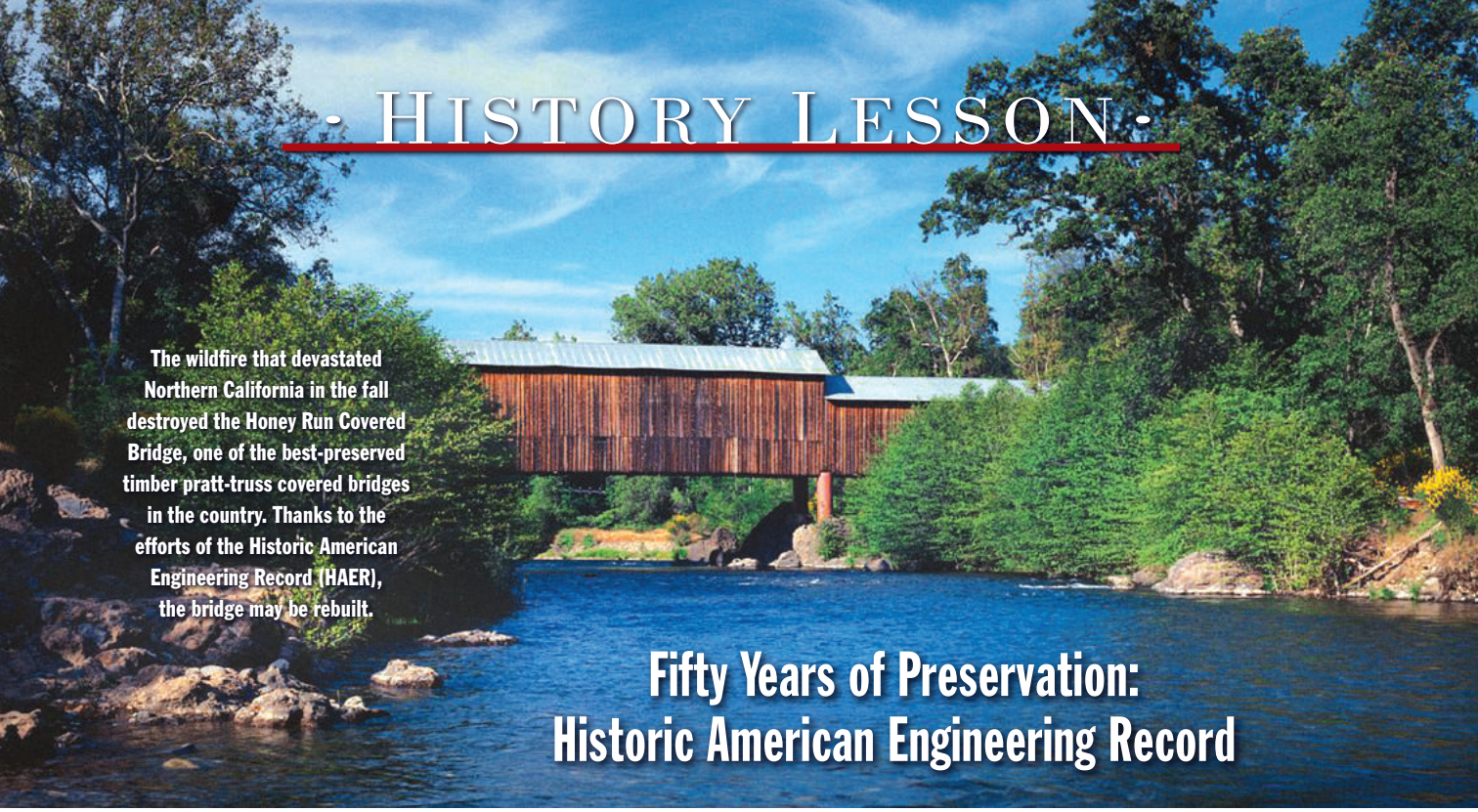


The wildfire that devastated Northern California in the fall destroyed the Honey Run Covered Bridge, one of the best-preserved timber pratt-truss covered bridges in the country. Thanks to the efforts of the Historic American Engineering Record (HAER), the bridge may be rebuilt.

Fifty Years of Preservation: Historic American Engineering Record

THE WILDFIRE that devastated Northern California in the fall, killing 85 and destroying thousands of homes, also incinerated the famous Honey Run Covered Bridge. The bridge, built in 1886, was one of the best-preserved timber pratt-truss covered bridges in the country.

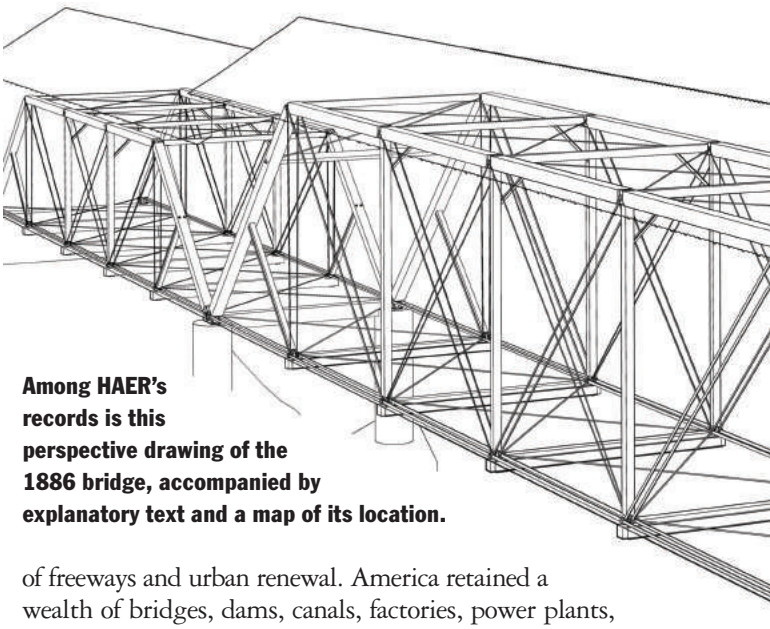
"People said, 'I hope there was documentation.' Well, yes, there was, and it was comprehensive," says Justine Christianson, a historian with the Historic American Engineering Record (HAER).

Since its founding 50 years ago, HAER has documented many of America's engineering, industrial, and technological landmarks—in large-format photos, written reports, and stunning drawings—not only preserving a record of structures that are often redeveloped, demolished, or simply forgotten, but, as Dean Herrin put it in his article "HAER—Documenting Creativity," "explaining how they worked, why what happened on these sites was important, and why Americans should care to preserve at least a portion of them." (*Cultural Resource Management* [*CRM*], National Park Service [NPS], Vol. 23, No. 4, 2000.)

HAER, along with its sister organizations at the NPS—the Historic American Buildings Survey (HABS) and the Historic American Landscapes Survey (HALS)—has documented thousands of significant buildings and sites, preserving the legacy of the growth of America's industrial power and innovation. But as HAER staff members look back on a successful 50 years, they face many questions about their organization's future.

The driving forces behind HAER's creation and success were four leaders: Neal FitzSimons, P.E., the founder of ASCE's History and Heritage Committee; Robert Vogel, the curator of mechanical and civil engineering at the Smithsonian Institution from 1957 to 1988; James Massey, HAER's first chief; and Eric DeLony, HAER's first permanent employee, hired in 1971, and its chief from 1987 to 2003. (DeLony passed away in October 2018.)

In his article "HAER and the Recording of Technological Heritage—Reflections on the Beginning," (*CRM*, NPS, Vol. 23, No. 4, 2000), DeLony wrote, "An abundance of industrial and engineering sites still dotted the American landscape in the 1960s, despite the onslaught of 'progress' in the form of freeways and urban renewal. America retained a wealth of bridges, dams, canals, factories, power plants, and other engineering and industrial structures of historic interest."



Among HAER's records is this perspective drawing of the 1886 bridge, accompanied by explanatory text and a map of its location.

The NPS maintained some historic sites with engineering or industrial themes, DeLony continued, but preservationists "realized that the future held little hope that many objects of engineering and industry could be saved as historic monuments."

However, preservation through documentation was a viable alternative. Vogel ("The Prehistory of HAER, 1965–1968," *CRM*, NPS, Vol. 23, No. 4, 2000) explained that early planners of what would become HAER took a unique approach to documenting industrial and engineering sites. They focused "less on the space-enclosing fabric itself than on the manufacturing equipment within, and where possible, on the process itself."

But what might that kind of preservation through documentation look like? Years before HAER officially began in 1969, a series of pilot projects pointed toward the answer. In 1965, a crew of just three—a HABS architect, a Smithsonian Institution curator, and an engineer-surveyor—took a week over the summer to measure, photograph, and document the C.P. Bradway Machine Works, a West Stafford, Connecticut, manufacturer of water turbines.

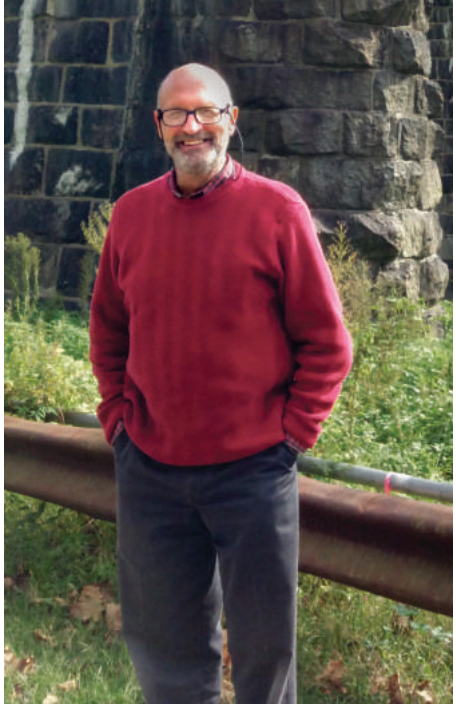
As Vogel explained, "The bulk of attention was devoted to the machine tools, other production equipment, and the extensive system of power-transmission machinery, for every machine, on both floors, was belt driven; there was not a single electric motor in the place. (The prime mover was a 1928 Chevrolet engine.)"

The following summer, in 1966, that documentation experiment was repeated in Wilkinsonville, Massachusetts at the Dudley Shuttles factory, which was, according to Vogel, one of the last American firms that produced wooden shuttles.

The success of both trial projects led to a full-blown program—the precursor to HAER—known as the New England Textile Mill Survey (NETMS). According to Vogel's account, the NETMS, which took place from 1967 to 1968, "was organized very much like a traditional HABS summer-long survey, with seniors drafted from several architectural schools to do the recording and produce the finished drawings. Vogel acted as the team historian, and a team photographer rather than a contractor did the photography."

The highlight of the work was the documentation of the massive campus of Amoskeag Manufacturing Co., of Manchester, New Hampshire, which at its height was "the largest textile-producing firm in the world on a single site."

The success of the NETMS at last paved the way for the creation of HAER, launched in 1969 through a tripartite agreement among the NPS, the Library of Congress, and ASCE, "so that documentation on outstanding works of engineering, industry, and technological processes could be preserved."



The late Eric DeLony was HAER's first permanent employee, hired in 1971, and its chief from 1987 to 2003.

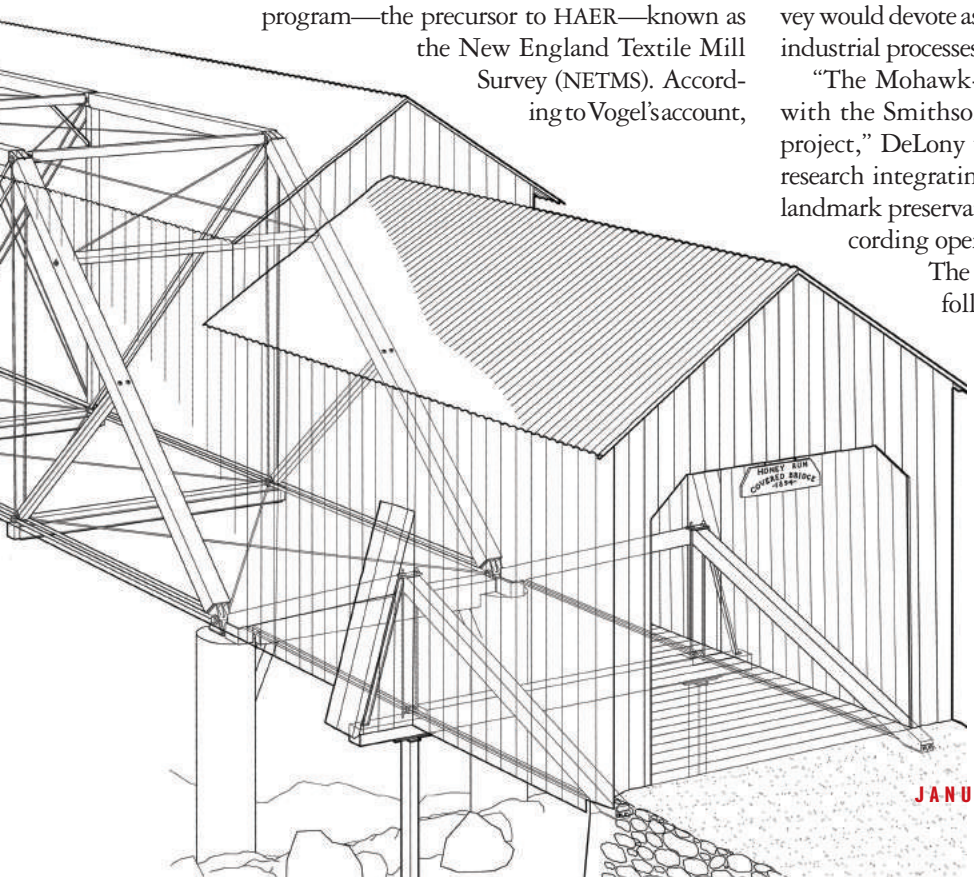
Each organization had clearly defined roles. The NPS conducted the surveys. The library received completed drawings, histories, and photographs into its archives, maintaining these collections and making them accessible to the general public. ASCE provided guidance and oversight.

HAER's first project was the 1969 Mohawk-Hudson Area Survey, an inventory of industrial archaeology sites near Troy, New York. DeLony explained that, unlike traditional building surveys conducted by HABS—which would treat, say, a mill "primarily as architectural phenomena"—HAER's survey would devote as much attention to the machinery and the industrial processes as to the architecture.

"The Mohawk-Hudson Survey, done in collaboration with the Smithsonian, was intended as a demonstration project," DeLony wrote, "a pioneer endeavor in historical research integrating engineering history, local history, and landmark preservation studies into a single research and recording operation."

The first summer survey was a success, and the following summer HAER turned its attention to the historic remains of the Baltimore & Ohio Railroad, America's first major trunk line.

Over the next 50 years, HAER would document more than 10,000 sites, producing more than 115,000 large-format photographs, 105,000 data pages, and 6,000 measured and interpretive drawings. All this documentation was sent to the Library of Congress, and "some of the sites recorded serve as the foundation for subsequent preservation efforts."

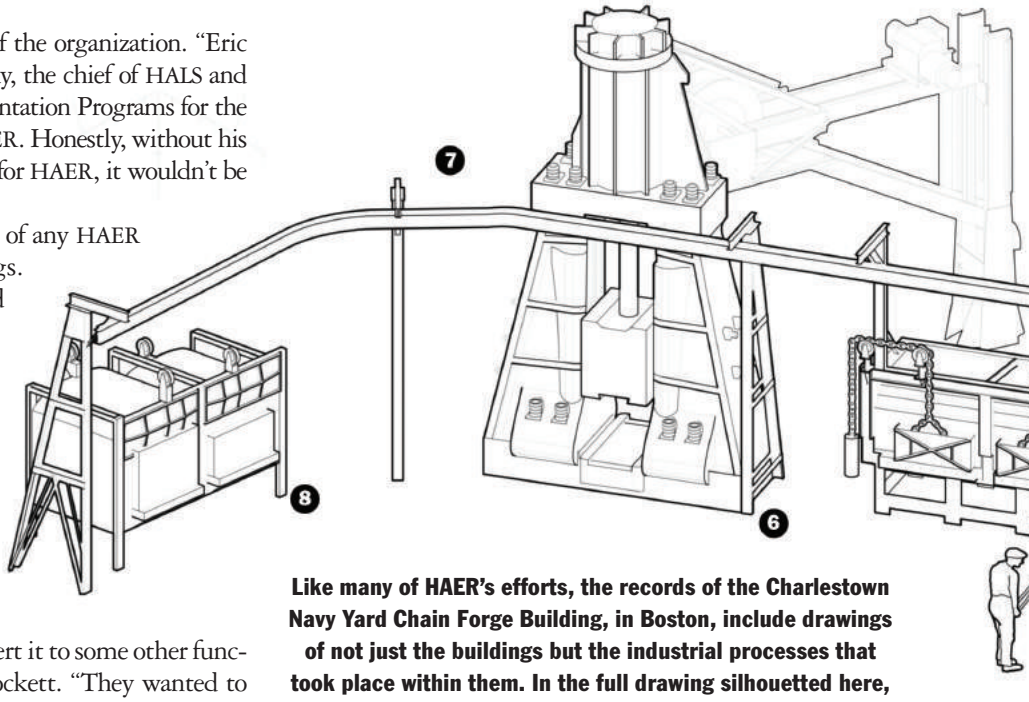


HAER CA-312-19 (CT), JET LOWE, 2004, *OPPOSITE TOP*; HAER CA-312, SHEET 1, JEREMY MAURO, BEN SHAKELTON, CHRISTOPHER H. MARSTON, 2012, *BELOW*; MARSTON, *RIGHT*

DeLony was key to the success of the organization. "Eric suffered no fools," says Paul Dolinsky, the chief of HALS and the acting chief of Heritage Documentation Programs for the NPS. "He was a street fighter for HAER. Honestly, without his hard work of just beating the streets for HAER, it wouldn't be here today."

One of the most striking aspects of any HAER report is its collection of drawings. Through axonometric, isometric, and perspective drawings, readers can truly see not just old bridges or factory facades but the workings of industrial processes themselves.

A good example of this is the survey for the Charlestown Navy Yard Chain Forge Building in Boston, which produced die-lock chains used by the U.S. Navy during World War II. "They were changing the building to convert it to some other function," says HAER architect Dana Lockett. "They wanted to document how this building was used and what was being made there. We came in and wanted to describe the placement of all the machinery. We explained where all the machinery was and how each machine was used." HAER could show in plan and isometric drawings how the metal flowed through the process to be made into chain links. "That's an example of what we do on many sites."



Like many of HAER's efforts, the records of the Charlestown Navy Yard Chain Forge Building, in Boston, include drawings of not just the buildings but the industrial processes that took place within them. In the full drawing silhouetted here, steps 1 through 8 are described in great detail.

While HAER has documented individual structures ranging from roads to viaducts and tunnels, it has also conducted ambitious projects that document larger categories of infrastructure. One long-standing project, begun in 2002, documented America's historic covered bridges. The Federal Highway Administration's National Historic Covered Bridge Preservation Program began with funding secured by former Vermont Sen. James Jeffords as an effort "to preserve and give funding to state DOTs [departments of transportation] to rehabilitate historic covered bridges," project leader Christopher H. Marston explains. DeLony was able to get some money from this program put aside for documentation and educational outreach efforts, says Marston. Those efforts have yielded nearly 100 individual recording projects in all 22 states that still have covered bridges, as well as two national conferences, a traveling exhibition, and two publications: *Covered Bridges and the Birth of American Engineering* (Christianson and Marston, executive editors; HAER, 2015) and the forthcoming *Guidelines for Rehabilitating Historic Covered Bridges*. HAER also produced *Covered Bridges National Historic Landmark Context Study*, written by Lola Bennett in 2012, based in part on its extensive documentation. Of the 20 bridges proposed as eligible for the NPS's National Historic Landmark status, 7 have been so designated. (The NPS landmark program is distinct from ASCE's Historic Civil Engineering Landmark Program.)

"The most significant historic bridges and the truss types are represented" in the effort, Marston says. "We weren't just picking them by which were the prettiest. We tried to be as broad-based and diversified as possible."

The covered bridge project drew to a close at the end of 2018. "I'm proud of our accomplishments to document a variety of covered bridges and show that these are significant engineering resources worthy of preservation and protection," Marston says. He adds that HAER's documentation is already being used as part of an effort to reconstruct the Honey Run Covered Bridge.

HAER architect Tom Behrens, meanwhile, has spent years documenting the Apollo-era and space shuttle-era facilities at the National Aeronautics and Space Administration (NASA), including test stands for rocket engines, facilities for brazing rocket engine nozzles, and astronaut training facilities—all as many NASA structures were being heavily modified or removed.

Another initiative is the HAER Maritime Program, coordinated by HAER architect Todd Croteau since 1992. It has documented hundreds of historic ships, small craft, lighthouses, and other land-based resources.

Through the years, HAER's technological capabilities have moved forward in parallel with those of the wider engineering and architecture fields. "We all started with drafting—hand measuring—and have moved on to digital drawings with CAD [computer-aided design] and laser scanning and other measuring resources," says Behrens.

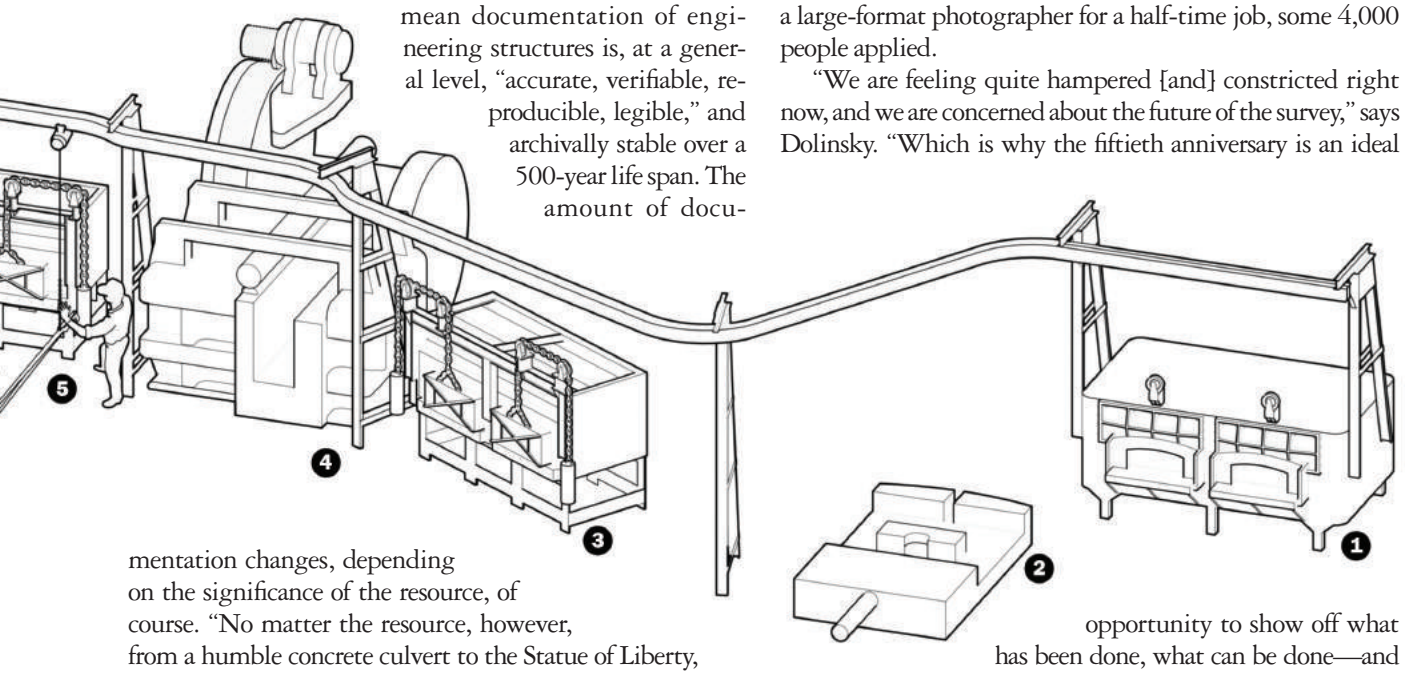
Lockett adds, "In 2006, the Statue of Liberty National Monument contacted HAER to measure the engineered sculpture as well as the fort and pedestal it stands on. The difficult nature of measuring such a large and tall site pushed us to explore the cutting-edge technology of terrestrial laser scanning. This technique consists of a rotating machine that pulses laser light millions of times per second and triangulates the 3-D position of each spot where the laser hits a surface, creating a very accurate 3-D model made of vertices, called a point cloud."

This technology is now used on virtually every HAER project and has led, Lockett says, to other 3-D digital measurement methods such as photogrammetry. The laser scanning

HAER MA-90-3, SHEET 7, EMILY WARREN, KIRK OLDENBURG, 2013

also opened up a new way to archive projects, including digital videos, mesh models, and virtual tours.

HAER's rigorous standards for documentation of historic structures have become everyone's standards. According to Christianson, HAER's standards mean documentation of engineering structures is, at a general level, "accurate, verifiable, reproducible, legible," and archivally stable over a 500-year life span. The amount of documentation changes, depending on the significance of the resource, of course. "No matter the resource, however, from a humble concrete culvert to the Statue of Liberty, the documentation must meet the HAER standards," she says.



And HAER's small staff works with contractors and consultants to make sure its reports meet those standards. "We're not just waiting for it to show up at the very end," says Marston. "There's a lot of work we do to advise and edit and help craft their product to make it…an acceptable HAER project."

Given its illustrious past, HAER's future would seem secure. After all, the National Historic Preservation Act requires that projects impacted by federal funds be documented to the standards of HAER, whether by independent cultural resource management firms contracted by federal agencies or by HAER itself.

Still, for all of HAER's success, Dolinsky describes the organization as "basically a mendicant order," minimally funded with just enough to cover staff salaries and reliant upon that staff's entrepreneurial spirit to make other agencies aware of HAER's work. Staff members leverage contacts from previous reports and pound the pavement to promote the organization's resources. "Those employees are fundamentally responsible for creating the HAER you see here today," says Dolinsky.

He describes HAER as "sort of a stepchild within NPS to a certain extent." HAER's budget, he adds, has "decreased significantly over the last generation," and staffs at HAER, HALS and HABS have been cut by about half within that time. HAER's staff is currently just five people.

HAER's chief engineer position has remained unfilled for years. Christianson is the only historian in the division. What's more, there hasn't been a chief of HAER itself for a decade—Dolinsky serves as the acting chief for the engineering record and the other two surveys. And if that's not enough, most staff members have been with HAER for 25 or 30 years; retirements are inevitable. "The succession planning in the office is a frightening thought," says Dolinsky. "There are very few new people brought on board, and that reduces our capacity to grow the survey." After four full-time photographers departed, for example, the survey went two years without one. But once funds became available to hire a large-format photographer for a half-time job, some 4,000 people applied.

"We are feeling quite hampered [and] constricted right now, and we are concerned about the future of the survey," says Dolinsky. "Which is why the fiftieth anniversary is an ideal opportunity to show off what has been done, what can be done—and what's not going to be done" if positions are not filled.

Collectively, HAER, HABS, and HALS have documented reports on 45,000 sites across the country, representing every state and nearly every county. Still, Dolinsky says, "HAER has just documented the tip of the iceberg. There's so much more to do."

HAER hasn't conducted surveys of many of ASCE's Historic Civil Engineering Landmarks, for instance. And Christianson notes that with greater resources, "HAER staff could undertake projects that would improve the searchability of the collection at the Library of Congress." The database has not yet been indexed with keywords, for example. "An indexing project would aid researchers using the collection," she explains.

HAER stands at a critical point as it enters its 51st year, seeking to strengthen its historic ties to both the Library of Congress and ASCE. "We're looking at the fiftieth anniversary to reaffirm the relationship between all three organizations," says Dolinsky.

What will be HAER's legacy? Dolinsky says he pictures a student who has never looked at historic engineering documents, searching by date and finding "drawings, history, and photographs of something that otherwise they may have never thought of before. That is certainly one of the most profound legacies of these programs."


Witcher

Behrens adds that the accomplishment of all the surveys is in capturing "the depth and breadth of our built endeavor for future generations. I see the value of our collections increasing as time passes." —T.R. WITCHER

T.R. Witcher is a contributing editor to Civil Engineering.