the reliability and limitations of the sources shall be included.” “Secretary of the Interior’s Guidelines for Architectural and Engineering Documentation; Notice of Revisions,” 43161.

6. An incredible online display of non-traditional materials submitted for HABS/HAER/HALS projects can be accessed through the NPS website: http://www.nps.gov/history/hdp/exhibits/multimedia/index.html


10. Ibid.
For instance, known changes or alterations were to be indicated through unique line-weights and line characteristics (like a dashed line) on plans, sections or elevations. These graphic standards were discussed in previous guidelines prior to the 1994 *HABS Guidelines: Recording Historic Structures and Sites with HABS Measured Drawings*, however it is only with the 1994 publication that specific reference to independent drawings of these alterations was made.


Ibid., 16.


This list is based off of an appendix on Bowie's "Documentation of America's Industrial Heritage: The Historic American Engineering Record," which relied on HAER project classification categories.

Bowie, "Documentation of America's Industrial Heritage," 55.


Ibid.


The creation of HABS in 1933 helped to usher in the now-widely held belief that architectural significance can be applied to “the complete resume of the builder’s art,” expanding heritage into the vernacular, natural and cultural landscapes, ensembles of buildings, and other subjects that are significant to specific groups of society. In a series of reports published by the Getty Conservation Institute in the late 1990s and early 2000s, research was conducted on the value and benefits of cultural heritage conservation, addressing the advancing and diverse contemporary understanding of value and significance in the preservation field, including the contributions of programs like HABS.\(^1\) The reports, acknowledging that the professions of preservation and conservation was until recent times a small, isolated field of experts and specialists, sought to understand how the field has changed due to the expansion of the field. “These groups of citizens, of professionals from other fields, and of representatives of special interests arrive in the heritage field with their own criteria and opinions—their own ‘values’ which often differ from our own as heritage specialists.”\(^2\) The recent democratization of these many groups has changed the heritage field and questioned the old canons; “the opinions of the specialists are not taken as articles of faith; and heritage decisions are recognized as complex negotiations to which diverse stakeholders bring their own values.”\(^3\) An inclusive approach, then, was recommended by these reports in the process of heritage conservation, expanding upon the traditional conservation methods remaining at the core.\(^4\)

The advantage of HABS incorporating interpretive drawings is that it helps bridge the program to include not only a wider typology of drawings, but to expand to a wider audience of both heritage professionals, tertiary groups and professionals, and the general public. It is a step to make the program more inclusive, similarly to how conservation and other heritage fields are becoming more inclusive. Drawings that reveal, or interpret, heritage subjects can facilitate a higher level of understanding of the subject. While HABS has made use of some form and level of interpretation within its surveys throughout its lifetime, the 2008 Drawing Guideline’s inclusion and official recognition of interpretation as its own genre of drawing has the potential to propel the program into uncharted territory of accessibility and comprehension. This potential can be extremely powerful and relevant when considering the recent explorations and academic research in the heritage field and when considering recent dialogue around the goals and pertinent objectives of HABS in a contemporary context.

HABS in the digital age faces many challenges. Balancing new technologies, recording techniques, and production methods with standards for quality and archival stability has become a contentious topic of discussion in the face of shrinking federal budgets and changes in architectural practice.
While the collection itself is becoming ever popular, fewer students and professionals are generating drawings to HABS standards than in the past. The ease of new digital devices and software, coupled with changing methodological shifts in architectural education has contributed to this decline. The rigorous and high recording standards too have been called into question, suggesting whether or not they may be relevant when resources and time are restricted for recording endangered sites, let alone the many other sites that are deserving of documentation. Catherine Lavoie, the current HABS Chief, despite these challenges suggested that “still, HABS must develop strategies to encourage greater participation in the recording process. Such strategies should include providing more outreach to students and professionals interested in undertaking documentation to HABS standards and codifying levels of recording that are appropriate to the significance of the site or structures and the resources available.”

The intensive recording methodology is still highly valued among historians and architects as revealed by a series of symposiums sponsored by HABS in 2008 to celebrate its 75th anniversary. These symposiums, one co-sponsored by the Vernacular Architecture Forum (VAF), and the other co-sponsored by the Library of Congress, brought together academics, public and private professionals, state preservation offices, and private institutions to explore and reevaluate the issue of HABS in contemporary documentation practice. Contributors affirmed that the HABS collection is a vital asset for historic and architectural documentation, and consensually agreed that while the standards could be burdensome, they were necessary in promoting the uniformity and reliability of the archive and the intensive recording methodology employed in the field as a means for studying historic architecture. Engaging students and professionals, then, is a crucial agenda for HABS to undertake for the continued growth of the collection. It is the intention of this thesis to suggest that the production and creation of interpretive drawings may be an avenue for this engagement, in addition to facilitating a higher level of understanding of a historic subject.

Another contemporary issue affecting HABS and the other Heritage Documentation Programs is the increasing number of subjects being recorded that are from the recent past. These subjects can be different from 19th or early 20th century structures in that they may have extensive existing documentation archived and made available, as the likelihood of documentation from the recent past surviving intact is greater than for significantly older sites. This documentation may also expand beyond conventional architectural construction drawings to include design and process drawings or even construction photography. The Secretary of Interior Standards indicate that if sufficient existing documentation exists (to HABS standards) then the production of new drawings may not
be needed," but this standard may become less ideal if the subjects increasingly make the process of creating new drawings obsolete. To that end, architectural subjects that are intellectualized works of design may require drawings describing said process of design or the connection between design process and the as-built structures to represent their significant value(s) in the HDP archives. These subjects from the mid to late 20th century also challenge the current standards, but perhaps through the use of the interpretive drawing, an answer can be found.

What is not being suggested in this thesis is the removal of the intensive standards for documentation, given the field's relative embrace of the integrity and methodology they represent as previously identified. Nor am I suggesting the removal of using traditional, or conventional, drawing techniques and representations, such as plans, sections, and the like. Instead, as understood in Chapter 2 in the evaluation of the power of the interpretive drawing already established in the Heritage Documentation Programs, my intention is to establish how the interpretive drawing can not only reinvigorate the HDP, but also facilitate a deeper, more comprehensive understanding of the built environment, and that the production of these drawings can occur more consistently in surveys using available digital software and tools.

As has been discussed in previous portions of this thesis, HABS and its sister programs have embraced changing technologies and methods of production over its lifetime, from manual field measuring and recording, to large-format photography, photogrammetry, laser scanning, digital photography, and CAD. Currently however, the archive does not accept digital records due to the unstable nature of storing (and then accessing) digital files and will continue to do so until the standards for their production and stability are developed and tested to guarantee their survival over time.10 Factors involve the cost of storing digital files, the necessary information technology infrastructure, quality control of the digital files, media degradation and file errors which compromise storage sustainability and use.11 While this is currently archival procedure, given that the majority of drawings are produced using CAD, HABS/HAER/HALS will accept digital files on a compact disc as part of the field notes.12 As part of the field notes, these compact discs can be accessed by the public upon request if they exist for a survey, but are not part of the official Library of Congress archive. Digital tools, from CAD to the 3D point cloud data generated by laser scanning, have become heavily relied on for HDP survey work and production of measured drawings. While the archival community debates and tests methods for digital stability, HABS/HAER/HALS must balance the anticipation of these digital files becoming accessible as part of the official archive in the future and the need to work within the accepted constructs of archive stability in the form of 2D production.
What will be evaluated in the following pages are the tools that digital software provides in the manipulation, creation, simulation, and analysis of heritage subjects for recordation. While specific software programs and technology may be referenced, focus will be on the mechanics of the software and not the intricacies of product-specific proprietary software. This is due to the seemingly immediate nature of technological creation and evolution, where obsolescence in file type and application occurs regularly, but the mechanical tools of one software will reincarnate from version to version or be adapted to another type of software and built upon (as the idea of layer management has been incorporated into multiple types of software, for instance). The digital tools evaluated will concern data manipulation, as opposed to data collection.
“The unification of documentation in a single electronic model links informational data with graphical representation, and it enables the model to be a resilient tool.”

Both digital and analog technology mediate the physical world into a representation, whether it is the measuring tape translating an object’s length into a numerical system of measurement or a laser recording locational points in a field as a point-cloud. As the draftsman uses interpretive drawing to establish relationships between unique types of data, so too do many digital tools commonly used in the architectural, engineering and heritage fields operate on the basis of data linkage. At its most basic, Computer Aided Drafting, or CAD, digitally mechanizes drafting, but the capabilities of CAD software have dramatically advanced since its inception to include much more than a direct conversion of analog 2D drafting on paper. The digital 2D drafting file using vector lines, points, and arcs can be articulated in three dimensions as objects, or extrusions of the 2D vector graphics on an X-Y coordinate system into the Z-axis, or third dimension. Computer Aided Design and Drafting (CADD), the evolution of CAD, is a database, or collection of data that provides an environment for input-based commands for streamlining design processes, drafting, documentation, and manufacturing processes.

Contemporary CADD software generates a slew of different input-based commands and data management techniques, but generally range in scope from:

- 2D & 3D drafting
- 3D modeling
- Information layer management
- External file referencing & group collaboration
- Analytical computation and organization
- Physical phenomena simulation and analysis
- Animation
- Geo-referencing, or location services
Software may incorporate one, many, or all of these techniques, but typically will take a specialized approach to accomplish a particular industry goal. Another way of understanding the combination of these different techniques is by defining them as one of three categories of technological manipulation: a) Data-management, or the integration of different information and the consequent relationships created; b) As-found conditions technologies, or the manipulation of as-found data such as existing drawings, photographs, photogrammetric negatives, and laser scanned information; and c) Performance-determining technologies, or technologies that use real-world simulation for performance-based analysis.

2D drafting typically employs the use of information layer management, where each “layer” is a layer of information associated with a particular set of data, inputted by the user, which can be turned on and off depending on the objectives of the output, or plotted drawing. When drafting measured drawings, the use of layers can expand a base drawing into infinite complexity, with each type of physical aspect of the structure (walls, doors, mechanical equipment, stairs, etc.) on its own layer. The National Park Service standard CAD drafting software is AutoCAD, which is also an industry standard in the architectural and engineering fields.

Modeling in 3D enables the data input to be represented as a volume, or a 3D object. Scale and proportion generally relate to real-world dimensions, and the object can be moved and visualized within the software through the control of a computer mouse or digitizing tablet as though it were moved and visualized by rotation of a hand holding an object. 2D drafted drawings can be “extruded,” or given depth in the Z-axis, to create a 3D object, such as a 2D perimeter of a wall extruded vertically in the digital environment to give it height as a surface. The inclusion of an added coordinate dimension (Z-axis) is what separates 3D modeling from drafting. 3D visualization software also typically utilizes information layer management, where objects exist on layers in the same way that 2D vectors might in drafting software, enabling the user to control how information is displayed. Many modeling programs also give the user control over geometric constraints, either of the objects independently, to one another (making objects dependent on one another), or to coordinates (such as locking an object to a particular location in space). Software for 3D modeling can produce outputs for printing 2D images in the form of extracted, or captured (like a camera would) images, vector lines for drawings, and renderings for printing; or, it can generate a mechanical output command for machinery operations. There are many industry standard products for 3D modeling, such as Revit, Rhinoceros, Maya, and 3ds Max.
Once software establishes the mode in which it will operate in (2D, 3D, or both), specialized commands and computation can be applied and controlled by the user. Commands for economizing drafting production, for instance, such as “snapping” to a user-defined measured grid or parameter of a vector, point or arc, can help generate orthogonal drafting more efficiently than if the user had to operate a mouse exactly as they would operate pen on paper. Constraints between 3D objects can be defined and executed, for instance, as a parametric (meaning an establish parameter) application that directly links an object to dimensional and/or mathematical variables for a variety of purposes and properties.\textsuperscript{7} In this instance, when an object that is parametrically linked to a variable (like a dimension, coordinate location, or other object) is modified, its linked parameters will dynamically modify as well and vice versa. Software commands can even be extended to launch particular computational processes in software relating to real-world simulations of weather, day-lighting, and energy use; commands can exist too for running calculations for analysis (like determining area in a volume or of a surface). Products from these types of software can be 2D prints, images or drawings, but can also be in the form animation or video, with certain software incorporating camera-like manipulation to produce moving images. Still even further, the output can be in form of mechanical instructions for the production of laser cutting, CNC (computer numerical control) routing, or 3D printing.

What these tools provide is the mechanism for describing, mediating, and the translation of input data into an output that establishes a relationship, or connective tissue, between input data. In heritage documentation projects, the management of data for historic subjects can be an enormous task, given the scope of multidisciplinary data for each subject. One particular process for applying software in this way is through Building Information Modeling, or BIM. BIM is typically a 3D model of the geometry of a building, but within the model is embedded information pertaining to the construction, materials, assemblies, and spaces within the building, and as such acts as a virtual representation of the supplied database of information.\textsuperscript{8} BIM is other than 3D drafting in that it can communicate more than simply the form of a structure, because the software allows the 3D form to include data relating to identification and inventory of parts, materials, and assemblies, but it can also incorporate phasing of multiple points in history and alterations of the building over time.\textsuperscript{9} A popular model for Building Information Modeling is Revit, from the same suite of software that AutoCAD and 3ds Max belong to.
As digital technology has penetrated most aspects of the modern world, its effect on the architectural practice and architectural education has been equally profound. Fluency in modeling and drafting software is becoming more and more standard, and is particularly emphasized in architectural education. Top academic architectural programs in the United States typically include introductory courses on CADD software in the first year of coursework, sometimes even requiring introductory courses as a prerequisite for applying and acceptance into the program. As a student progresses throughout their education, the mastery and application of digital tools becomes increasingly more complex for the goal of producing clear, beautiful, and compelling design work. As David M. Foxe writes in “Building Information Modeling for Constructing the Past and Its Future,” he states, “as more young practitioners and students fluent with modeling software navigate the practical connections between parametrically defined forms and realities of construction, their skills in geometry and modeling can be readily adapted to the geometric and computational fluency for preservation efforts using BIM and other tools.”

In addressing HABS and the other programs of HDP that rely on student involvement in the creation of measured drawings for the surveys, acknowledging and taking advantage of this emergence of digital fluency could be a vital opportunity to inject interest back into the lagging participation of these programs.

With the understanding that contemporary tools can manage and link data as a single electronic model and database, a logical step in their application for heritage documentation would be to use these tools for extracting interpretive relationships through the medium of drawing. The architecture of digital tools lends itself for this kind of production because the files themselves are artifacts of interpretation, a blend of the discreet decisions the user made in inputting specific data and the translation of said data within the digital software into representational, graphic and textual outputs. Manipulating the vast layers of data in a digital model, the user would mirror the displayed information in the model to match the significance features an interpretive drawing would communicate. The complexity of the resulting drawing would be appropriate to both HABS guidelines and the Secretary of Interior Standards, reflecting the necessary level of documentation required for both Level I and Level II surveys.
Figure 4.1: Translation of Value of a Heritage Subject. Raw input, or objective information of a subject is translated via digital tools into an output that defines intelligent and curated relationships between the original data (or the themes understood in interpretive drawings).

By Susan Bopp.
4.3 Drawing as a Tool for Analysis

The complexity of the interpretive drawing relies on the complexity of analysis that is completed through the act of drawing and the type of data collected to work from. Thinking through drawing has been a process that has been discussed in depth throughout time, from the likes of Leon Battista Alberti to more recently Stan Allen and Robin Evans, and many others. Lines of a drawing are only that: lines of ink on paper – their associative value to that of architecture is only translated in the mind by the architect. The plan, section, and elevation are like a language, or tools of communication. They are the means for the architect to negotiate the gap between idea (design) and material (build), a transformation of reality by indirect means. There exists power in representation due to its inherently abstract character, but only if it remains true to abstraction, not in its false mission to "transcribe, or fix something as ephemeral as visual perception," to quote Evans. But perception of architecture is still necessary in how the architect interprets architecture, and Marco Frascari states in his essay "Lines As Architectural Thinking,"

Architects can draw the lines of a building in direct sight, reconstruct the lines of a demolished structure, or devise the lines for a future building. The common denominator in all these procedures is the making visible of that which is invisible. Through a peculiar and curious procedure of de-composition, selection and re-composition, through a polysemic use of lines, architects can trace rooms, structures and building details whose functions become self-evident in the composition of the lines that will never actually be seen in the constructed building. However, it is essential for presenting the inner and outer spaces simultaneously and revealing the many temporal sequences of architectural perception. The building is represented in its entirety but there is no necessary likeness between the lines and the original.

In heritage documentation, what does this inherent abstraction of drawing mean for interpretation of value and significance? The drawing can become the ground for analysis of value and significance, through the act of an architect trying to capture the elements of a building onto paper. Simon Unwin suggests that the paper, or computer screen, which is drawn on becomes "the surface on which the architecture of a building is forged, in preparation for its eventual realization in physical form. It is also on this 'ground' that the mind of the analyst can access the lineaments [a term as defined by Alberti as the intellectual instruments of control over the form of a building] embedded in the work, by redrawing it." Unwin further argues that by the draftsman engaging the existing building through drawing and understanding that architecture's lineaments, the draftsman enters the same 'arena' in which the architecture of the building was enacted. The mind then becomes both
receptive and an involved actor in architectural analysis.\textsuperscript{5} By an architect engaging in the analysis of drawing historic architecture, by these definitions, the threshold that the analyst enters between idea and reality is where the true power of engagement with the subject exists. The complexity of interpretative drawings, then, should encompass this engagement with the subject. “Interpretation is the revelation of a larger truth that lies behind any statement of fact,” Freeman Tilden wrote in 1957;\textsuperscript{6} perhaps entering into the original arena of the historic structure is where the larger truth lies.

Another approach of the application of the interpretive drawing within HABS surveys could be the use of the diagram in all Level I, II & III surveys. In particular, a discussion concerning Level III surveys and the place of the drawing could be addressed through the use of the diagram. As time and resources are limited, and in conjunction with the recommendations of the Secretary of Interior Standards, Level III surveys may only include a sketch drawing, typically a plan, neatly drawn by hand on archive bond paper to be included with the field notes if relevant. A suggestion that may advance the cause of the interpretive drawing would be to recommend the inclusion of a diagram drawing, with the same resolution applied. In this case, the diagram would be a drawing of a distilled reduction of information, abstracting the building to its essential form and its significant features.\textsuperscript{7}

These diagrams would highlight content in a highly graphic and simplified manner, using as few lines and tricks as necessary to convey a point. The advantage of this style of abstraction would promote further and honor the idea that a drawing is only a placeholder for a building, bridging the gap between the translation of essential significance and the physical reality of the building, but still communicate through the medium of drawing the value of the building. An example of this type of diagram would be as simple as drawing a sketch plan not in an orthogonal top view, but from an isometric angle, incorporating depth; overall dimensioning would still be labeled and the organizational scheme of the plan still legible. The isometric would allow for an extrusion of the structure’s massing as an outline of its perimeter, three-dimensional form, to be drawn above the plan, with the opportunity for the inclusion of basic elevation and sectional information to be overlayed as well. Should it be relevant, additional diagrammatic information could be additionally overlaid, such as important sun exposures, circulation paths to and from the building, or landscape features situated around the building.
The diagram in this application, a variant of the interpretive drawing, could supply a relatively in-depth but simple analysis of the heritage subject being documented in the archive of the survey. Production of these drawings could be done through the use of digital tools as described in previous pages, or even manually by hand as is currently the standard. The freedom these Level III sketch drawings (both digitally and manually) enjoy in their untethered connection to the intense measured drawing guidelines should be taken advantage of through the use of the reductive, but informative and accurately referenced diagram. However that is not to say that the diagram should not be included in Level I & II surveys; certainly the power in their representation could fulfill the guidelines while communicating effectively. Since Level III surveys are typically subjects of the vernacular or have limited recording resources, a drawing that conveys as much information as efficiently and accurately as possible produced would elevate the survey into a more comprehensive record of the subject documented.
4.4 THE DIGITAL ARTIFACT

Even though the stable archiving of digital data is still undergoing intensive debate and formulation, the ubiquitous nature of digital technology cannot be ignored in the heritage field outside of documentation. High level 3D imaging for the conservation and restoration of objects has become widely used and methodologically applied in conservation labs, while museum collections are increasingly being scanned and made accessible as a digital, interactive collection to be accessed either within the museum staff circles and/or the general public through online accessible archives.¹ HABS/HAER/HALS too has within the recent decade begun to display some of these digital outputs, such as animated fly-through videos of 3D modeling of HDP projects through its NPS website. It may not be so far off to imagine in the future an online collection, through the NPS and Library of Congress website, of digital files that were created in the process of documentation.²

A framework of resolution of the displayed digital file would have to be addressed, given the nature of specialized skill involved in working with and comprehending files of point-cloud data, or understanding the complexity of 3D modeling with complex layer information management, or even the platform the file would operate on natively. But the products produced by these digital files, such as a dynamic animation, video, or even 3D object files that could be taken to a 3D printing shop and printed, would not necessarily require the same specialized skill in their digestion by the general public. “The delight that naïve people take in a skillful simulation [of heritage subjects] should not be confused with a naïve understanding [of the subject],”³ an important point to remember when discussing the topic of heritage tourism (or in this case, the more abstract online tourism of heritage through the accessing of a digital archive). In fact, in this moment in time in the digital age, it may be a unique cultural moment where the general public is perfectly baptized in the doctrine of digital consumption, and an accessible display of digitalized heritage documentation would be well received and enjoyed. The display of video and interactive 3D imaging through online media has been well articulated in the new millennium, with repositories such as Google Earth accepting user generated 3D files in KML file formats, or web browser plug-ins and WebGL (Web Graphics Library, a Javascript application programming interface, or API) generated for the specific purpose of displaying detailed, high quality interactive 3D models on compatible web browsers.⁴

On the working end of the digital file as artifact, the content contained within a file has the potential for an almost infinite amount of output. Layers can be turned on and off; 3D models spun, cut, ghosted; views can be endlessly manipulated in their aspect ratios or in the zooming in and out of displayed content; vector drawings, photo-realistic renders, or even 3D prints can be produced from a digital file with enough resolution modeled. The digital file could be akin to an archeological site,
where after the initial mining of information has been conducted, the site is left in tact for future revisiting with more advanced mechanisms for extraction and data comprehension. The following was written by Jean-Paul Saint-Aubin in 1990 in reference to photogrammetric negatives, but has been adapted for understanding the afterlife of the digital file by replacing the references to photogrammetry and replacing them with the digital file:

On the one hand, the [digital files] are like an x-ray of the volume of the edifice, whatever its size or complexity. On the other hand, the [files] represent a global memory always available to deliver through a wide spectrum of treatments, graphic or numerical, a pertinent analysis of the building even when it has disappeared. [Digital files] thus constitutes an effective and very powerful means of arranging for the future in that it offers today the certainty of being able to respond tomorrow to any future questions regarding forms, dimensions, or proportions of the architecture – and this without having these responses tainted by hypothesis of regularity or of preconceived and subjective interpretation, as we usually have in the case of traditional renderings.

Once the digital files have been successfully archived through whichever means is decided upon in the future for HDP stable archived documentation, the data embedded within the files would be extremely valuable as an active file, or an active archeological site, used by the professional. It would then be up to the professional evaluating the digital file to use their judgment to produce an output, like the interpretive drawing, that is both scholarly and coherent; the data mined from a digital artifact would have to be processed in this way for the data to have valuable use. Even if the application of this archeological mining of existing digital files created during heritage documentation is delayed in the context of HDP archival stability, anticipation of the future use of these files should be considered for their potential use and contribution to advancing the methodology of heritage documentation production.

To restate the problem: the advantage of HABS incorporating interpretive drawings is that it motivates the program to include not only a wider typology of drawings, but to expand to a wider audience of both heritage professionals, tertiary groups and professionals, and the general public. It is a step to make the program more inclusive, similarly to how conservation and other heritage fields are becoming more inclusive. Drawings that reveal, or interpret, heritage subjects can facilitate a higher level of understanding of the subject, and the production of these interpretive drawings can be done through the use of contemporary digital tools. These tools can be categorized into the
following three typologies: a) Data-management, or the integration of different information and the consequent relationships created; b) As-found conditions technologies, or the manipulation of as-found data such as existing drawings, photographs, photogrammetric negatives, and laser scanned information; and c) Performance-determining technologies, or technologies that use real-world simulation for performance-based analysis. Through the negotiation and management of data provided by digital tools, interpretive drawings produced by these technologies can define relationships between data that may have been difficult, or impossible, to produce in a pre-digital era.
Chapter 4 Endnotes


4. Ibid.


7. Ibid., 22.

8. Ibid.

9. “While existing drawings are rarely suitable as as-built drawings, they are adequate in many cases for documentation purposes. Only when the desirability of having as-built is clear are Level I measured drawings required in addition to existing drawings. If existing drawings are housed and preserved in an accessible archival collection, their reproduction for HABS/HAER/HALS may not be necessary.”

“Secretary of the Interior’s Guidelines for Architectural and Engineering Documentation; Notice of Revisions,” 68 Federal Register 139 (July 21, 2003), 43161.


11. Ibid., 190.


13. As Lavoie notes in “HABS Documentation in the Digital Age,” the Library of Congress “requires the use of open source software in the production of digital files for its collections” to avoid the challenges of using and maintaining proprietary software. 189.


16 This list was generated by the author from years of experience working with digital tools in an academic and professional setting, and from many sources of literature consulted throughout those learning years.

17 For instance, the software AutoCad is generally accepted as an efficient and superb software for drafting, even though recent versions include three dimensional capabilities, while software such as Rhinoceros is proficient in modeling NURBS (Non-Uniform Rational B-Splines, a type of mathematically representation) 3D objects, even though it incorporates 2D drafting capabilities.

18 This list adapts a version of technological divisions as outlined by George Skarmeas, but does not include data gathering technology. George C. Skarmeas, “From HABS to BIM: Personal Experiences, Thoughts, and Reflections,” *APT Bulletin* 41, no. 4 (January 1, 2010): 50.


20 Foxe, “Building Information Modeling for Constructing the Past and Its Future,” 40.

21 Ibid.

22 Ibid.

23 Ibid., 44.

24 As an architecture student of this generation, and having worked professionally with BIM and other digital tools for preservation purposes, I can attest to this assertion.


Ibid., 109.


Examples of the kinds of diagrams referenced can be explored in Roger Clark’s “Precedents in Architecture,” a series of publications that provide a diagrammatic vocabulary for the analysis of architecture. It is also important to note here that the “diagram” has a rich history as it relates to modern and contemporary architecture and design; for the purposes of this discussion, that history will not be discussed. Roger H. Clark, *Precedents in Architecture: Analytic Diagrams, Formative Ideas, and Partis*, 4th ed. (Hoboken, N.J.: John Wiley & Sons, 2012).


Issues of funding and administration of such an archive suspended for a moment.


Chapter 5: Creating & Evaluating the Production of Interpretive Drawings
5.1 Case Studies

The digital tools, or mechanisms for data management and interpretation, described in this last chapter are tested through a series of case studies. Using the case study methodology of research and evaluation enables both the use of general, and specific, methods of drawing production to be analyzed and interpreted in an immediate and concise manner. While the case studies are equally about digital file management and creation, the generated outputs for these files are in the form of the 2D interpretive drawing, which is the main focus of analysis and discussion.

The reasoning behind producing static, 2D output is so that the drawing can be evaluated within the current standards of HABS measured drawing guidelines. The potential of digital files, as already considered, could be for the future production of infinite outputs of various modes beyond the 2D drawing; however, understanding and respecting the established value and benefits of the HABS/HAER/HALS standards for their clarity and uniformity of information was an important consideration when defining the boundaries of the case studies.

The subjects of the three case studies that are analyzed were chosen from existing HABS/HAER/HALS surveys of varying age. The first two subjects have potential for interpretive drawings that would describe some kind of intangible or experiential quality of the site and its architecture that was deemed significant but was not represented in the existing drawings, while the last subject was chosen for its extensive amount of manually created documentation, but lack of cohesive and immediate understanding of how the disparate pieces of documentation connected to one another. Each case study includes a project summary of the heritage subject and of the objectives behind the interpretive drawing, an evaluation of the digital tools used and the significance highlighted in the interpretive drawing made possible by those digital tools, and a summary of results. Process imagery is used to supplement the analysis of drawing creation.
CASE STUDIES:

5.2 Gettysburg Cyclorama Building

Cyclorama Building, 125 Taneytown Road, Gettysburg, Adams County, PA. HABS PA-6709. Survey completed in 2004. (http://www.loc.gov/pictures/item/pa3988/)

5.3 Ellis Island, Contagious Disease Hospital Measles Ward A


5.4 Merritt Parkway

The Gettysburg Cyclorama Building was erected as part of the National Park Service’s Mission 66 initiative, proposed in 1958 and completed construction in 1962. Designed by Richard Neutra and Robert Alexander, the Cyclorama Building was one of the few high profile Mission 66 projects designed by a well-known private architectural firm. Hiring Neutra and Alexander, prominent architects of the Modernist style, reflected the popular 1950s embrace and belief in technology and progress. The project was the first purpose-built administration building and modern visitor center for the Gettysburg National Military Park and was a significant example of the visitor center as a type. Its large reinforced concrete rotunda characterized the building and was designed to house and display the 19th century cyclorama painting of Pickett’s Charge on July 3, 1863, painted by French artist Paul Dominique Philippoteaux. As the written historical and descriptive report for the HABS Cyclorama Building survey states, the Cyclorama Building “represented both the resolution of a long-standing need for a new purpose-built facility for the Cyclorama painting and the expanding interpretive duties of the park staff.”

Through the design and planning of the Cyclorama Building, the architects had a dominant hand in the public experience of the exhibit displays, including the cyclorama painting. Citing Neutra’s “Remarks About Gettysburg Museum Exhibits” in the HABS written report, he discussed the physiological impact of looking at a series of exhibits such as those chronologically planned for the Cyclorama Building:

The directionalism can in its impact on the brain and the nervous system of the person who walks, stands still and proceeds further while he is looking and internally reverberating impressions just received, be greatly helped by the design arrangements, inscriptions and lettering. . . . The architect endeavors to serve the meticulous job of the historian who has ascertained all facts by advising on the means of producing emotional and lasting memory retention in the visitor, passing the exhibit series and taking with him a long lasting experience.

Located three stories above the main ground floor where the public typically entered, visitors had to ascend on a central spiral ramp within the rotunda to reach the viewing area for the cyclorama painting. This prescriptively designed circulation path demonstrated how Neutra’s architecture could affect the user experience of the exhibits, inducing a physiological response in addition to the visual response of the architectural design. The interpretation and display of the cyclorama painting also relied on sound and lighting effects to dramatize the work, by which the painting was
gradually revealed through dim-to-bright lighting design and presentation, impacting the visitor’s visual and spatial chronological understanding of the painting.

Placement of the mid-century modern building of reinforced concrete, glass, and fieldstone in the landscape of Ziegler’s Grove in Gettysburg National Military Park was a contentious decision; ultimately, the desire to place a comprehensive visitors center as close as possible to the important site at the time was considered paramount to a successful educational experience. It was further believed by Neutra and the Mission 66 planners at the time that modern buildings could fade into the landscape as a backdrop to the historic landscape, which hindsight revealed was not necessarily the perceived outcome.\(^5\)

In November 1999, the proposed General Management Plan for the battlefield park was approved, which included the demolition of the Cyclorama Building so that a recreated landscape of the 1863 appearance of Ziegler’s Grove could be implemented, as well as to allow for new museum collection facilities. The Advisory Council on Historic Preservation in a controversial ruling from 1999 supported the General Management Plan, acknowledging the sacrifice of one historic resource in support of another, contingent on the restoration of the cyclorama painting and improved conditions for its display in a new facility.\(^6\) Even though the Cyclorama Building was deemed eligible for the National Register of Historic Places in 1998, its application submitted by the Society of Architectural Historians was rejected in 2000. As such, documentation of the building was completed by HABS in 2004 as part of the mitigation requirements for demolition of the National Register-eligible building. Demolition of the structure was completed in early 2013 while a new, quasi barn-like replacement visitors center designed by Cooper, Robertson & Partners was completed and open to the public in 2008 with the newly restored cyclorama painting on display.\(^7\)

Data produced for the HABS Cyclorama Building survey:

- Photo(s): 103
- Color Transparencies: 7
- Measured Drawing(s): 24
- Data Page(s): 77
- Photo Caption Page(s): 8
The HABS survey of the Cyclorama Building produced a significant amount of physical documentation of the important structure. The measured drawings included extensive details of the plans, sections, elevations and site survey work, with over a hundred photographs to supplement the graphic documentation. One drawing focusing on the circulation system inspired the development of this case study sequence of drawings. The original HABS drawing in question contains a series of building plans at each level, with diagrammatic arrows indicating flow of public circulation throughout the building including annotated written descriptions of the sequence.

The Circulation Diagram drawing is extremely descriptive and critical to the understanding of the intention of the building’s purpose. It clearly indicates the circulation sequence through diagrammatic arrows along the circulation path, with annotations describing the sites seen along the way. The opportunity that arises by choosing the Gettysburg Cyclorama Building as a case study is to represent, through interpretive drawing, a more dynamic and enriched description of the circulation path focusing on the relationship of the sectional movement through the entire building and through the cinematic-like experience of the individual perception of the space as one moves through it. As Neutra himself wrote, the effect of the architecture on the exhibition sequence and of the physiological impression of the visitor was a significant feature in the design of the building. Describing these two aspects became the focus of the interpretive drawings.

To begin the production of the Gettysburg case study drawings, I put into practice one of the major strategies discussed in Chapter 4: treating the digital file as an archeological site and subsequently extracting data from it. The digital AutoCAD (.dwg) files created and used in the 2004 HABS survey were applied as the base document for my own 3D digital modeling of the Cyclorama Building. 

1 Quite literally, I was able to import the plans, sections, and details previously drawn as vector graphics into a 3D modeling software, allowing the building to be extruded from it. This process in and of itself was an analysis of the building. The creation of the 3D object required the proper correlation between 2D drawings; lining up the floor plan of a wall with its respective section cut allowed me to virtually reconstruct the now-demolished structure in algorithmic space, exposing me to an intimate awareness of the spatial quality of the Cyclorama Building without having to leave my computer desk. An additional aspect that came about through modeling was the verification of the accuracy of the original drawings. Their accuracy was not only vital to the production of an accurate 3D model, but through digitally modelling, the accuracy of the original source drawings were tested and verified without the expense of physical construction. The intent of using the 3D modeling method was to create an accurately measured digital model that could then be manipu-
Figure 5.1: Existing Circulation Diagram drawing from the HABS Cyclorama Building survey. HABS PA-6709, sheet 3 of 24.
lated infinitely to test different drawing typologies. The use of 3D modeling is standard procedure in the architecture program I attend at Columbia’s Graduate School of Architecture, Planning and Preservation, and as such this method of image creation is my standard method of working with architectural projects, providing me with the necessary skills to complete the task.

With the 3D model, drawings of any scale of frame can be produced; i.e., the tight framing of an interior perspective of a room to an overall broad perspective section or axonometric of the entire building. The 3D model, digitally reproducing all elements of the physical building in a 1:1 scale, is an index of information that can then be edited in the production of the interpretive drawing. In the case of the Gettysburg Cyclorama, I heavily deployed the axonometric drawing akin to those commonly used in HAER survey work. The axon provides the three-dimensional spatial relationship of building element to building element, and in this case I chose to highlight the floor path of the whole-building circulation, with the adjacent walls visible, so that the sectional movement of the patron vertically on the spiral ramp to the cyclorama painting and to the exterior roof lookout could be assessed in one curated view. The rotunda is exploded vertically and quarter-sectioned to reveal the details of the spiral ramp, and to highlight the 360 degree view the visitor experiences once arriving at the 3rd-floor viewing platform. Written annotation describes the circulation sequence in the same manner as the original HABS Circulation Diagram does, however in this example the depth and complexity of the path can be discerned through the axonometric relationship of the building elements to the circulation path.

**Drawing 1: Gettysburg Cyclorama Building Exterior Axonometric**

**Drawing 2: Gettysburg Cyclorama Building Axonometric Circulation Drawing, First Floor**

**Drawing 3: Gettysburg Cyclorama Building Axonometric Circulation Drawing, Second Floor**

**Drawing 4: Gettysburg Cyclorama Building Interior Circulation Sequence**

**Drawing 5: Gettysburg Cyclorama Building Exterior Facing South**
FIRST FLOOR EXHIBITS
RECEPTION
ORIENTATION IN AUDITORIUM
PUBLIC ENTRY
ASCENT TO CYCLORAMA

CIRCULATION AXONOMETRIC
AXONOMETRIC SECTION OF 1ST FLOOR
CIRCULATION SEQUENCE

GETTYSBURG CYCLORAMA BUILDING
1ST FLOOR ENTRANCE FOR ASCENT TO CYCLORAMA
2ND FLOOR LOBBY & ADDITIONAL EXHIBITS - WEST EXIT
ASCENT TO OVERLOOK
BATTLEFIELD OVERLOOK

CIRCULATION AXONOMETRIC
EXPLODED AXON OF 2ND & 3RD FLOORS OF CYCLORAMA

EXTERIOR AXONOMETRIC
VIEW FACING SOUTH

CIRCULATION AXONOMETRIC
INTERIOR CIRCULATION SEQUENCE

GETTYSBURG CYCLORAMA BUILDING
1ST FLOOR EXHIBITION
ASCENT TO CYCLORAMA
ASCENT TO PANORAMA PLATFORM
PERSPECTIVE OF 3RD FLOOR CYCLORAMA
DECENT TO 2ND FLOOR BRIDGE
PERSPECTIVE VIEW OF WEST FACADE
PERSPECTIVE VIEW OF MAIN ENTRANCE/WEST FACADE

INTERIOR CIRCULATION SEQUENCE

EXTERIOR VIEWS IN SITE
Drawing 1:
Gettysburg Cyclorama Building Exterior Axonometric.
Drawn by Susan Bopp.
GETTYSBURG CYCLORAMA BUILDING

EXTERIOR AXONOMETRIC
VIEW FACING SOUTH
Drawing 2:
Gettysburg Cyclorama Axonometric Circulation Drawing, First Floor.
Drawn by Susan Bopp.
GETTYSBURG CYCLORAMA BUILDING

CIRCULATION SEQUENCE
- PUBLIC ENTRY
- RECEPTION
- ORIENTATION IN AUDITORIUM
- FIRST FLOOR EXHIBITS
- ASCENT TO CYCLORAMA

CIRCULATION AXONOMETRIC

AXONOMETRIC SECTION OF 1ST FLOOR
5.2.1

Drawing 3:
Gettysburg Cyclorama Building Axonometric Circulation Drawing, Second Floor.
Drawn by Susan Bopp.
GETTYSBURG CYCLORAMA BUILDING

CIRCULATION AXONOMETRIC
EXPLODED AXON OF 2ND & 3RD FLOORS OF CYCLORAMA

CIRCULATION SEQUENCE
- 1ST FLOOR ENTRANCE FOR ASCENT TO CYCLORAMA
- 2ND FLOOR CYCLORAMA VIEWING PLATFORM
- VIEW OF PANORAMA MURAL FROM 3RD FLOOR PLATFORM
- 3RD FLOOR EXIT FROM CYCLORAMA
- 3RD FLOOR LOBBY & ADDITIONAL EXHIBITS - WEST EXIT
- ASCENT TO OVERLOOK
- BATTLEFIELD OVERLOOK
- BATTLEFIELD OVERLOOK
Drawing 4:
Gettysburg Cyclorama Building Interior Circulation Sequence.
Drawn by Susan Bopp.
GETTYSBURG CYCLORAMA BUILDING

INTERIOR CIRCULATION SEQUENCE
Drawing 5:
Gettysburg Cyclorama Building Exterior Facing South.
Drawn by Susan Bopp.
While the axonometric was explicitly used for its descriptive detailing, it is worth noting that this particular drawing was extracted from the digital model and refined in an extraordinarily more efficient amount of time than it would have taken if the drawing were produced through traditional methods of drafting. The refined techniques of constructing an axonometric drawing without the aid of a model, though extremely valuable and analytical in its own right, were not required so strictly for the production of Drawing #1. Once the specific angle of the axonometric was established, the software itself allowed for the manipulation of the “camera lens,” so to speak, creating the ideal view to be captured as a drawing. Vertical lines, at the click of a command, were made perfectly parallel; panning around the software’s viewport allowed for me to curate exactly which view I thought would be the properly established angle for describing the circulation sequence.

The last drawing in the sequence (Drawing #4), addresses the experiential views of the visitor in and around the building in the historic battlefield landscape. The axonometric view of the building is employed within the existing HABS Site Plan (HABS PA-6709 sheet 2 of 24) for contextual relationships between the scale of the building and the various exterior approaches and views to and from the building. The reveal of the interior circulation includes interior perspective views of the visitor circulating through the space in a cinematic approach. The interior perspectives are not measurable, but they were produced within the modeling software using a 24mm wide-angle lens to simulate a realistic depiction of the view. Through combining different views of both the interior and exterior of the building, the drawing emphasizes the importance and careful design of how the visitor operates within and around the building, an important and significant aspect of the design as mentioned in the HABS written report but not revealed in drawing. The photographic collection in the survey excellently depicts the particular details and “lived-in” condition of the interior and exterior of the building at the time of documentation, but they are presented only as an index of reference.

Drawing #4 threads together the whole building circulation sequence as a series of chronological perspective views in an effort to use a specific drawing language, the perspective, as a descriptor of experience and not just as tectonic articulation (i.e. a different language than the plan, section, or elevation). The perspective views, in conjunction with the measurable axonometric of the whole building, also provide a broadly understood and recognizable depiction of space that can be understood by both specialists (heritage professionals) and non-specialists (the public). While not replacing the value and use of intensely and meticulously accurate HABS utilitarian architectural drawings, the perspective drawing as signifier of personal experience supplements the overall understanding and comprehensive documentation of the Cyclorama Building.
CYCLORAMA BUILDING

AXON

LAYERS ON & OFF

PERSPECTIVE

SECTION

ZOOM & CROP
Consequently, through the use of 3D digital modeling, the legacy of the digital artifact becomes more valuable in the case of the Gettysburg Cyclorama Building. Since the real building has been demolished, the digital manifestation of it, in parallel with the other documentation mediums, becomes the re-incarnated identity of the perished building. The use, then, of the 3D digital model when the physical structure has been destroyed, can be critical in further digestion and interpretation of the heritage subject. Whether it is through the production of static 2D drawings, 3D interactive online models, or even 3D printed models, the Cyclorama Building as a digital 3D model can be continuously observed and viable for future use.

Matrix for the Cyclorama Building Case Study:

<table>
<thead>
<tr>
<th>INPUT</th>
<th>TRANSLATION</th>
<th>OUTPUT</th>
</tr>
</thead>
<tbody>
<tr>
<td>[Raw Data]</td>
<td>[Digital Tools]</td>
<td>[Relationships Between Data]</td>
</tr>
<tr>
<td>• Structure</td>
<td>• 3D modeling</td>
<td>• Typical use patterns</td>
</tr>
<tr>
<td>• Tectonics</td>
<td>• Layers of information</td>
<td>through circulation</td>
</tr>
<tr>
<td>• Circulation</td>
<td>• Reference of multiple files</td>
<td>• Subjective/Objective</td>
</tr>
<tr>
<td>• Site landscape</td>
<td>• Simulation of physical world phenomena</td>
<td>perspectives</td>
</tr>
</tbody>
</table>
Measles Ward A is part of the Contagious Disease Hospital complex on Ellis Island in New York City. As one of eight identical measles pavilions, it was built between 1907-1908 to address the needs of sick immigrants arriving at Ellis Island and to contain and treat them on the island to prevent the spread of disease throughout the city. In later years the function of the hospitals at Ellis Island (run by the U.S. Public Health Service, or USPHS) expanded beyond the care of immigrants to that of detainees, merchant seaman, service members and local citizens qualified for government care. Measles Ward A and the rest of the Contagious Disease Hospital at Ellis Island were a developed example of the pavilion plan hospital, the favored hospital form in both Europe and the United States in the 19th century. Self-contained ward pavilions were arranged for maximum ventilation and light, connected to the administration and staff quarters by covered corridors. Each pavilion floor was designed to be a spacious open ward with large windows on three sides and independent ventilation ducts. This enabled the segregation of air between the wards and administrative areas to prevent the spread of disease.

The Contagious Disease Hospital was designed by James Knox Taylor, the Supervising Architect of the Treasury, which was responsible for the design of federal facilities. It was designed in the style of the Georgian Revival as was popular type in the early 20th century. The early stages of the design process included collaboration between immigration officials, public health surgeons, and federal engineers and architects, reflecting the desire to promote quality care through responsive hospital architecture. The pavilion hospital plan, emphasizing access to fresh air and sanitary conditions, explicitly drove the design of the wards and their organization through this pavilion plan. Cross-ventilation was key, determining the placement of parallel rectangular wards attached at one end via corridor, while an independent ventilation system for the wards separated the ward from contaminating the corridor. The details of ventilation and finishes were debated in the medical and architectural professions, but the free-standing or semi-attached pavilion wards dominated hospital design from the Civil War to just after the completion of the Contagious Disease Hospital.

In Measles Ward A, air was circulated through ducts, ventilation grills, and fresh air intakes underneath the limestone windowsills along the three walls of the ward. The vents on both floors of the ward circulated air vertically through ducts in the walls and attic to its discharge through a large round copper ventilator at the roof ridge above the administration area. The large, uniform windows on the three walls of the wards provide for extensive natural light; the ward was built with electrical service, but the prevailing medical ideas about light and air still emphasized access to natural light.
The USPHS vacated the hospital facilities in 1951 and in 1954 the Ellis Island U.S. Immigration Station ceased operation. The complex was made part of the Statue of Liberty National Monument in 1965. As indicated in the HABS written report, “Measles Ward A remains as one of the most intact examples of an original pavilion ward, with few alterations and many surviving original features.” The HABS survey of Measles Ward A was implemented in 2010.

Data Produced for the HABS Ellis Island Measles Ward A Survey:

Photo(s): 12
Measured Drawing(s): 8
Data Page(s): 41
Photo Caption Page(s): 1

Figure 5.2: East Elevation of Ellis Island Measles Ward A. HABS NY-6086, sheet 6 of 8. 2010.
The HABS survey produced for Ellis Island Measles Ward A is part of a larger survey project of the Contagious Disease Hospital complex. With 8 measured drawings and 12 photos, the graphic information successfully conveys the tectonics and organization of the building, but there are no drawings explicitly depicting the mechanical and natural ventilation system in the building. The goal for this case study then is to describe through drawing the importance and details of the mechanical and ventilation systems of the ward as well as access to natural light.

As with the Cyclorama Building, I digitally 3D modeled Measles Ward A, using the original CAD files used in the production of the HABS survey drawings as the base file from which to work. For the same reasons stated previously for the Cyclorama Building, creating the 3D model gave me a canvas of workable data, allowing me to spin, zoom, and decipher how and what type of drawings to produce. Ultimately, I chose again the axonometric view for its measurability and descriptive qualities, to describe the building mass in relationship to its mechanical ventilation system. The duct placement within the model and as described in Drawing #5 was determined from a combination of the written data, indications within the plan drawings, and from photographs of the attic given to me by HABS historian and project historian of the Measles Ward A survey, Lisa Davidson.

The advantage of using the axonometric drawing in the case of Measles Ward A is that the mechanics of an axonometric are particularly friendly for orthogonal shapes such as the pavilion hospital plan. Not only can the confines of the building be easily articulated, when the mechanical ductwork is isolated and placed on top of the building mass, the purpose and function of the architectural form can be clearly conveyed. Arrows indicating the fresh air intake below the sills of the windows, in the axonometric view, suggest the cross-ventilation from one side of the building to the other; the placement of the ventilation ducts at both long ends of the ward area literally frame the ward's isolation from the connected service area. In this particular case study using Measles Ward A, the careful and curated interpretive drawing that may at the outset merely be just a description of the building's mechanical systems, when depicted in a typology like the axonometric, can simultaneously act as the amalgamation of the building design strategies, articulations of the constructed built form, and the historical (and contextual) ideology as read through spatial relationships, such as the relationship between ventilation and space planning. Recognizing this relationship of building infrastructure to its significant features will become more important as buildings from the mid 20th century and later become more commonly documented, where infrastructure and design can be one in the same.
ELLIS ISLAND MEASLES WARD A

AXON

LAYERS ON & OFF

3D + 2D
The second approach to analysis for Measles Ward A was to produce a series of drawings depicting how daylight floods the interior ward throughout a given day. In an effort to provide a typical example, a daylighting study was done for both June 21st (during Daylight Savings) and December 21st, recording the hours of 7am, 9am, 11am, 1pm, 3pm, 5pm, and 7pm. Recording how light accesses the interior space through the large windows of the ward reflects the importance of the window design and placement for the pavilion hospital plan. As access to fresh air was considered crucial in germ contagion theory, so too was access to natural light. The planning of the independent ward of a pavilion plan hospital allowed for natural light penetration on three sides of the structure, with courtyards separating each ward projected from the main services corridor of the Contagious Disease Hospital. The unified repetition of the same large two-sash, four light window around the perimeter of the hospital ward guaranteed equal access to light on both the first and second floors; the Daylighting studies done for Measles Ward A confirms how daylight would typically fill the ward.

Drawings 6 & 7 were generated by the use of a rendering software, AutoDesk's 3ds Max, which placed the digital model in the exact geographical coordinates of the real physical site, while also simulating the sun path for a given time period in that geographical location. Specifics like time of day were easily and quickly set and a resulting image, or render, was produced of the determined effects. The time period for the renders, or 2D raster images, produced for Drawings 6 & 7 were determined by the quality of image desired; because of the requirement for reproduction and clarity, the render engine was set to produce a higher quality image (set at a resolution of 4500 x 5000 pixels; a High Definition (HD) resolution is typically set at 1920 x 1080 pixels for comparison) and took roughly 8 minutes per image to render. The ability to quickly and efficiently calculate a complex graphic image such as how light fills an architectural space is made exceptionally straightforward through the use of rendering software, by which complex light and shadow computations are streamlined as part of the basic applications of the software. To render on paper by hand the same lighting effects might easily be an all-consuming task, heavily relying on the scientific skillset of the renderer. Using the digital software supplies the renderer with the accurate data, freeing the renderer to use his or her scholarly judgment on curating the composition and successful depiction of the scene, rather than spending the time calculating the effects of solar path data. The rendering
Drawings 6 & 7 were generated by the use of a rendering software, AutoDesk’s 3ds Max, which placed the digital model in the exact geographical coordinates of the real physical site, while also simulating the sun path for a given time period in that geographical location. Specifics like time of day were easily and quickly set and a resulting image, or render, was produced of the determined effects. The time period for the renders, or 2D raster images, produced for Drawings 6 & 7 were determined by the quality of image desired; because of the requirement for reproduction and clarity, the render engine was set to produce a higher quality image (set at a resolution of 4500 x 5000 pixels; a High Definition (HD) resolution is typically set at 1920 x 1080 pixels for comparison) and took roughly 8 minutes per image to render. The ability to quickly and efficiently calculate a complex graphic image such as how light fills an architectural space is made exceptionally straightforward through the use of rendering software, by which complex light and shadow computations are streamlined as part of the basic applications of the software. To render on paper by hand the same lighting effects might easily be an all-consuming task, heavily relying on the scientific skillset of the renderer. Using the digital software supplies the renderer with the accurate data, freeing the renderer to use his or her scholarly judgment on curating the composition and successful depiction of the scene, rather than spending the time calculating the effects of solar path data. The rendering software produces an efficient, accurate result and catapults the ability to represent existing conditions within a space beyond what was for a typical HABS survey in the pre-digital age. Emphasis on the ethereal and intangible aspects of a heritage subject can be as equally valuable in how the building is understood and what its significance and historical contributions might be. In the case of Ellis Island Measles Ward A, access to light and air were the primary drivers of the pavilion plan design. Graphically emphasizing this relationship in the measured drawing set immediately calls attention to that fact, while also providing the user a tangible account and experience of light within the space.

Drawing 6: Ventilation & The Pavilion Plan Axonometric. Ellis Island Measles Ward A.

Drawing 7: Ventilation & The Pavilion Plan Axonometric. Ellis Island Measles Ward A.

Drawing 8: Ventilation & The Pavilion Plan Axonometric. Ellis Island Measles Ward A.
Matrix for Measles Ward A Case Study:

<table>
<thead>
<tr>
<th>INPUT [Raw Data]</th>
<th>TRANSLATION [Digital Tools]</th>
<th>OUTPUT [Relationships Between Data]</th>
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<td>• Tectonics</td>
<td>• Layers of information</td>
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<td>• Reference of multiple files</td>
<td>mechanical and ventilation</td>
</tr>
<tr>
<td>• Light Access</td>
<td>• Physical phenomena</td>
<td>systems</td>
</tr>
<tr>
<td>• Air Flow</td>
<td>simulation</td>
<td>• Daylighting study</td>
</tr>
<tr>
<td>• Social history via pavilion hospital plan</td>
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</tbody>
</table>
Drawing 6: Ventilation & The Pavilion Plan Axonometric. Ellis Island Measles Ward A.
Drawn by Susan Bopp.
ELLIS ISLAND MEASLES WARD A

VENTILATION & THE PAVILION PLAN

NOTES: DUCTS, VENTILATION GRILLS, AND FRESH AIR INTAKES SECURELY FACILITATED AIR MOVEMENT WITHIN WARD A TO PREVENT CROSS-CONTAMINATION. AS A PAVILION PLAN HOSPITAL, ACCESS TO FRESH LIGHT AND AIR WAS CONSIDERED CRUCIAL TO RECOVERY AND AS SUCH DICTATED THE ORGANIZATION OF THE PLAN.
5.3.1

Drawing 7:
Daylight Access on June 21st, Second Floor Ward.
Drawn by Susan Bopp.
ELLIS ISLAND MEASLES WARD A

DAYLIGHT ACCESS ON A SINGLE DAY: JUNE 21ST
SECOND FLOOR

NOTES: THE BELOW DAYLIGHTING STUDIES WERE GENERATED WITH A RENDERING SOFTWARE THAT SIMULATED THE CORRECT GEOGRAPHIC LOCATION, TIME AND SUN POSITIONS FOR THE ELLIS ISLAND MEASLES WARD A SITE. THE HOURS SIMULATED ARE DURING THE SPAN OF JUNE 21ST DURING DAYLIGHT SAVINGS TIME.
Drawing 8:
Daylight Access on December 21st, Second Floor Ward.
Drawn by Susan Bopp.
ELLIS ISLAND MEASLES WARD A

DAYLIGHT ACCESS ON A SINGLE DAY: DECEMBER 21ST
SECOND FLOOR

NOTES: THE BELOW DAYLIGHTING STUDIES WERE GENERATED WITH A RENDERING SOFTWARE THAT SIMULATED THE CORRECT GEOGRAPHIC LOCATION, TIME AND SUN POSITIONS FOR THE ELLIS ISLAND MEASLES WARD A SITE. THE HOURS SIMULATED ARE DURING THE SPAN OF DECEMBER 21ST.
An extensive survey conducted jointly by HABS and HAER in 1992 documented the extent of the Merritt Parkway in Connecticut, one of the first American roads to combine the aesthetics of scenic and recreational parkways with the efficiency of high-speed motorways. The Parkway was also the first divided-lane, limited access highway in Connecticut and represents a significant development in the evolution of American highway design.\(^1\) The Parkway includes a collection of nearly fifty rigid-frame bridges, the design of which reflected the aesthetic of commercial architectural trends of the 1930s as well as introducing Art Deco and Art Moderne styles to the scenery and context of a parkway.\(^2\) Landscape design as it relates to the motor experience was also an important contribution to highway design by the Merritt Parkway, where a progression of changing vistas is achieved by planting native trees, shrubs, and ground coverings “in a contrived-but-naturalistic” manner.\(^3\) The extensive HABS/HAER survey undertaken for the Parkway included a primary survey (HAER CT-63) which supplied the overview and index information for the entire 38-mile span of road, and was supplemented by 80 smaller surveys (consisting of a written report and set of photographs), for each individual bridge and structure associated with the Parkway.

Data Produced for the Merritt Parkway Survey (HAER CT-63):

- Photo(s): 119
- Measured Drawing(s): 21
- Data Page(s): 160
- Photo Caption Page(s): 8
- Additional Associated Surveys: 80
Figure 5.2: One of many drawings cataloging the bridges of the Merritt Parkway. HAER CT-63, sheet 5 of 21.
The Merritt Parkway was chosen as a case study so that an experiment could be conducted involving the creation of an interpretive drawing or graphic representation that describes and traces data management within such an expansive survey. Here, “data” is referencing the written, drawn and photographic sets of information within the “master” Merritt Parkway HAER CT-63 survey, but also includes the relationship of the additional 80 surveys associated with the Parkway. The rationale behind this study was twofold: to suggest that the use of an interpretive drawing to describe administrative information of the survey could be useful for accessing and comprehending the information within the survey, and secondly to provide a potential work flow for managing extensive data.

To narrow down such an expansive survey such as the Merritt Parkway, for the purposes of this case study, I have specifically focused on the more than 50 bridges designed and built for the Parkway. The goal for the study was to connect the content of each bridge’s individual survey to the larger context of or position within the Parkway’s timeline of construction. In doing so, the goal is to convey multiple layers of information within a single drawing, with the explicit purpose of data management within the survey(s).

The expansive written data report for the master Merritt Parkway survey includes an appendix that describes the timeline for construction phases from beginning to end, 1934 to 1942. Phase II of construction consisted of the bridges, and the appendix includes each bridge’s dates of completion, independent HAER survey number, Connecticut Department of Transportation identification number, and cost of construction if available. This timeline of bridge completion is the base foundation for how my study is implemented. I parsed out the information in this appendix into a spreadsheet, listing each name of the bridge, what year it was completed, its HAER independent survey number, and the content of that survey via number of pages in the written report and number of photographs within the survey.

To synthesize this data, I created a generative algorithm using the visual programming tool known as Grasshopper, a plug-in for the 3D modeling software Rhinoceros. The algorithms produced by Grasshopper, or “definitions” as they are called, are parametric in that they produce a framework of commands that can be manipulated when the given parameters, like numerical values, vector information, or 3D geometries, are modified. In this instance, I created my definition for this study to produce an output that is identifiable as vector graphics for a drawing.
As Drawing #6 indicates, each circle graph is associated with a year of construction that is further divided by the number of bridges associated with that year. Each bridge wedge is additionally divided by the number of report pages (indicated by solid lines) and the number of photographs (indicated by dashed lines) included in its independent HAER survey. The algorithm I created that generated this drawing references the data I collected in the spreadsheet of bridge information, by which the text of the bridge's name and the numerical values associated with the report and photographic set influence the parameters of the circular vectors in the drawing.

Drawing #6 accomplished two objectives: to display data graphically and to create relationships across multiple HABS/HAER surveys on a single subject (the Merritt Parkway). For instance, within a given year the graphic representation of the amount of documentation data associated with a bridge is immediately telling of the character of the bridge; in some way, the more documentation a bridge has, the more significant it was deemed. This significance is alluded to in the master Merritt Parkway written report, but Drawing #6 provides an efficient and direct understanding of importance through the graphic representation of documentation quantities. What might have taken a large amount of time to discern through reading is easily identified in seconds through Drawing #6. Additionally, by using the timeline of bridge completion as the foundational organization of the drawing, this drawing calls out the evolution and transformation of the Parkway in a graphic way that was not easily perceptible in the original survey’s drawings.

The advantage of using a digital tool like a generative algorithm is that the output, like most any other of the previously mentioned digital tools, can be infinite. In the definition I created for the Merritt Parkway, by simply changing the information of the referenced spreadsheet alone would dynamically and immediately update the graphics to reflect that information accordingly. The structure of the circular graphics is, after all, only a framework of vectors that is defined by the annotation of the drawing; a photograph or a digital 3D model could instead be the input that defines the meaning of the vectors. The nature of the Grasshopper definition also allows for the easy modification of commands; meaning, instead of vector arcs generated like those in Drawing #6, in their place could easily be straight lines, scaled rectangles, or three-dimensional objects. The definition is a workflow that could be applied to many different types of projects and applications in future large-scale survey use.
Matrix for Merritt Parkway Case Study:

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<th>TRANSLATION</th>
<th>OUTPUT</th>
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<td>[Relationships Between Data]</td>
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<td>• Relevant dates as a timeline</td>
<td>• Analytical computation</td>
<td>• Archive and administration of data, or data management as graphic form</td>
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<td>• Contextual information in the form of survey documentation data for each bridge</td>
<td>• Organization of numerical data as a spreadsheet</td>
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<tr>
<td>Name</td>
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<td>Total Data Pg #</td>
</tr>
<tr>
<td>-------------------------------------------</td>
<td>---------</td>
<td>-----------------</td>
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<tr>
<td>Stanwich Rd Bridge, Greenwich</td>
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<td>7</td>
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<tr>
<td>Sport Hill Rd/Rte 59 Bridge, Fairfield</td>
<td>HAER# CT-55</td>
<td>11</td>
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<tr>
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<td>HAER# CT-79</td>
<td>7</td>
</tr>
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<td>North St Bridge, Greenwich</td>
<td>HAER# CT-70</td>
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<td>Guinea Rd Bridge, Stamford</td>
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<td>Mianus River (culvert), Stamford</td>
<td>HAER# CT-74</td>
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<td>South Ave/Rte 124 Bridge, New Canaan</td>
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<td>Metro North Railroad Bridge, New Canaan</td>
<td>HAER# CT-83</td>
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<td>HAER# CT-91</td>
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<td>Norwalk River Bridge, Norwalk</td>
<td>HAER# CT-92</td>
<td>6</td>
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<td>Main St/Rte 7 Bridge, Norwalk</td>
<td>HAER# CT-93</td>
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<tr>
<td>New Canaan Rd/Rte 123 Bridge, New Canaan</td>
<td>HAER# CT-87</td>
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Figure 5.3: A spreadsheet of data informs the scripted algorithm how to generate the drawing.
Drawing 9:
Merritt Parkway Timeline of Bridge Completion and Related HAER Survey Data
(Version 1)
Drawn by Susan Bopp.
TIMELINE OF BRIDGE COMPLETION & RELATED HAER SURVEY DATA

1934
- HAER CT-64
- HAER CT-122
  - West Branch Byram River Bridge, Greenwich
  - White Plains Rd/Rte 127 Bridge, Trumbull

1935
- HAER CT-65
- HAER CT-76
  - Rye Brook Road Bridge, Greenwich
  - East Branch Byram River Bridge, Greenwich
  - Round Hill Rd Bridge, Greenwich
  - Pequonnock River Bridge, Trumbull
  - Rocky Hill Rd Bridge, Trumbull

1936
- HAER CT-78
- HAER CT-79
  - Rye Brook Road Bridge, Greenwich
  - Long Ridge Rd/Rte 154 Bridge, Stamford
  - Perry Ave Bridge, Norwalk

1937
- HAER CT-72
  - Separate Rd Bridge, Greenwich
  - Sport Hill Rd/Rte 55 Bridge, Fairfield
  - High Ridge Rd/Rte 157 Bridge, Stamford
  - North St Bridge, Greenwich
  - Tacoma Rd Bridge, Greenwich
  - Doane Rd Bridge, New Canaan
  - Newfield Rd Bridge, Stamford
  - Rensell Rd Bridge, Stamford
  - Cemetery Rd Bridge, Easton
  - Mianus River (southern), Stamford
  - South Ave/Rte 154 Bridge, New Canaan
  - Mianus River (northern), Norwalk
  - White Oak Rd Bridge, New Canaan
  - Marina Bridge, New Canaan
  - More North Railroad/Winnipauk Railroad Bridge, Norwalk
  - New Canaan Rd/Rte 123 Bridge, New Canaan

1938
- HAER CT-77
- HAER CT-78
  - West Mill Rd Bridge, Stamford
  - Cemetery Rd Bridge, Fairfield
  - West Ridge Rd Bridge, Norwalk
  - East Ridge Rd Bridge, Norwalk
  - Grassfield Rd Bridge, Norwalk
  - Black Rock Turnpike/Rte 154 Bridge, Fairfield
  - Wilson Rd/Rte 35 Bridge, Westport
  - Westfield Rd/Rte 35 Bridge, Westport
  - Easton Rd/Rte 154 Bridge, Westport
  - Cross Highway Bridge, Westport-Fairfield
  - Comstock Hill Rd Bridge, Norwalk
  - Saugatuck River Bridge, Westport
  - Silvermine Rd Bridge, Norwalk
  - Silvermine River Bridge, Norwalk
  - Ironside River Bridge, Norwalk

1939
- HAER CT-101
  - North Ave Bridge, Westport
  - Redding Rd Bridge, Fairfield
  - Old Stamford Rd/Rte 106 Bridge, New Canaan
  - Beakley Lane Bridge, Westport
  - Newfield Ave/Temple Bridge, Westport
  - River St Bridge, Fairfield
  - Hackensack Highway Bridge, Fairfield
  - Pleasant Hill Rd (former: Comstock Hill Rd) Bridge, Trumbull
  - Old Route 123 Bridge, Trumbull
  - Reservoir Rd Bridge, Trumbull

1940
- HAER CT-102
  - Clinton Ave/North Clinton Ave Bridge, Westport
  - High Ridge Rd Bridge, Fairfield
  - Huntington Rd Bridge, Stratford
  - Merona Lane Bridge, Fairfield
  - Hillside Rd Bridge, Fairfield
  - Fish Ave Bridge, Fairfield
  - Huntington Temple/Rte 106 Bridge, Trumbull
  - Lake Ave Bridge, Greenwich
  - Unity Rd (former: Templeton Ave) Bridge, Trumbull
  - Crotcher Brook (northern), Fairfield
  - Newfield Rd Bridge, Stratford
  - Center Road Bridge, Stratford
  - Main St/Rte 10 (former: Rte 8) Bridge, Stamford

1941
- HAER CT-120
  - Pumpkin Brook (culvert), Stratford

1942
- HAER CT-119
  - Decker Street Rd Bridge, Trumbull
Drawing 10: 
Merritt Parkway Timeline of Bridge Completion and Related HAER Survey Data
(Version 2)
Drawn by Susan Bopp.
THE MERRITT PARKWAY
FAIRFIELD COUNTY, CONNECTICUT

TIMELINE OF BRIDGE COMPLETION & RELATED HAER SURVEY DATA
Through investigating three different and unique case studies, several conclusions can be drawn, particularly in relation to how digital tools facilitate interpretative drawing production. Primarily, the digital file is akin to an archeological site, or a digital amalgam of information that can produce an infinite amount of variables in the form of interpretive drawings as per the objectives of the interpreter. Digital tools are assets for information management as well as facilitators for producing graphics that could not as easily be rendered by hand. The combination of ability plus the opportunity to return to a file and mine it further for information is a critical development in how contemporary documentation practice has evolved.

The case study investigations also highlight the limitations of two-dimensional drawings when compared to the exciting and dynamic possibilities of the digital files from which the drawings are created. The attractive features of digital media, such as animations, 3D printing, and the ability for the file to be interactive, render the 2D drawing as somewhat restricted because of its static qualities. The limitations in size and the medium of lines on paper require that the drawing produced is legible and accessible; therefore, the amount of layers of information within a drawing needs to be curated by a professional in order to achieve the desired successful expression of information. The digital file, by comparison, has a different set of limitations, such as archival stability and the sometimes-specialized skill required for use. Yet these limitations in the cultural moment of the early 21st century seem likely to be short lived as globalization and technological development increasingly acclimate the public and professional world to a more intimate relationship with digital technology. Even as this digital evolution (and revolution) continues into the future, the undeniable value of the intensive methodological documentation via measured drawings supported by HABS, HAER and HALS, continues to appreciate exponentially and educate the public about the United States’ varied and exceptional historic resources.
The Heritage Documentation Programs have a tradition of encouraging and evolving methods of documentation production, and the methods described in the creation of the three case studies continues that trajectory. The ability for these digital tools to both manage project data and enable the creation of dynamic and parametric graphics facilitates a more sophisticated understanding of cultural value in any given project. Old methods of graphic expression, such as the axonometric, are enhanced by the new ability to efficiently and economically turn on and off layers of information in a digital file to produce, in a matter of minutes, a vigorous study of different interpretations of data (the Gettysburg Cyclorama Building and Ellis Island Measles Ward A, for instance). Taking advantage of computational algorithms to process complex data frees the professional to focus on the consequences and values of scholarly interpretation. Digital tools blend the effectiveness and proven value of measured, expertly delineated drawings, with the dynamic ability to produce infinite amount of drawing iterations that further express a structure’s cultural value. As evidenced by the evolution of documentation practice described in this thesis, the possibilities available for current and future heritage interpretation can and will be reflected in how digital tools can successfully facilitate.
Chapter 5 Endnotes


2. Ibid., 3.


4. Ibid., 40.

5. Ibid., 20.

6. Ibid., 45.


8. Mark Schara, HABS Architect who worked on the Cyclorama Building survey project, generously supplied the original CAD drawings.


10. Ibid.

11. Ibid., 2.

12. Ibid., 11.

13. Ibid., 31.

14. Lisa Davidson, HABS Historian, generously supplied the original CAD files.

15. In addition to the time of day, specific rendering properties of the digital 3D object can be adjusted depending on the objective of the render output. The view of the ward in Drawings 6 & 7 from above and onto the second floor did not show the roof as visible, but did depict the rendered light and shadows as though the roof were visible. This was achieved by adjusting the rendering properties of the roof so that it would not be rendered as an object, only as a contributing element that would impact the lighting inside the ward space.

17 Ibid., 6.

18 Ibid.

19 Ibid., 119.


Lavoie, Catherine. “Laying the Groundwork, Prologue to the Establishment of HABS.” In *American


Lavoie, Catherine C. “HABS Documentation in the Digital Age: Combining Traditional and New 3D Methods of Recording.” Change Over Time 1, no. 2 (Fall 2011): 184–97,291.


Chase, Volney, and John W. Stenhouse. "Lyles House, Livingston Road, Fort Washington, Prince


