



SOCIETY FOR INDUSTRIAL ARCHEOLOGY

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NATIONAL HERITAGE AREAS

Current Trends Shaping the Future of America's Industrial Sites

Over the past 20 years the national heritage area movement has gained momentum and embraced industrial history. National heritage areas receive federal funding and technical support from the U. S. National Park Service (NPS) but emphasize a partnership of local private and public institutions that share common themes and actually own or manage most of the properties within the heritage area. For example, Detroit's Motorcities National Heritage Area brings together local organizations around the theme of automobile history, Dayton's National Aviation Heritage Area around aviation history, and Pittsburgh's Rivers of Steel Heritage Area around steel heritage. Many heritage areas are located along former canals or waterways and include the Augusta Canal (GA), Cane River (LA), Delaware & Lehigh Canal (PA), Illinois & Michigan Canal (IL), Ohio & Erie Canal (IN), and Schuylkill River (PA).

The first national heritage area was the Illinois & Michigan Canal National Heritage Corridor, established by President Reagan in 1984 to recognize the significance of the 97-mile-long canal and the adjacent communities that served as an early transportation link between Chicago and the Mississippi River. The corridor was created using a new approach to fed-

eral conservation; it was not established as a National Park unit, but as a heritage area—a large living landscape—where the federal government offered assistance to local organizers. This idea opened the door to the conservation of other large-scale waterways, canal systems, and associated industrial sites that previously were seen as just too big to handle as traditional parks. Since then, 27 national heritage areas have been established and 36 bills are currently pending in Congress to establish new heritage areas. The majority of existing national heritage areas are organized around the themes of industrial and transportation history, but in recent years themes of maritime, Civil War battlefield, and agricultural history have been used.

Today, the increasing interest in establishing new heritage areas has challenged both Congress and the NPS to develop a legislative framework to set standards for evaluation and administration. At a meeting last May in Washington, the NPS asked its Advisory Board for assistance. The board looked at the outcomes of designation and assessed the performance of heritage areas in demonstrating excellence in resource conservation (cultural, historic, natural, and recreational) and telling nationally important stories. In addition,

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NY State Canal Corporation

Fairport (NY) Canal Days at the Erie Canalway National Heritage Corridor.

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the board was asked to review how the national heritage areas support the mission of the NPS, where heritage areas should stand in the system, and the appropriate level of assistance and management. Finally, the Advisory Board was asked to consider how the NPS should maximize the lessons of partnership and cooperation, and how the agency could capitalize on the growth and popular support of this concept.

One challenge the Advisory Board faced was defining commonalities among the currently designated national heritage areas. The 27 areas range in size, geography, themes, and priorities. Their one commonality may be that each is unique. However, the majority of heritage areas share in our country's industrial heritage, and work together to interpret that story. In fact the legislation that designated Pennsylvania's Schuylkill River Valley in 2000 man-



All photos courtesy of National Park Service

Bethlehem Steel in the Delaware & Lehigh National Heritage Area in eastern Pennsylvania.



Visitors board the East Broad Top RR, part of the Path of Progress National Heritage Area in SW Pennsylvania.

The *SIA Newsletter* is published quarterly by the Society for Industrial Archeology. It is sent to SIA members, who also receive the Society's journal, *IA*, published biannually. The SIA through its publications, conferences, tours, and projects encourages the study, interpretation, and preservation of historically significant industrial sites, structures, artifacts, and technology. By providing a forum for the discussion and exchange of information, the Society advances an awareness and appreciation of the value of preserving our industrial heritage. Annual membership: individual \$35; couple \$40; full-time student \$20; institutional \$50; contributing \$75; sustaining \$125; corporate \$500. For members outside of North America, add \$10 surface-mailing fee. Send check or money order payable in U.S. funds to the Society for Industrial Archeology to SIA-HQ, Dept. of Social Sciences, Michigan Technological University, 1400 Townsend Drive, Houghton, MI 49931-1295; (906) 487-1889; e-mail: SIA@mtu.edu; Web site: www.sia-web.org.

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The *SIA Newsletter* welcomes material and correspondence from members, especially in the form of copy already digested and written! The usefulness and timeliness of the newsletter depends on you, the reader, as an important source of information and opinion.

TO CONTACT THE EDITOR: Patrick Harshbarger, Editor, *SIA Newsletter*, 305 Rodman Road, Wilmington, DE 19809; (302) 764-7464; e-mail: phsianews@aol.com.

dated that it participate with the Delaware & Lehigh Canal National Heritage Corridor and the Lackawanna Heritage Valley Area, which border the Schuylkill and share a history of anthracite mining and transportation. While the specific industrial themes may vary, heritage areas that share similar resources also have common approaches to preservation, interpretation, and achieving economic stability.

The Advisory Board's final report recognizes the value of the national heritage areas, particularly their ability to harness the collective power of local and state cultural and recreational institutions. The board's number-one recommendation was to adopt a legislative foundation for the national heritage areas with clear criteria and standards for designation. It emphasized the need for better direction in managing the areas and for protecting the rights of private property owners. Recommendations have been incorporated into S.R. 243, which passed the Senate in July and has been sent to the House where there awaits a companion bill, H.B. 706. With a year left in the legislative session, this is the furthest the legislation has traveled in the past ten years.

As Congress and the NPS work together to create a legislative and policy framework for heritage areas, it is hoped that the approach will gain momentum at the state level as

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Woonsocket, RI, in the Blackstone Valley National Heritage Corridor.

Call for Papers

SIA 35th Annual Conference • St. Louis, Missouri • June 1-4, 2006

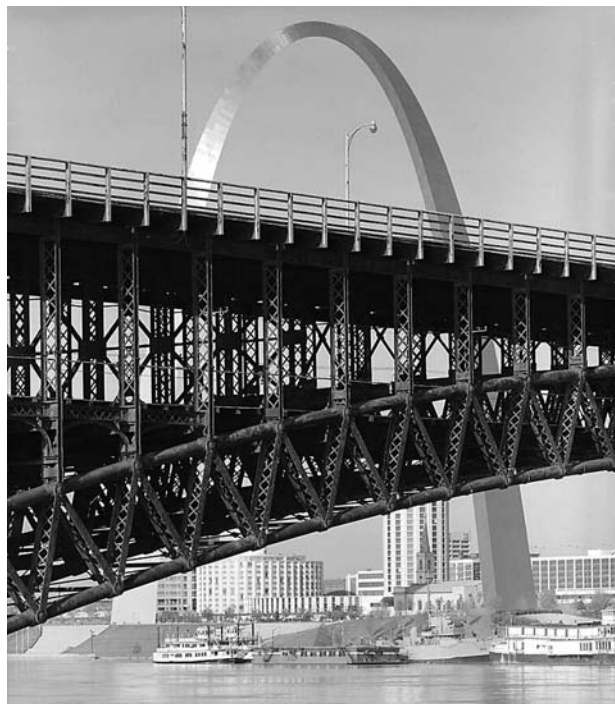
The SIA invites proposals for papers and poster sessions to be presented at the Annual Conference on Sat., June 3, 2006, at St. Louis, MO. Poster sessions can be works in progress. Presentations on all topics related to industrial archeology are welcome. Papers about bridges are also encouraged. All papers and poster sessions should offer interpretation and synthesis of data.

Presentation Formats: Proposals may be for individual papers, themed papers filling a 90-min. session, or organized 90-min. panel discussions (formal commentator optional).

Proposal Formats: Each proposal must include: 1) title; 2) an abstract with a detailed discussion of points, findings, or conclusions to be presented in hard copy and electronic format (Word or WordPerfect); 3) résumé for the presenter(s), including postal address, telephone/fax, and e-mail; 4) a list of visual-aid requests. A panel organizer should submit all paper proposals as a group, accompanied by a title and a brief description of the theme or purpose. If any of these items are missing, the proposal will not be considered.

Presenters are encouraged to consider transforming papers into an article for *IA: The Journal of the Society for Industrial Archeology*. No conference proceedings are published.

Deadline for paper proposals: January 31, 2006. Send copies of all proposals to: Robert S. Newbery, Chairman SIA 2006 Paper Sessions, 2518 Van Hise Ave., Madison, WI 53705; (608) 266-0369; Robert.Newbery@dot.state.wi.us.



HAER MO-96 SALU-77-12, Library of Congress, Jet Lowe

Eads Bridge (1869-74) with the Gateway Arch in the background. St. Louis will be host to the SIA's 35th Annual Conference, June 1-4.

well, and that other states will join Maryland, Pennsylvania, Utah, New York, and Louisiana in fostering state heritage area programs. Commitment at the state level will additionally support the conservation work of regions across the country where industrial heritage continues to shape the lives of the people who live there and the generations to come.

For more information on the national heritage area program, a full copy of both the Advisory Board's report and of recent legislation, and links to the 27 national heritage areas, visit www.cr.nps.gov/heritageareas.

Brenda Barrett & Suzanne Copping



Illinois & Michigan Canal was the nation's first national heritage area in 1984.

Student Travel Scholarships. The SIA awards travel scholarships to help full-time students and professionals with less than three years of full-time experience to attend annual conferences. Those interested in applying for a travel scholarship to attend the annual conference in St. Louis, June 1-4, 2006, should submit a concise letter outlining their demonstrated interest in and commitment to industrial archeology or a related field, and one letter of reference. **Deadline for applications is April 1, 2006.** Info: Patrick Harshbarger, SIA Scholarships, 305 Rodman Road, Wilmington, DE; (302) 764-7464; phsianews@aol.com. Notice of awards will be made by May 1.

For members wishing to make a contribution to the scholarship fund, a check-off is provided with annual dues notices. Your support is kindly appreciated and helps students to participate in the Society and its programs.

Future of Francis Mill Looking Bright

SIA Preservation Grant Helps Bring Complete Restoration Closer

Late July was once again the scene of a joint Heritage Conservation Network (HCN) and Francis Mill Preservation Society (FMPS) building conservation workshop at the Francis Mill in Waynesville, North Carolina. This year's workshop built upon the work completed last summer (SIAN, Fall 2004).

The 2004 workshop focused on the lower-level posts and bracing and replacement of the seriously deteriorated 26-ft. sill beam. This year's crew picked up from there and in two weeks replaced the entire east-side upper-level framing, which included putting in four new posts, twelve new girts, and replacing the entire top plate beam. They also repaired beam ends, including the beams that support the millstones, as well as creating dutchman repairs on some of the original girts to lock the frame back together. The floor joist ends were repaired, some new flooring was installed to fill in sec-

tions where the original flooring was missing, and last but not least, the rafter ends were sistered and attached to the new top plate. With only one day remaining, work focused on making the building weathertight. New white-oak siding was installed along the east side, which had been so heavily damaged and rotted two years ago that the structure was threatened with collapse. The building is now in better condition than it's been for more than fifty years.

Passersby now see a fully enclosed structure rather than a picturesque ruin. It will not be long before the new siding acquires a bit of the patina that had made it so photogenic, but with the FMPS and the Francis Cove community watching over it, it will never be a ruin again.

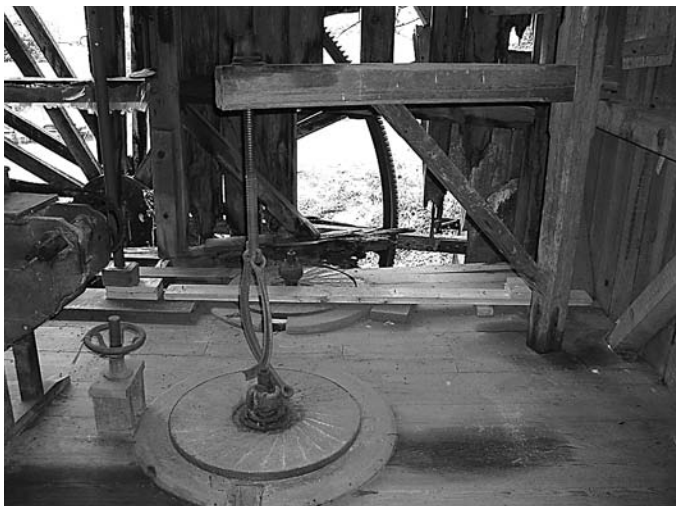
The workshop benefited from a grant from the SIA that was used to purchase building materials and supplies. The \$2,500 grant was more than matched by donations from the community, the fundraising the FMPS conducted over the past year, and the value of the labor provided by the participants. A total of 56 different people were involved in the 2005 workshop. Workshop participants worked a total of 325 hours, with their labor alone valued at \$4,900. FMPS volunteers contributed another 450 hours of effort.

HCN also received a grant from the Terence L. Mills Preservation Fund for North and South Carolina, which helped cover the cost of bringing preservation specialist Jeffrey Finch in to lead the workshop and provide the training. That grant, awarded through the National Trust for Historic Preservation's Preservation Services Fund, was made possible in part by a gift from Mrs. Damon R. Averill of Brevard, North Carolina. Two students from the graduate program in historic preservation at Eastern Michigan



Tama Timbes, FMPS

The Francis Mill Preservation Society thanks the three preservation organizations that supported the 2005 workshop at the mill, including the SIA.



Mark Slater

Lower millstones in situ at the Francis Mill.



Jeffrey Finch

The c. 1887 Francis Mill after the completion of the 2005 workshop, showing the new siding on the east side and new top plate beam.

SIA INDUSTRIAL HERITAGE PRESERVATION GRANTS

The SIA Industrial Heritage Preservation Grants support the research, documentation, and preservation of industrial sites and practices. Grant guidelines are available at www.sia-web.org. Deadline for applications is March 31. Info: Lynn Rakos, SIA Grants Committee, lrakos@hotmail.com, 917-790-8629.

CALL FOR NOMINATIONS OF SIA OFFICERS, DIRECTORS AND COMMITTEE MEMBERS

Keep Your Society Moving Forward

The annual Call for Nominations is your opportunity to help maintain the quality, strength, and diversity of leadership that has kept SIA growing for more than three decades. SIA counts on its members to organize activities that bring us together and produce publications that spread our message to others. The Society's role is always expanding, by introducing new programs such as the Industrial Heritage Preservation Grants, by creating ties to similar organizations throughout the world, and by reaching out to increase our membership. We expect our leadership to consider and reflect members' interests and goals in continuing to plan the future of SIA.

In 2006 a large slate of positions will be open because all officer terms will expire. In addition, two openings will occur on the Board of Directors and one on the Nominations Committee. We need candidates willing to give back to the SIA by volunteering their time, knowledge, and experience. The Nominations Committee is depending on you to identify members—friends, colleagues, or perhaps even yourself—who are qualified and willing to serve. (If modesty precludes you from self-nomination, please find someone else to nominate you.)

Each candidate must be an SIA member in good standing and must consent to being considered for nomination. Candidates for President and Vice-President shall have served on the Board for a minimum of one (1) year as a voting member. Candidates for Officer and Director positions must adhere to and sign the Society's Conflict of Interest Policy prior to the election. The Society has established a policy concerning reimbursement for travel costs associated

with Board meetings; it is available from any member of the Nominations Committee.

The deadline for nominations is Jan. 16, 2006. If you have any questions or need additional information, please don't hesitate to call or write: Martha Mayer, Chair, Nominations Committee, 133 Griswold Rd., Wethersfield, CT 06109; (860) 257-1705; m4mayer@att.net.

Positions Open in 2006:

President (2-year term) Chairs Board meetings, coordinates management of SIA funds and official activities (conferences, tours, publications), liaisons with related professional societies, institutions and organizations; sees that orders and resolutions of the Board are carried out. For 2 years after term expires, serves as an ex-officio voting member of the Board and ex-officio member of the Nominations Committee.

Vice-President (2-year term) Serves on the Board, chairs meetings and carries out other official presidential functions in the president's absence. The vice president traditionally is elected president at the end of his or her term in order to provide continuity of leadership. In effect, this means a 6-year term: 2 years as VP; 2 years as President and 2 years as Past President.

Secretary (3-year term) Is a full member of the Board; records minutes of its meetings and the Society's annual business meeting. Distributes copies of minutes to all board members. Compiles and distributes board meeting agendas and notifies officers and board members of times and locations of upcoming board meetings. Maintains current list

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University attended the first week of the workshop. They were hoping to get some hands-on experience and they did: by the end of their week they were wielding hammers and power tools with the best of them.

Three of the participants were old hands at the mill, having attended the 2004 workshop and been so drawn to the project that they returned to contribute their various skills and abilities to the restoration work. The returnees included a historical architect with the National Park Service; a new resident of North Carolina who performs carpentry and building restoration as part of his occupation; and a local resident who has worked continuously in past years with the FMPS.

The goal of the FMPS is to restore the mill to operating condition and make it available to school and tour groups for educational visits. They are planning to have the mill operational in 2007, 120 years after William Francis built it. The Francis Mill is the last remaining grist mill in Haywood County. Now that the structure itself has been restored, attention will focus on the internal workings, restoring the mill pond, and constructing a flume so that the mill can be brought back on line. Fortunately, almost all the machinery

remains inside the building, protected by the Francis family since the day in 1976 when the mill ceased operating.

Plans for the flume have already been drawn up by a volunteer, a retired engineer. Construction is slated for 2006. Work to be done on the mechanical system includes resetting shafts, cleaning bearings, rebuilding the curb on the east stones, installing belts, and setting up machinery. And of course the stones need to be dressed. The waterwheel also needs repair, a task that could cost as much as \$75,000. HCN's building conservation workshops at the Francis Mill have proven a highly cost-effective way of accomplishing significant quantities of work at the site, and the two organizations plan to continue working together. Look for a workshop at the site in 2006 and a big celebration in 2007.

For more info on the FMPS: Tanna Timbes, (828) 456-6307, timbes1@earthlink.net. For more information about upcoming workshops at the Francis Mill, or any of HCN's other building conservation workshops: www.heritageconservation.net; (303) 444-0128.

Jamie Donahoe

Drawings Verify Concerns During Environmental Assessment

The professional background and interests of SIA members vary greatly, but are all joined by an interest in the industrial past and its physical remains. Michael Bernstein [SIA] is an environmental assessor who evaluates the presence and potential dangers of hazardous materials at old industrial sites. His case study offers a look at one of the many applications of IA.

The storage and use of hazardous materials, and the generation and disposal of hazardous waste, do not necessarily constitute actual concerns upon the completion of an environmental assessment. However, the assessor must envision a succession of possible events and pathways by which hazardous substances might be released to the environment and result in soil or groundwater contamination. Some of the classic tools of the industrial archeologist, such as the use of original plans and drawings, can aid immeasurably.

Identifying channels of migration or discharge is essential. Plumbing plans obviously are important. However, drawings can be problematic: they might be unavailable, or they might depict a system that was proposed but never constructed, or they might depict a proposed system that was actually built to different specifications, or they might depict what was constructed but later removed, or they might depict features that still exist but are no longer discernable or accessible. Positive correspondence between observed reality and plans is the environmental assessor's delight.

In February 2005, the author assessed an industrial property in Ohio, where drawings confirmed observations that identified features of potential concern. This case in point also illustrates how chemical leakage and spillage historical-

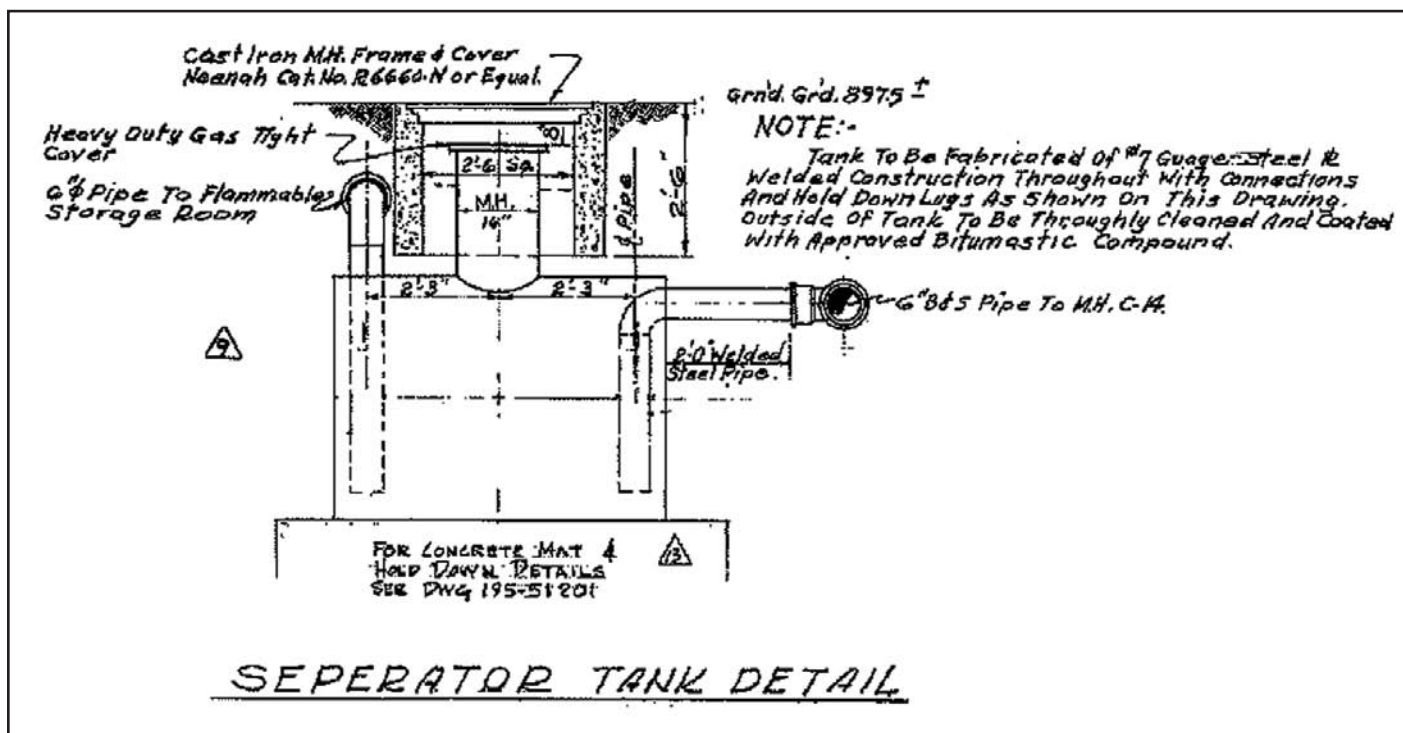
ly were managed by deliberate discharge to the environment.

The subject facility was constructed during the late 1950s for the manufacture and assembly of electromechanical and electronic telephone switching equipment. Processes included degreasing, electroplating, soldering, painting, and etching. In addition to the main manufacturing building, the physical plant included underground storage tanks, aboveground storage tanks, a wastewater treatment plant (WWTP), and a boilerhouse. Manufacturing operations had been discontinued prior to the environmental assessment.

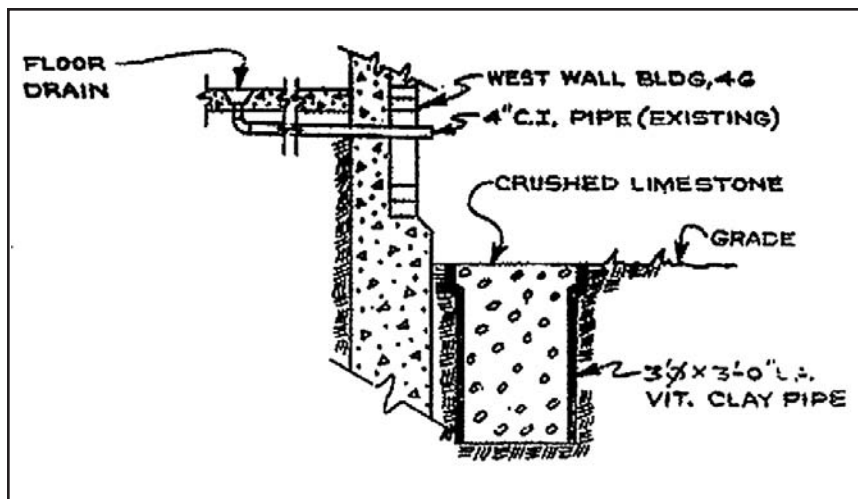
Solvent-based paints and hazardous paint-related materials remained in a dedicated room located in the main building. Two floor drains were present, in addition to a trench drain that extended across the main doorway. The function of the floor drains was to remove spillage or leakage in order to prevent an explosion or fire. The purpose of the trench drain was to prevent a massive release from entering the adjoining portions of the plant. Coincidentally, a steel plate and a storm sewer inlet were observed outside the paint storage room; their proximity to the paint storage room rendered them suspect.

Chromic and other acids had been isolated in a detached storage building constructed for that purpose. A floor drain was observed at an eyewash station, but the remainder of the floor was concealed by stored office furniture. Two open-mouth pipes in the exterior wall faces were judged too small to be roof drain outfalls, which rendered them suspect.

The vital point with regard to these floor drainage systems was to identify their receptors. Connection to the



Section of separator tank.



Section of floor drain and outfall in acid-storage building, discharging into limestone-filled pipe.



Floor drain outfall corresponding to sectional drawing.

municipal sanitary sewerage system or the WWTP was unlikely; even in the 1950s, it was understood that a slug of acid or solvent could ravage the treatment process and possibly be life-threatening to treatment plant personnel. Discharge to the environment or an in-ground containment structure was more likely.

Fortunately, the original plumbing plans were available. The drains depicted on the plan of the paint storage room corresponded to those observed. More importantly, the plans revealed that the steel plate located outside the paint storage room was a hinged cover that provided access to an underground 510-gallon "separator tank." This tank received the floor drainage and allowed it to separate into its heavier and lighter components. Upon opening of the cover, the dimensions and appearance of the tank pump-out port were seen to correspond to the plan. Waste was present in the tank, whose integrity was unknown. Further increasing the level of concern was the plan's indication that overflow from the tank was directed to the adjoining inlet, which discharged to surface water at an off-site location. Installation of the inlet at the overflow connection presumably was intended to introduce additional stormwater that would flush and dilute the overflow.

Plumbing plans of the acid storage building indicated that two additional floor drains were present, at a washdown station and in an isolation bay. The plans revealed that the pipes in the outside walls were outfalls for the two wash station drains. Open-bottomed lengths of vitrified clay pipe, set vertically in the ground and filled with crushed limestone, received the effluent. Although the acid would be neutralized by the limestone, the chromium would remain. According to the plan, the drain in the isolation bay discharged to a 36-cubic-ft. pit filled with crushed limestone, the entirety of this system being underground.

The concurrence of these features with their depictions and locations on the plumbing plans was very pleasing, and constitutes evidence that cannot be denied by an argumentative owner, lender, attorney, or buyer.

Review of previous reports and regulatory agency files revealed that these floor drainage systems had not been recognized during previous closure activities. Therefore, soil and groundwater quality at those locations had not been evaluated. The previous investigations had been limited to

the identification of waste-management facilities immediately associated with the manufacturing processes. The features might not have been previously identified as regulated Hazardous Waste Management Units because the hazardous substances stored at those locations were fresh products, not waste. However, once fresh product has entered a floor drainage system it is considered waste by regulation, since a floor drainage system is a sewerage system and anything in a sewerage system is necessarily waste. The post-closure identification of these additional Hazardous Waste Management Units constituted a serious complication to this multi-million-dollar real estate transaction, and required additional regulatory compliance actions and expenditures.

Michael Bernstein

NB: The name and location of the plant have been purposely omitted due to confidentiality issues.



Pump-out port for separator tank.

MONOCACY AQUEDUCT STABILIZATION

After 30 years in a steel girdle that held its deteriorating walls and arches together, the Chesapeake and Ohio Canal's landmark Monocacy Aqueduct has undergone a long anticipated stabilization. Thanks to a \$6.4-million appropriation from Congress, its stonework was extensively repaired and reinforced, a new railing modeled on the original was installed, and the entire structure was sealed in a way that should prevent water and ice from working to pry it apart.

The aqueduct, 516 ft. from end to end, is the longest and best preserved on the canal, which runs 184 miles between Washington and Cumberland, MD. The aqueduct was constructed of white stone between 1829 and 1833 to a design by the canal's chief engineer, Benjamin Wright. Its seven shallow arches marked off by handsome pilasters immediately made it one of Maryland's most noted structures. Although the canal closed in 1924, a victim of repeated

all leaked badly, as old photographs document. In warm weather, the leaks tunneled through the rubble that fills the interior space between the bottom of the canal prism and the upper surface of the stone arches. In cold weather, water that had leaked into the structures froze and expanded, loosening stones—particularly in the berm walls, which were about two ft. narrower than the towpath walls. Once the canal was drained for good, the leaking decreased, but the structures are still vulnerable to damage by whatever rain-water or snow melt gets inside.

The second problem is flooding, which brought not only water but also trees and other debris crashing down the streams that the aqueducts crossed. The canal's designers had put the towpath on the Potomac side of the waterway, which made sense for other reasons but means that the aqueducts' weaker sides are upstream, where they bear the brunt of the assaults from floods.

The two problems together, McMullan says, mean that the aqueducts are weakest just inside of their berm walls. Indeed, only three of the structures still have their berm walls and upstream spandrels completely intact—the Monocacy, Antietam, and Fifteen Mile Creek aqueducts. The Catoctin Aqueduct, all but one arch of which collapsed in 1973, had previously lost its berm wall and upstream spandrels as well as much of its rubble fill and upstream portions of its arches.

While the Monocacy Aqueduct has remained intact, a walk under the arch at either end reveals long cracks in the stonework

beneath the berm wall. In places the upstream spandrels bulge so dramatically that they might have been drawn in by a cartoonist.

Hence the steel girdle, designed by Federal Highway Administration engineers, who also put hidden rods through arch stones to tie them together and partly filled the canal prism with dirt, to give the structure more weight and help it survive floods. The bracing not only surrounded and braced the aqueduct's exterior, but did the job that water in the prism once took care of, holding the berm and towpath walls apart.

Although some skeptics doubted that the bracing did much more than spoil the structure's beauty and make it miserable for bikers to cross, McMullan says the bracing was



Laurence Biemiller

The rehabilitated Monocacy Aqueduct, Aug. 2005.

Potomac River floods and changing transportation needs, its towpath and most of its historic structures remain intact, and today the towpath is popular with bikers, hikers, runners, and nature lovers. It has been a National Historical Park since 1971.

But all of its aqueducts have suffered damage over the years. Denis J. McMullan, president of McMullan & Associates, served as engineer for both the Monocacy Aqueduct stabilization and for an earlier stabilization of the canal's Conococheague Aqueduct, which in 1920 lost its berm wall (the berm is the side of a canal opposite the towpath). McMullan says the canal's 11 stone aqueducts all face essentially the same two major problems.

The first is that while the canal was in use, the structures

“a very good idea to hold it all together.” Some other aqueducts on the canal sport similar bracing, although not as extensive as that fitted to the Monocacy. In any event, the Monocacy’s unappealing steelwork encouraged members of the all-volunteer C&O Canal Association and the park’s former superintendent, Douglas D. Faris, who died in 2004, to press for the stabilization project.

When McMullan and NPS officials began planning the stabilization, “we realized we needed something to hold the aqueduct together without its being visible,” he says. Fortunately, the tie rods inserted in the arches in the 1970s were found to be in good condition and could remain. That was a start. New rods were inserted into the aqueduct’s piers to hold them together, and their bases were grouted where the river had slightly undermined them.

The next step was dealing with the rubble fill. McMullan’s plan, injecting grout into the voids, proved difficult and time-consuming. The project’s contractor, Corman Construction, came up with an easier approach—removing most of the rubble and replacing it with a flowable, low-strength concrete mix.

But the stabilization’s showpiece is a new, well-drained concrete slab poured in the canal prism. It adds weight to the structure and provides a tight seal to keep water out of the interior. It also gave McMullan a tough layer into which he could drill a new set of hidden tie rods that help brace the entire structure. The surface of the concrete is scored in a pattern resembling wood planks, which McMullan surmises



Patrick Harshberger

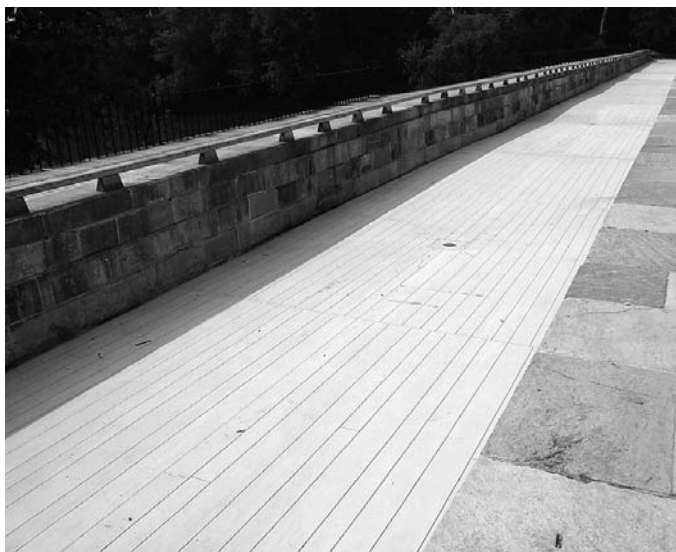
The C&O’s Monocacy Aqueduct with its steel girdles, ca. 1995.

may have formed the prism’s original floor.

In addition to repairing and remortaring all of the structure’s exterior stones, the stabilization brought a new railing to match the few sections of original iron railing that survive. But the new railing can be swiftly removed if flooding is predicted, instead of remaining in place to catch passing trees. “We want to keep this aqueduct another 150 years,” McMullan says.

The aqueduct was formally rededicated May 21.

Lawrence Biemiller



Lawrence Biemiller

The aqueduct’s canal prism with its new concrete slab floor, scored to appear as wood planks, Aug. 2005.

The National Park Service’s 2006 Workshop on Archeological Propection Techniques will be held May 15-19, 2006, at the Fort Frederica National Monument on St. Simons Island, GA. This will be the 16th year of the workshop dedicated to the use of geophysical, aerial photography, and other remote sensing methods as they apply to the identification, evaluation, conservation, and protection of archeological resources throughout the U.S. This year’s workshop will focus on the theory of operation, methodology, processing, interpretation, and on-hands use of the equipment in the field. Tuition: \$475. Applications are available: www.cr.nps.gov/mwac. Info: Steven L. DeVore, NPS Midwest Archeological Center, Federal Bldg., Rm. 474, 100 Centennial Mall North, Lincoln, NE 68508; (402) 437-5392, ext. 141; steve_de_vore@nps.gov.

Hope for the Kinzua Viaduct

New project turns tornado into opportunity

Brian Emberg made his way through splintered railroad ties and twisted steel high above Pennsylvania's Kinzua Valley. The winds had died down, and a deep, dusky fog was rising from the gorge like a smoldering bomb. Something was terribly wrong. One more move and he would pitch forward, 225 feet to the valley floor.

Emberg stopped short. The vice president of Herbert, Rowland & Grubic, Inc., an engineering consulting firm, knew every micrometer of this 2,053-ft. span—every rivet, every bent, every strut of the Kinzua Viaduct—the tall, slender structure that was once the highest and longest railroad bridge in the world.

Built of wrought iron in 1882 by a crew of 125 men in 94 days for a branch of the Erie RR, the bridge had become a symbol of American ingenuity and determination. Some of the nation's most celebrated transportation engineers had a hand in its design. They were pioneers like Octave Chanute, chief engineer for the Erie, whose study of wind tolerances in the Kinzua Valley would later influence his glider designs and the future of aviation; Thomas Curtis Clarke, senior partner with Clarke, Reeves & Co., whose vision and creativity led to the Chicago, Burlington & Quincy (IL) Bridge over the Mississippi River, the Poughkeepsie (NY) Bridge over the Hudson, the New York Elevated Railway, and the Hawkesbury Bridge in Australia; and Adolphus Bonzano, a mechanical genius and inventor who was the idea man behind the locking devices for draw-bridges. Bonzano would later play a role in hundreds of bridges, including the Red Rock (AZ) Cantilever Bridge over the Colorado River Canyon, completed in 1890.

But in 1882, Bonzano, superintendent for the Phoenix Bridge Co. in Phoenixville, PA, was busy designing the Kinzua Viaduct using the patented Phoenix column. He, more than anyone else, knew how to exploit its extraordinary strength. Unlike cast-iron columns, the Phoenix column was made of rolled wrought-iron segments riveted through flanges, enabling taller, stronger structures better able to withstand vibration and buckling. When asked if he could tackle a bridge a half-mile long and 300-ft. high,

Bonzano said, "I'll build you a bridge 1,000-ft. tall if you furnish the money."

As soon as the Kinzua Viaduct was completed in September, 1882, it was an immediate sensation, garnering headlines in newspapers and professional journals around the world. In 1900, as the nation's factories demanded more coal, lumber and oil, the viaduct was reconstructed on the original piers to handle heavier loads. The last freight train rolled across the tracks in 1959. The viaduct, nearly sold for scrap in the 1960s, became the centerpiece of Kinzua Bridge State Park in 1970, attracting 150,000 visitors every year.

Revered for its engineering and transportation heritage and for its artistic placement against the dramatic forest backdrop, the Kinzua Viaduct was named to the National Register of Historic Places and as a National Historic Civil Engineering Landmark in 1977.

When an inspection deemed the bridge unsafe in the summer of 2002, the Pennsylvania Department of Conservation and Natural Resources (DCNR) embarked on a \$12 million rehabilitation project to stabilize the bridge. Herbert, Rowland & Grubic, Inc. was awarded the engineering contract, and Brian Emberg came on board as consulting engineer and project manager.

Emberg and the DCNR project team began studying the work of the early bridge builders, drawing upon early photographs and the Kinzua Viaduct's original 1882 and 1900 ink-on-linen drawings, carefully preserved at the Smithsonian.

Work commenced in March, 2003 as the W. M. Brode Co. blazed trails deep into the gorge through waist-high snow in order to get its heavy equipment in place. By early summer, high-tech materials, an onsite fabricating shop, and a corps of professionals dedicated to maintaining the viaduct's structural and historical integrity had all but guaranteed the repairs would be completed ahead of schedule. Soon the Knox & Kane Railroad's excursion train would once again roll across the track, carrying 40,000 visitors a year to Kinzua Bridge State Park.

But an F-1 tornado packing 94 mph winds doesn't give a whit about time or place or good intentions. On July 21, 2003



The last known photo taken of the Kinzua Viaduct prior to the tornado on July 19, 2003.

Ed Bernik



Two days later, eleven of the viaduct's 20 towers lay twisted on the valley floor.

at 3:21 p.m. a twister smashed through the forest, unseating eleven of the viaduct's 20 towers of steel, snapping their anchor bolts off at the base. A complex pattern of winds, combined with corrosion and fatigue of the collar assembly used to anchor the towers to their masonry piers, contributed to the failure. In less than 30 seconds, the center of the bridge lay in ruins, while the repaired towers stood like sentries, standing guard against the wind (SIAN, Fall 2003).

"We assumed there had to be problems with the anchor bolts and sleeves hidden inside the piers; our inspection report identified as much, and we had a plan to strengthen them," Emberg said later. "It's just that the tornado got there before we did."

Independent reviews by a forensic engineering team and by the Federal Emergency Management Agency, followed by two years of public discussion about the viaduct's role in the region's economic development, still beg the questions—is rebuilding worth the estimated \$45 million cost? And, if not, what is the highest and best use for what the *Mechanical News* in January, 1883 touted as an "enduring monument of American engineering skill?"

On September 13, 2005, DCNR officials answered the second question with an \$8 million proposal to develop an interpretive center and other improvements at Kinzua Bridge State Park. If all goes as planned, the fallen bridge will remain on the ground as a way of documenting what happened there.

The project includes repairs and stabilization of the nine bridge towers that are still standing; a cantilevered observation deck that will allow limited access to the bridge and views of the debris field below; a fenced-in hiking trail with views of the fallen towers; a visitor center featuring exhibits, classroom space and administration offices; and new picnic pavilions, maintenance and storage buildings, roads, parking and other infrastructure improvements.

The \$8 million project will be funded by a \$7 million legislative appropriation approved in 2004 and an expected \$1 million from the Pennsylvania Department of Transportation.

"When I heard the news that a tornado had struck the bridge and knocked down a significant portion of it, I'll be honest with you, it was sort of like losing a member of the

family," said Gene Comoss, director of DCNR's Bureau of Design and Construction and chief proponent of the new project. "My staff and I had invested so much personal time in trying to develop the project and see that it stayed on schedule, that it was initially very devastating. In fact, I was probably in shock when I heard it."

Now Comoss, Emberg, and others believe the tornado can provide a rare opportunity to tell the story of the historic bridge and its battle against the elements.

"I think visitors are going to be really interested in the scientific information we collected after the failure, including an animation of the tornado," said Comoss. "The visitor center will be a home for artifacts from the bridge, pictures, stories, and memorabilia that people have collected over the years."

But there is still at least one more hurdle to cross before the project can begin. When faced with the results of a mandated hydraulic study that showed that two of the fallen towers could disturb the flow of Kinzua Creek, DCNR's chief engineer Jim Eppley came up with the most creative solution yet—why not rearrange them to build a bridge? A decision by the U.S. Army Corps of Engineers is pending.

Lisa Gensheimer

Editor's Note: Lisa Gensheimer, president of Main Street Media, Inc., is a writer and filmmaker whose work has appeared on public television stations nationwide. Main Street Media's documentary about the Kinzua Viaduct, TRACKS ACROSS THE SKY, was commissioned by the Allegheny National Forest Vacation Bureau and released in 2004. It is available on VHS and DVD from Penn State Media Sales, <http://www.medi-sales.psu.edu>. A portion of the video sales goes to the Kinzua Bridge Foundation, which is also accepting donations: Kinzua Bridge Foundation, Inc., c/o Hamlin Back & Trust, 34 Fraley St., Kane, PA 16735.



Engineer Brian Emberg has led the project to stabilize the Kinzua Viaduct's remaining spans.

Lisa Gensheimer



One of the cracked sleeves that contributed to the failure of the Kinzua Viaduct.

Brian Emberg

Tenure-Track Position in IA

Michigan Technological University's Program in IA & History anticipates filling a tenure-track position for an industrial archeologist to begin academic year 2006-07. The ideal candidate will possess a research record and demonstrated scholarship related to the archeology of industry, as well as experience in field investigations related to the standing remains and material culture of industrial sites or the organization of industrial communities. Duties will include: (1) expanding an active field program involving graduate students through the development and acquisition of external funding from public and private sponsors; (2) contributing to undergraduate and graduate teaching (two classes per semester); (3) active writing and scholarly publications in the areas of industrial archaeology or industrial heritage; and (4) advising graduate students. PhD required; women and members of under-represented minorities are strongly encouraged to apply. Salary and rank dependent on qualifications, with the expectation of hiring at the assistant professor level.

For more info on the IA Program, situated in the Dept. of Social Sciences: www.social.mtu.edu.

Please submit a detailed letter of interest, current curriculum vitae, and names of three references to Chair, Industrial Archeology Search Committee, Dept. of Social Sciences, MTU, 1400 Townsend Dr., Houghton, MI 49931-1295. MTU faculty are represented by the AAUP. MTU is an Equal Opportunity Educational Institution/Equal Opportunity Employer.

The Department will begin reviewing applications about Nov. 15 and will continue until an appointment is made. Interviews may be scheduled at the annual meeting of the Society for Historical Archeology in Sacramento, CA, in early January. Final hiring and date of decision is subject to budgetary considerations, but position is scheduled to begin Aug. 2006. Questions or queries should be addressed to above or Patrick Martin, Program Director, pemartin@mtu.edu. ■

CALL FOR NOMINATIONS (continued from page 5)

and addresses of all officers of the Society. Keeps records of all other official business of the SIA.

Treasurer (3-year term) Is a full member of the Board; maintains the Society's bank accounts and investments per the Board's instructions. Keeps records of the Society's receipts and expenses. Completes analyses and projections pertinent to the Society's fiscal health in response to the Board's requests. Reports at each board meeting and at the Society's annual business meeting.

Directors (3-year term), two of seven directors on the Board of Directors, which meets three to four times per year, including during the annual conference. Directors govern official business of the SIA and chair committees that oversee operations, such as publications, tours and conferences, and local chapters.

Nominations Committee Member (3-year term), one of three elected members who oversee the annual nominations and elections. The newly elected member will chair the committee during the final year of the term.

All nominations will be reviewed by the Nominations Committee, which will present a slate of candidates to the membership. Each nomination must include the name, address, telephone number, and e-mail address of the person being nominated, the office for which the nomination is being made, and evidence that the candidate consents to being nominated. Once the slate is selected, the Nominations Committee will request a brief biographical statement and a photograph from each nominee.

Please submit nominations by January 16, 2005, to Martha Mayer, Nominations Committee Chair, 133 Griswold Rd., Wethersfield, CT 06109; m4mayer@att.net or (860) 257-1705. For summaries of the nomination process (Article 2) and responsibilities of Society officials (Articles

3,4,7) view the Society by-laws on the **Chapters** screen of the web site www.siahq.org. If you're unsure about the process or the obligation, please call or write.

Editor's Note: The Board of Directors requested that the Call for Nominations appear in the newsletter to save the Society the considerable cost of a separate mailing. The by-laws state that the Nominations Committee shall request suggested nominations by the members by means of a printed announcement at least thirty days prior to selection by the Nominations Committee, Section 2.05 (a). This is that printed announcement.

SIA Officers and Directors, 2005-2006

Chris Andrae, President (2004-06)
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Patrick E. Martin, Executive Secretary, Editor IA, and
TICCIH Representative
Patrick Harshbarger, Editor SIAN

Nominations Committee

Martha Mayer, Chair (2003-06)
Jet Lowe (2004-07)
Cydney Millstein (2005-08)



SOCIETY FOR INDUSTRIAL ARCHEOLOGY

NEWSLETTER

PUBLICATIONS OF INTEREST

Vol. 34, No. 4

Fall 2005

COMPILED BY

Mary Habstritt, New York, NY; and Patrick Harshbarger, SIAN editor.

GENERAL INTEREST

- ♦ Thomas P. Hughes. **Human-Built World: How to Think about Technology and Culture.** Univ. of Chicago Pr., 2004. 223 pp. \$22.50. Drawing mainly on American and German examples, surveys the history of technology from the industrial revolution to the present. Written for the general public and distills much of the current scholarship in the history of technology. Rev.: *T&C*, v. 46,3 (July 2005), pp. 626-27.
- ♦ E. E. Lewis. **Masterworks of Technology: The Story of Creative Engineering, Architecture and Design.** Oxford Univ. Pr., 2004. 328 pp., photos, illus. \$28. From the craftsmanship of a wagon to medieval cathedrals, Egyptian pyramids, and space-age rockets. The author, a professor of mechanical engineering, describes and analyzes humankind's greatest engineering achievements. Rev.: *T&C*, v. 46,3 (July 2005), pp. 632-33.
- ♦ David Weitzman [SIA]. **A Subway for New York.** Farr, Straus and Giroux (www.fsgkidsbooks.com), 2005. \$17. Children's book accurately depicts the construction of the 1900-04 New York City subway. Richly detailed pin-and-ink drawings and cutaway views illustrate surveying, digging, blasting, and tunneling (including a marvelous drawing of a tunneling shield); powerhouses and substations; passenger stations and cars. Explains the subway's engineering and the workers—masons, riveters, sandhogs, and common laborers—who made it possible.
- ♦ Barbara Zabel. **Assembling Art: The Machine and the American Avant-Garde.** Univ. Pr. of Mississippi, 2004. 202 pp. \$45. Early-20th-c. artists and their creative works, both celebrating and critiquing American technology. Features many works of art incorporating images of machines and their components. Rev.: *T&C*, v. 46,3 (July 2005), pp. 682-84.

MINES & MINING

- ♦ Debbie Gilbert. **Asbestos Common in North Georgia.** *The Gainesville (GA) Times* (Aug. 7, 2005); www.gainesvilletimes.com. Local history of asbestos mining is recalled; Georgia has 52 former mines and prospecting sites, far more than any other region of eastern North America.
- ♦ Jeffrey Scott. **Family Carves a Living from Rock.** *Atlanta Journal-Constitution* (July 21, 2005). The Reagin Granite Co. near Lithonia, GA, one of the last "hand quarries" in Georgia where granite slabs are removed without blasting by using drills, chisels, wedges, and sledges. Most of the granite is used in restoration work or curbstones.

BUILDINGS & STRUCTURES

- ♦ Paul Belford. **Monasteries of Manufacture: Questioning the Origins of English Industrial Architecture.** *IA Review*, v. 26,1 (2004), pp. 45-62. Traces possible origins of factory architecture in medieval monasteries. Influences persisted into the 19th c.
- ♦ David W. Dunlap. **Below Ground Zero, Ghosts of the Past and Stirrings of the Future.** *NY Times* (July 25, 2005). Efforts to preserve "touches of history" in the new transportation hub being built below ground at the World Trade Center. Includes cast-iron rings of the Hudson & Manhattan RR tunnel, the vault of the Bank of Nova Scotia, and 18th- and 19th-c. archeological sites.
- ♦ Fred Hapgood. **The Underground Cutting Edge.** *I&T* (Fall 2004), pp. 42-48. Tunneling with boring machines from the mid-19th c. to present.
- ♦ Herbert Harwood Jr. [SIA]. **The Van Sweringen Enigma.** *Timeline* (July/Aug. 2004), pp. 38-54. O.P. and M.J. Van Sweringen, brothers who stood behind the construction of Cleveland's Terminal Tower (tour site—1986 SIA Annual Conference) and Public Square, as well as numerous railroad, real estate, and financial ventures of the 1920s. Shady dealings and a nearly reclusive lifestyle have added to the brothers' mystique.
- ♦ T. A. Heppenheimer. **The Space Building.** *I&T* (Fall 2005), pp. 40-47. Building NASA's 50-story-tall Vehicle Assembly Building at Cape Canaveral in the 1960s. Designed to assemble and house Saturn V Rockets.
- ♦ Roger E. Kelly. **America's World War II Home Front Heritage.** *CRM*, v. 1,2 (Summer 2004), pp. 34-50. Recognizing and preserving home-front sites, from prisoner-of-war camps to industrial facilities.
- ♦ Yasmin S. Khan. **Engineering Architecture: The Vision of Fazlur R. Khan.** Norton, 2004. 416 pp. \$55. Biography of Khan (1929-82), acclaimed civil engineer best known for his contributions to skyscraper design, including Chicago's Sears Tower. The author is Khan's daughter, also an engineer. Rev.: *T&C*, v. 46,3 (July 2005), pp. 633-34.
- ♦ Christine H. O'Toole. **Arts and Science Remake the Steel City: Pittsburgh's Old Mill Sites Become Homes, Offices, Theaters, and Parks.** *NY Times* (July 20, 2005), p. C7. Describes efforts to turn the industrial waterfront into a high-tech hub and recreation destination. Includes several tour sites from the 1993 SIA Annual Conference.
- ♦ John A. Peterson. **The Birth of City Planning in the United States, 1840-1917.** Johns Hopkins Univ. Pr., 2003. 431 pp. \$59.95. Detailed story of the emergence of city plans as a tool

to control growth, and city planning as a technical speciality. Rev.: *T&C*, v. 46,3 (July 2005), pp. 674-75.

- ◆ Deborah M. Rehn, David M. Hansen, and Kimberly Keagle. **Historic Fortification Preservation Handbook**. Washington State Parks & Recreation Commission (Box 24650, Olympia, WA 98504), 2004. Guidance and detailed technical methods for preserving concrete, masonry, and earthen fortifications. Co-sponsored by the National Park Service.
- ◆ Terrence Young. **Building San Francisco's Parks, 1850-1930**. Johns Hopkins Univ. Pr., 2004. 260 pp., tables, maps, illus. Examines the development of Golden Gate Park, paying special attention to the crucial role played by civil engineers like William Hammond Hall.

BRIDGES

- ◆ David de Haan. **The Iron Bridge – New Research in the Ironbridge Gorge**. *IA Review*, v. 26,1 (2004), pp. 3-19. New discoveries that emerged during the recent survey of the Iron Bridge in Shropshire, including detailed analysis of how the 1779 cast-iron arch was fabricated and erected.
- ◆ Ross E. Pollock [SIA]. **The Eads Bridge and the Baltimore & Ohio RR**. *The Sentinel*, v. 26, 3 (2004), pp. 27-32. Rail traffic patterns over Mississippi bridges and the political opposition to bridges from ferry interests. Photos and maps. *Sentinel* is a publication of the B&O RR Historical Society (www.borhs.org).

POWER GENERATION

- ◆ Josh Gelinas. **Nonprofit SRS Group Plans New Visitor Site**. *Augusta (GA) Chronicle* (Aug. 12, 2005). Group has been formed to develop a museum at the Savannah River Site (SRS) of the U.S. Dept. of Energy. The plant, many parts of which are currently being decommissioned or demolished, opened in the early 1950s at the beginning of the Cold War to advance the nation's nuclear weapons programs. The group hopes to be able to offer tours of the decommissioned Reactor "C," which was the last and largest reactor (operated from 1955 to 1985).
- ◆ Roy Gregory. **The Industrial Windmill in Britain**. Phillimore (www.phillimore.co.uk), 2005. 160 pp., illus. £19.99. Windpower used for crushing oil seed, sawing timber, and grinding snuff, etc., from the 12th c. to the 19th c., as opposed to grinding wheat for flour or, in some places, pumping water. Documents over 263 windmills.
- ◆ John Langdon. **Mills in the Medieval Economy: England, 1300-1450**. Oxford, 2004. 369 pp. \$115. Clear explanations of how medieval mills worked, whether water or wind powered, and analysis of their distribution, economics, and technology. Rev.: *T&C*, v. 46,3 (July 2005), pp. 636-38.
- ◆ Ben Marsden. **Watt's Perfect Engine: Steam and the Age of Invention**. Columbia Univ. Pr., 2004. 213 pp. \$19.50. Biography of inventor and manufacturer James Watt explores how his image came to be romanticized and canonized even before his death in 1819. Rev.: *T&C*, v. 46,3 (July 2005), pp. 651-52.

WATER TRANSPORT

- ◆ Ken Andrews & Stuart Burroughs. **Stothert & Pitt: Cranemakers to the World**. Tempus Press, 2003. 128 pp. Based in Bath, England, company had origins as an ironmonger in the 18th c. and evolved into a large engineering operation specializing in cranes, capstans, and other dockside equipment. Rev.: *IA Review*, v. 26,1 (2004), pp. 65-66.

- ◆ David Chaplin. **The Propulsion of Cross-River Ferries in 19th Century Maine**. *SIA New England Chapters Newsletter*, v. 24,1 (2004), pp. 1-8. Surveys known methods of operation including sailing, rowing or poling, manual pulling or pushing of on-deck mounted cables, and simply using currents.
- ◆ Chester Hearn. **Carriers in Combat: The Air War at Sea**. Greenwood Pr., 2005. 336 pp., maps, photos. \$49.95. From the improvised wooden platforms of the early 20th c. to today's nuclear-powered carriers, explores how combat experience of key individuals drove the development, technology, and tactics of the world's navies.
- ◆ Wendell Jamieson. **Tugboat Alley**. *NY Times* (Aug. 21, 2005). Operations of the McAllister and Moran tugboat companies, based on Staten Island.
- ◆ Tracy Panek. **Challenge to Change: The Legacy of the Port Chicago Disaster**. *Common Ground* (Summer 2004), pp. 16-25. Port Chicago, on Suisun Bay east of San Francisco, was the site of the worst home-front disaster of WWII when a munitions explosion took 320 lives, most of them African-American enlistees. The aftermath, which included a mass mutiny, challenged the military's segregation policy and contributed to the integration of the armed forces in 1948. Photos and descriptions of work at the base.
- ◆ Dawne Shand. **Smooth Sailing**. *Preservation Online Magazine* (Sept. 9, 2005), www.nationaltrust.org/magazine. Successful efforts to preserve and prevent the closing of the historic Portsmouth Naval Shipyard in Kittery, ME.

RAILROADS

- ◆ Robert Angevine. **The Railroad and the State: War, Politics and Technology in 19th-Century America**. Stanford Univ. Pr., c. 2003. 351 pp. \$65. Relationship between the U.S. Army and America's railroads. Army engineers supplied much of the survey and engineering talent, justified by needs of national defense and economic development. Rev.: *NRB*, v. 69,3 (2004), p. 44.
- ◆ Richard C. Carpenter. **A Railroad Atlas of the United States in 1946. Volume 1: The Mid-Atlantic States**. Johns Hopkins Univ. Pr., 2003. 297 pp. \$65. Contains maps for DC, DE, MD, NJ, PA, VA, and WV drawn at a scale of 1 in. = 4 mi. Each railroad company is identified by color with stations, interlocking points, coaling docks, track plans, tunnels, viaducts and bridges, etc. Rev.: *NRB*, v. 69,3 (2004), pp. 48-9.
- ◆ Dan Cupper. **The Curve**. *RH* (Spring-Summer 2004), pp. 12-25. Celebrating 150 years of train watching at the Pennsylvania RR's Horseshoe Curve near Altoona.
- ◆ Luis V. Dominguez and Manuel Diaz Ceballos. **Cuba and Railroads**. *RH* (Spring-Summer 2004), pp. 26-55. Overview of long and remarkable influence of railroads on Cuba's economic development from the late 1830s to the present. Maps and photos.
- ◆ Howard W. French. **Sentimental or Not, a Steam-Powered Journey is Ending**. *NY Times* (Oct. 4, 2005). Last of the world's main-line steam railways (Jitong railway, a 567-mile line in Inner Mongolia) is replacing its steam locomotives with diesel.
- ◆ Tom Kozub. **Rebirth on the Rails**. *Timber Transfer*, v. 21,3 (Winter 2005), pp. 12-29. Detailed description, photos, and drawings of restoration of 1920 caboose at the East Broad Top Railroad (EBT) in Huntingdon County, PA. Published by Friends of the EBT, www.febt.org.

- ◆ J. Parker Lamb. **Perfecting the American Steam Locomotive.** Indiana Univ. Pr., 2003. 224 pp. \$44.95. Technological development of the steam locomotive from the 1820s to the 1940s. Described by the reviewer as making the technology less mysterious and offering a framework for understanding the phases of development. Rev.: *RH* (Spring-Summer 2004), pp. 118-20.
- ◆ Don Leach. **Counterbalancing 10-Coupled Power.** *R&LHS Newsletter*, v.24,3 (Summer 2004), pp. 5-16. Analyzing and designing steam locomotives with five driving axles.
- ◆ Vernon F. Linnaus. **A Real, Live Railroad: The 40-Year Saga of the Ill-Fated Yankton-Norfolk Line.** South Platte Press (Box 163, David City, NB 68632), 2003. 64 pp. \$12.95 ppd. From the 1880s to the 1920s, the community of Yankton, SD, dreamed of a railroad that would connect it with Norfolk, NE. They even built a bridge across the Missouri River, yet never finished the line due to lack of financial resources. A case study of the failed efforts many small towns made to gain the advantages and prestige of a railroad. Rev.: *NRB*, v. 69,3 (2004), p. 44.
- ◆ Jerry Marlette. **Indianapolis Railways: A Complete History.** Pioneer Press of West Virginia, 2003. 301 pp. \$50. Despite title, focus is on the interurban and local street railway systems radiating from the city. Cover the horsecar era beginning in the 1860s to the abandonment of the last trolley line in 1953. Rev.: *NRB*, v. 69,3 (2004), p. 45.
- ◆ Christopher McGowan. **Rail, Steam, and Speed: The "Rocket" and the Birth of Steam Locomotion.** Columbia Univ. Pr., 2004. 379 pp. \$29.95. Succinctly covers the pioneering steam railroads, engines, and locomotive builders. Rev.: *T&C*, v. 46,3 (July 2005), pp. 666-68.
- ◆ **Mid-Continent Compendium.** Mid-Continent Railway Historical Society (Box 358, North Freedom, WI 53951; 608-522-4261; www.midcontinent.org), 2005. 103 pp., illus. \$5. Guidebook to the Mid-Continent Rwy. Museum featuring a detailed equipment roster, train-ride guide, and local railroad history. Includes a chapter on the iron mines served by the former branch of the Chicago & North Western Rwy.
- ◆ Tony Reeve. **O. Winston Link.** *RH* (Spring-Summer 2004), pp. 78-101. Biography and review of the well-known railroad photographer (1914-2001).
- ◆ Richard Reinhardt. **Workin' on the Railroad: Reminiscences from the Age of Steam.** Univ. of Oklahoma Pr., 2003. 327 pp. \$19.95. Personal recollections of railroad men compiled from old periodicals, like *Harper's Weekly*, *Railroad Gazette*, and *Scribner's Monthly*. Presents a clear view of the hazards and dangers, as well as satisfaction and accomplishments, of railroad workers from the 1850s to the 1920s. Rev.: *NRB*, v. 69,3 (2004), pp. 46-7.
- ◆ Ralf Roth and Marie-Noëlle Polino. **The City and the Railway in Europe.** Ashgate, 2003. 287 pp. \$79.95. Influence of railways on the development of cities. Series of essays explore this theme and cover some countries beyond the usual, including Portugal, Romania, Ireland, and Finland. Rev.: *T&C*, v. 46,3 (July 2005), pp. 665-66.
- ◆ Gene Sansone. **New York Subways: An Illustrated History of New York City's Transit Cars.** Johns Hopkins Univ. Pr., 2004. 508 pp. \$49.95. Design, construction, and service record of virtually every type of transit car ever built and in service in NYC over the past 130 years. Rev.: *T&C*, v. 46,3 (July 2005), pp. 668-69.
- ◆ Richard Saunders, Jr. **Main Lines: Rebirth of the North American Railroads, 1970-2002.** Northern Illinois Univ. Pr., 2003. 436 pp. Beginning with the collapse of the Penn Central in 1970, reviews the federal legislation, economic restructuring, and management changes that have helped American railroads to survive and to some extent thrive in recent years. Rev.: *RH* (Spring-Summer 2004), pp. 112-14.
- ◆ Joseph P. Schwieterman. **Santa Fe's Exodus from Prescott.** *NRB*, v. 69,3 (2004), pp. 4-23. In-depth analysis of one railroad town's efforts to prevent the loss of rail service from the 1950s to the 1990s. Prescott (AZ) continues to embrace its railroad heritage, although the line has become a rails-to-trails project. Also, **When the Railroad Leaves Town.** Truman St. Univ. Pr., c. 2003. 2 vols. (eastern and western U.S.). Case studies of the effects of railroad abandonment on more than 100 communities. Rev.: *NRB*, v. 69,3 (2004), p. 50.
- ◆ Thomas Taber III. **Two Days on a West Virginia Logging Railroad.** *NRB*, v. 69,3 (2004), pp. 24-43. History of Elk River Coal & Lumber (Swandale, WV). Photo-documentation of narrow-gauge railway, logging, and sawmill operations in the late 1950s.
- ◆ John H. White, Jr. **Oh, To Be a Locomotive Engineer.** *RH* (Spring-Summer 2004), pp. 56-77. Life stories of engineers, famous and forgotten, illustrate the hazards and rewards of the occupation over the past 175 years.

AUTOMOBILES & HIGHWAYS

- ◆ **Lincoln Highway: Special Resource Study/Environmental Assessment.** National Park Service, 2004. Examines alternatives for managing tourism and preserving sites along the trans-continental automobile route established in 1913. History of the route and list of more than 1,000 sites (bridges, service stations, motels, diners, etc.).
- ◆ David J. Sell. **Roll on Columbia: The "King of Roads" Still Wears Its Crown.** *American Road*, v. 3,3 (Autumn 2005), pp. 14-22. Story of Oregon's Columbia River Highway, opened in 1915 and widely considered the nation's first scenic highway, known for its tunnels and aesthetic bridges.
- ◆ Paula Reed Ward. **State Plans to Recycle Old Turnpike Sections into Bike Trail.** *Pittsburgh Post-Gazette* (July 10,

CONTRIBUTORS TO THIS ISSUE

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With Thanks.

2005). An 11-mile bypassed stretch of the 1937-40 Pennsylvania Turnpike, including the Sideling Hill and Rays Hill tunnels near Breezewood, will be turned into a bike path.

AGRICULTURE & FOOD PROCESSING

- ◆ David W. Dunlap. **Archaeologists Trace Mystery Wall Not to War, but to Beer.** *NY Times* (July 31, 2005). Old foundations exposed at W. End Ave. and 59th St., NYC, were thought by many observers to be a 19th-c. fortress, but turned out to be the foundation of Clausen & Price ale and porter brewery (1871-1910). Includes interview with Susan Appel [SIA].
- ◆ Chris Marr. **Plowing Through History.** *Rome (GA) News-Tribune* (Aug. 22, 2005). Collection of plowshare molds found in a collapsing building, formerly the Sullivan & Towers Plow Co. in Rome. Some molds will be donated to the Rome Area History Museum.
- ◆ Jonathan Rees. **"I Did Not Know ... Any Danger Was Attached": Safety Consciousness in the Early American Ice and Refrigeration Industry.** *T&C*, v. 46,3 (July 2005), pp. 541-60. Examines the fire risks and frequent explosions at refrigeration and cold-storage facilities that used ammonia-compression technology. The initial push toward safety was due to high insurance costs and safety codes passed by municipalities in the 1910s. During the 1920s, new refrigerants were developed because manufacturers made safety a top priority so that consumers could bring refrigerators into their houses.
- ◆ Veront M. Satchell. **Estate Ruins as Loci for Industrial Archaeology in Jamaica.** *IA Review*, v. 26,1 (2004), pp. 37-44. Sampling of sugar plantations identifies archeology of sugar estate work yards, power sources, and sugar mills.
- ◆ Michelle York. **In Sequel for an Old Chocolate Factory, Nobody Knows What They're Doing Yet.** *NY Times* (June 2, 2005), p. A25. 104-year-old former Nestlé factory in Fulton, NY, struggles under new ownership (NY Chocolate Co.). Keeping the plant open was hailed as a victory by politicians, but Nestlé had auctioned off the equipment rather than sell it intact to a competitor. Manufacturing problems abound for the re-hired workers and the new management.

TEXTILES

- ◆ Lyn Riddle. **Closed Factories a Font of Wealth.** *Atlanta Journal-Constitution* (June 6, 2004). Gibbs International is a company that specializes in buying old textile mill machinery and reselling it, mostly overseas. The closing of hundreds of Southern textile mills in past decades has netted huge profits and several large warehouses full of machinery in Spartanburg, SC.
- ◆ Diana Sprout, Ronan Toolis, James Hephher, and Dorothy Rankin. **Town and Factory: An Historic Building Survey of 200 Years of John Paton's Kilncraigs Woolen Mill in Alloa, Clackmannanshire.** *IA Review*, v. 26,1 (2004), pp. 21-36. Sprawling 150-year-old mill complex was documented with measured drawings and photography.

MISC. INDUSTRIES

- ◆ David V. Herlihy. **Bicycle: The History.** Yale Univ. Pr., 2004. 470 pp. \$35. Comprehensive history of the bicycle from its origins in the early 19th c. to the icon of late-19th-c. culture. Rev.: *T&C*, v. 46,3 (July 2005), pp. 680-81.
- ◆ Carol J. Hunsberger. **The Gruber Wagon Works: The Place Where Time Stood Still.** McDonald & Woodward Pub.

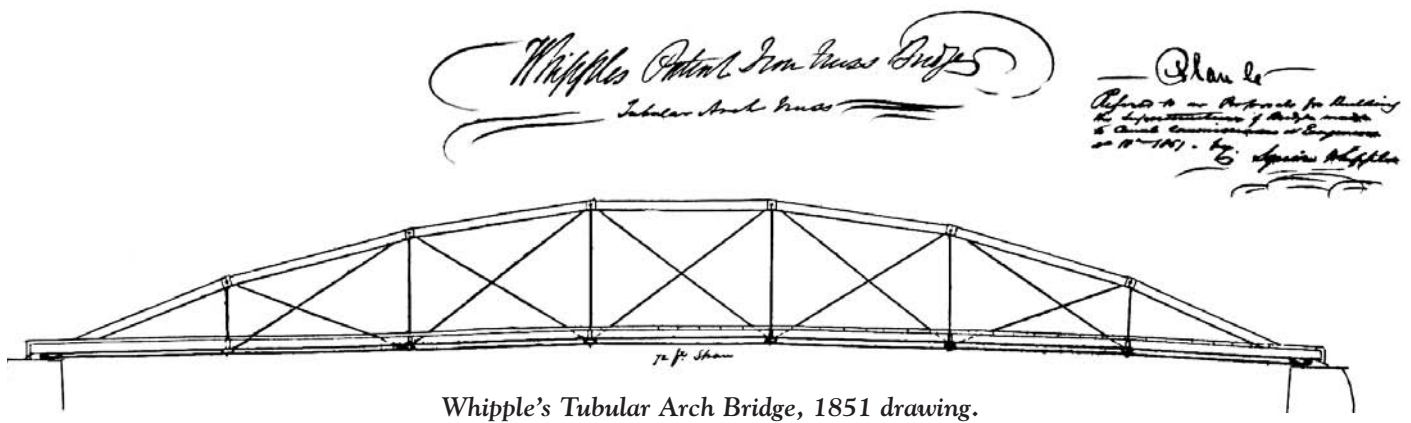
(www.mwpubco.com/gruber.html), 2005. 195 pp., illus. \$35. The Berks Co. (PA) wagon works was built by Franklin H. Gruber in 1882-84 and housed the family business repairing and building farm wagons until 1972, when it was closed due to a flood control project. The works was relocated and restored by the U.S. Army Corps of Engineers and opened as a museum in 1982. Comprehensive history compiles for the first time the vast amount of documentation and personal interviews and reminiscences of the family and those who worked to preserve and relocate the works. Also avail. from the same publisher: Paul A. Kube. **Wagon-Making in the United States during the Late-19th through Mid-20th Centuries: A Study of the Gruber Wagon Works at Mt. Pleasant, Pennsylvania**, 2005. 264 pp., photos. \$29.95. Reprint of original 1968 thesis; considered one of the best descriptions of wagon-making in the U.S. prior to the automotive era.

- ◆ Jack Kelly. **"The Most Perfect Weapon."** *I&T* (Fall 2004), pp. 18-27. Samuel Colt and his efforts to make civilian handguns cheaper and more lethal, resulting in a legacy that inspired a broad vision for American mass production.
- ◆ Richard A. Rajala. **Feds, Forests, and Fire: A Century of Canadian Forestry Innovation.** Ottawa: Canadian Science and Technology Museum (www.technomuses.ca), 2005. Transformation Series No. 13.
- ◆ Robert J. Simcoe. **The Revolution in Your Pocket.** *I&T* (Fall 2004), pp. 12-17. Fifty years ago a transistor radio called the TR1 started the semi-conductor revolution.
- ◆ John N. Wilford. **Archaeologists Discover an Ancient Egyptian Glass Factory.** *NY Times* (June 21, 2005). 13th-c. B.C. glass factory is the first-ever direct evidence of glass-making in the Late Bronze Age. A well-preserved crucible containing a block of glass and fragments of several hundred individual vessels used in glassmaking and coloring have been discovered in ruins from the time of Ramses the Great at the Qantir-Pirameses site in the eastern Nile delta.

ABBREVIATIONS:

Common Ground	= Published by the National Park Service, www.cr.nps.gov/CommonGround
CRM	= <i>The Journal of Heritage Stewardship</i> , published by the National Park Service.
I&T	= <i>American Heritage of Invention & Technology</i>
IA Review	= <i>Industrial Archaeology Review</i> , Journal of the Assn. for Industrial Archaeology (UK)
NRB	= <i>National Railway Bulletin</i> , published by the National Railway Historical Society.
RH	= <i>Railroad History</i> , Journal of the Railway & Locomotive Historical Society (R&LHS)
T&C	= <i>Technology & Culture</i> , Quarterly of the Society for the History of Technology
Timeline	= Magazine of the Ohio Historical Society, 1982 Velma Ave., Columbus, OH 43211

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Whipple's Tubular Arch Bridge, 1851 drawing.

New York State Archive

THE WONDERFUL “ODDITIES” OF AMERICAN BRIDGE BUILDING

Two articles appearing elsewhere in this *SIAN* describe metal-truss bridges in which commercial pipes were used or proposed for the main compression members. These bridges are interesting, if for no other reason than they were uncommon in their time. In fact, they can be looked upon as a subset of a larger number of bridges that, as a group, helped define the rich diversity of American bridge building in the last half of the 19th century and the early years of the 20th, but were clearly out of the mainstream of where the technology was moving. Few of these “oddities” were commercially viable for more than a few years, if at all. The pipe truss bridges of Charles H. Ball, being a case in point, sustained a business for eight years or less.

At the risk of oversimplifying, the history of America's truss bridges suggests that an entrepreneur wishing to gain a purchase in the commercial market had available one, or a combination, of two principal options. He could manipulate the structural form, that is, he could offer a new arrangement of individual structural elements that, working together, transferred the bridge's weight and its live loads to the abutments. Or, he could offer a different cross section for one or more of the structural elements, most commonly the principal compression member, what is called the “upper chord.” These were not the only options, but they were the most common.

Typically, such innovations were heralded by their inventors as improvements over existing practices, and many were patented. However, their history is spotty. Some were designed but never built. Others were built in small numbers but soon yielded to designs that were more structurally viable or more economically competitive. Yet, others, like Ball's pipe truss bridges, were able to sustain a modest commercial enterprise for a few years, typically in a limited geographic area and, more often than not, through skillful promotion.

The earliest use of commercial pipes for the upper chord of a bridge may have been based on an 1851 design of Squire Whipple, the Utica, NY, engineer who, arguably, would become the most important American theoretician and practitioner of metal-truss bridge design in the last half of the 19th century. Whipple proposed a *Tubular Arch Bridge* design for adoption by the Erie Canal Commissioners at a time when that authority was considering iron for the hundreds of new superstructures that would be required for the canal's widening. Whipple's design, clearly proposed for

light loads, was never patented and probably not widely used, though some are known to have been built as secondary structures along the widened canal. The example shown here, referred to in canal documents as *Whipple's Pipe Arch Bridge*, is likely derived from that 1851 design.

It is significant here that among the many compression sections proposed and used for metal-truss bridges, the most successful were some variation of a hollow tube. While the ability to resist crushing is a simple function of the amount of metal in the cross section, the ability to resist buckling, the primary failure mode, depends as much on how the metal is arranged in the cross-section as on how much of it is used. From considerations of structural mechanics alone, it was known that the most efficient arrangement to resist buckling from an axial load is a hollow circular tube. Thus, it is not surprising that most of the earliest successful truss designs employed some form of cast-iron tube for their compression members; and most of the later ones, some form of tube built-up from sections of rolled wrought iron. The fact that a few inventors along the way would see advantage to adapting, for structural purposes, a tubular product already manufactured, though for an entirely different purpose (i.e., transport of fluids under pressure), seems predictable.

These bridges fabricated from commercial pipes are reminis-

(continued on page 18)



Whipple's Pipe Arch Bridge, at Rome, NY; undated photograph.

New York State Archive

cent of another curious subset of bridges that also adapted for their principal members a different product from another industry, in this instance, iron railroad rails. The railroad iron bridges of the Lane Bridge Works of Painted Post, NY (SIAN, Nov. 1977) and John Greiner (SIAN, Fall 2000) have been reported. A lesser known example is the diminutive patented (1877) *Railroad Iron Bowstring Truss* of the emerging Groton Iron Bridge Co. of Groton, NY in which bent rails formed both the upper and lower chords. This innovation was the “signature” product of the new company, appearing on its first letterhead, but the design was soon abandoned in favor of a more practical variation in which railroad rails were replaced by bent I-bars.

We will likely never know exactly what the thought processes were that resulted in most of these oddities but, thankfully, examples of many have been preserved for our appreciation and enjoyment and, yes, to tease our curiosity. For this, we are thankful for the efforts of the established preservation community as well as individuals and small groups that share a fondness for what these unusual examples can teach about one aspect of our transportation heritage. The bridges of Charles H. Ball, one of which has now



Bill Chamberlin

Patented Railroad Iron Bowstring Truss Bridge, Nubia, NY, built c. 1877 by the Groton Iron Bridge Co.

been removed to the campus of the University of Massachusetts by Alan Lutteneger, are an important contribution to this legacy.

Bill Chamberlin

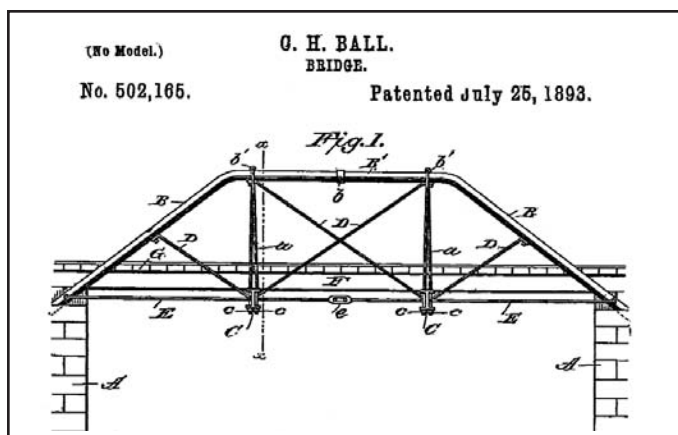
Iron Pipe Bridges of Charles H. Ball

In 1893, an enterprising mechanic and inventor from East Windsor, MA, named Charles H. Ball, patented a design for a small pony-truss bridge using iron pipes for the upper chords (Patent No. 502,165, July 25, 1893). At least 25 such bridges are known to have been built between about 1888 and 1896, principally for small towns throughout western New England, in Massachusetts, Vermont, and Connecticut. The design and construction illustrate the inventiveness and ingenuity of the designer, and, for their time, represent an uncommon approach to catalog iron bridges for local roads, being one of the unusual patented forms, using wrought-iron pipe for the main truss members. Like many entrepreneurs, Ball served as both designer and

builder, thus ushering in the design-build concept well before the beginning of the last century.

As far as is known, Ball only produced pony-truss bridges in the King Post and Queen Post configurations. Span lengths were modest, ranging from about 22 ft. to 42 ft. In his advertisement, Ball claimed “As Strong as the Strongest” and “As Durable as Iron and Steel” and “The Cheapest Iron Bridge in the World.” His design philosophy was essentially described as follows:

“To meet the demand for a low priced iron bridge having all the important qualities of strength and durability found in the best iron bridges now made, I have perfected a pipe truss bridge.... The question of artistic or architectural effect was not considered



Drawing from Ball's 1893 patent for a pipe-truss bridge.



Alan Lutteneger, all photos

The Windsor Bush Road Ball Pipe-Truss Bridge is abandoned and threatened with loss.

in planning this bridge, the main point being to produce a strong, cheap bridge, that would last as long as any iron bridge, and cost but little, if any, more than a wooden bridge."

The unique feature of Ball's design was in the use of wrought-iron pipe for the upper chord. In his sales pamphlet, Ball stated, "The pipes used are not the ordinary gas and steam pipe found in the market, but are heavier, and are made for special purpose requiring great strength." Typically, the pipe had an outside diameter of between 5½ and 7 in., and it was usually made of two sections joined by a threaded coupling. Legend has it that the pipes were often bent to the required shape with great ceremony on a Saturday night with local boys and men bending the pipe after it had been heated in a fire.

At the ends of the pipe, a cast-iron boss with a bearing plate was placed so that the lower chord members, typically pairs of 1½-in. diameter wrought-iron rods with threaded ends could be attached to hold everything together. Beams were suspended from the top chord from wrought-iron hangers that looped over the top chord. Diagonal bracing, also of wrought-iron rods, ran from the upper chord, under or through a beam, and then back to the diagonal end of the upper chord. There were no rivets and essentially no bolts used.

Only three of Ball's bridges are known to have survived; fortunately they represent typical examples of Ball's enterprise and include two Queen Post bridges and a King Post bridge. Ball's bridges were previously described in a brief note in the *SIAN* (Sept. 1977) by Bernard A. Drew. Following is an update on the surviving examples:

The **Holiday Road (Dalton) Bridge**, originally located in Dalton, MA, is a 42-ft.-long, pony-truss bridge of the Queen Post design. The top chord is made from 6½-in. diameter wrought-iron pipe. The lower chords are pairs of 1½-in. diameter, wrought-iron rods. In 1990, the bridge was moved, intact, to outside storage behind the Windsor (MA) Historical Museum. In 2004, disassembly of the bridge was begun as the first step to move the bridge to the University of Massachusetts-Amherst for reconstruction as a pedestrian bridge. The bridge has undergone a series of crude mod-

ifications over the years, but will be rebuilt to its original design. On each truss, there are two, 2¾-in. diameter, wrought-iron posts that are placed between the bottom side of the upper chord and the top of the beams that appear to be original and were probably placed to add strength to the bridge, given the span.

The **Windsor Bush Road Bridge** is a 31-ft.-long, pony-truss bridge of the Queen Post design, and is very similar to the Holiday Road Bridge. Unlike the Holiday Road Bridge, this bridge does not have the vertical posts running between the upper chord and the beams. The upper chords are composed of 5¼-in. diameter, wrought-iron pipe. The lower chords are 1¼-in. diameter, wrought-iron rods. Windsor Bush Road is now abandoned and a protected beaver dam downstream has raised the water level to about 3 in. below the wood deck, raising the possibility that the bridge will soon be submerged and inaccessible. There is currently no plan to preserve it.

The **Cummington Bridge** is a 29-ft.-long, pony-truss bridge of the King Post design. The upper chords are 7-in. diameter, wrought-iron pipe. The bridge has a single floor-beam held in place by a wrought-iron hanger extending over the upper chord. The lower chords are 1¼-in. diameter, wrought-iron rods. The bridge was refurbished a few years ago and is currently a pedestrian bridge behind the Berkshire Trail Elementary School in Cummington, MA.

The Ball pipe-truss bridges represent one man's approach to late-19th-century bridge design. Clearly, the span length was limited, not only in engineering, but in fabrication ability and construction. However, the bridges did fill a need in the local market for inexpensive short-span bridges that could be easily fabricated and quickly constructed. As such, they represent a fascinating era in bridge technology, and it is important to take steps to preserve this engineering heritage. Info: Alan J. Lutenege, Dept. of Civil & Environmental Engineering, Univ. of Massachusetts, Amherst, MA 01003; lutenege@ecs.umass.edu.

Alan J. Lutenege



Holiday Road (Dalton) Ball Pipe-Truss Bridge in storage at the Windsor (MA) Historical Museum. The bridge is being disassembled, rehabilitated, and re-erected as a pedestrian bridge at the University of MA—Amherst.



The Cummington (MA) Ball Pipe-Truss Bridge has been rehabilitated and preserved as a pedestrian bridge on a trail behind the local elementary school.

Bridge Patents & Pipes

19th-century, metal-truss bridges built with hollow round members

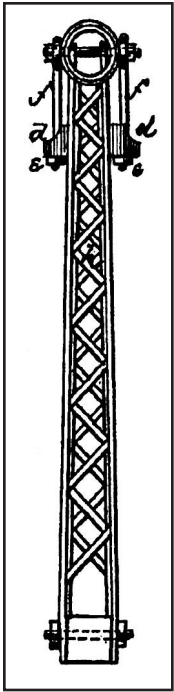
A truss is an assemblage of parts selected from stock items readily available from lumberyards or metal shops. Rarely is a truss member (other than a joinery piece) cast, wrought, or extruded specifically for a particular truss. Metal-truss chords and web struts often are built-up from several pieces, such as a pair of channels laced together. The individual pieces of the assemblage, however, are stock items cut to required lengths.

The logic for using a length of tubular iron or steel for the compressive members of a metal truss is compelling. A hollow circular tube is the most efficient shape for a compression member. A structural member, such as a column or truss member subjected to axial compression, will fail by bending in the direction of its weakest dimension. Due to cross-sectional symmetry, a cylinder is efficient because it has no weak axis.

A “pipe” is a hollow tube initially intended to transport a liquid or gas. Pipes can be put to other uses, a fence post for instance, or, of course, truss members. Round hollow members manufactured specifically for structural usage, such as lally columns are not considered to be pipes; nor are the huge round hollow chords of the world famous Firth of Forth Bridge (tour site—1997 SIA Study Tour, Scotland). There are also non-typical exotic examples. General Montgomery Meigs’s 1860 arch bridge supplied water to Washington, DC, through its tubular cast-iron arch (tour site—2001 Annual Conference), a case where a pipe became the bridge, rather than a bridge utilizing pipe parts for some of its members. Wendell Bollman’s 1877 truss (SIAN, Sept. 1973) that used hollow chords to carry water over Jones Fall in Baltimore is a similar example.

Iron pipe came into common usage in the 1880s for car-

Date	Patent No.	Inventor	Comment
Aug. 12, 1846	4,694	Frederick Harbach	Oldest American patent calling for the use of a round hollow (pipe-like) member as part of a truss.
Oct. 18, 1859	25,852	Joseph Sprague	Pratt truss using wrought-iron tubular sections.
Aug. 30, 1870	106,760	John S. Adams	Pratt truss using pipes for the compression members. Adams method was to connect the pipes using matching concave/convex sockets.
Nov. 18, 1873	144,766	Phelps Johnson	Bowstring truss using tubular sections for the top chord. Verticals, which look like stout pipes, are tensile members, with the forces being handled by rods inserted through the tubular strut.
May 5, 1874	150,515	Ova H. Bogardus	Patent for a Howe truss with a parabolic top chord and compression diagonals that utilized pipes. Terminating the diagonals was a difficult task. Bogardus proposed cast-iron “joint blocks” into which he inserted his hollow members. Upper chord and braces could be made of either wrought-iron or steel, making this one of the earliest references to steel framing members in an American truss bridge patent.
May 2, 1876	176,806	John W. Post	Post called his patent a “girder truss,” basically a short-span trussed-beam. He used tubes or pipes screwed into couplings for his top chord and a continuous bent tube for his lower chord.
Apr. 2, 1889	400,704	John W. Paisley	A King-post pony truss with a bent tube for the top chord.
Aug. 25, 1891	458,161	William W. Green	Utilized threaded tie rods inserted through “metal tubes” in his variation of a Pratt truss.
Nov. 8, 1892	485,689	James F. Hardesty	A bedstead Queen-post truss with compression verticals specified as “plain cast-iron cylinders or pipes.”
Jan. 17, 1893	489,946	Robert Gray	Half-hip, Pratt, pony-truss bridge with round, hollow compression members.
July 25, 1893	502,165	Charles Ball	Queen-post pony-truss bridge called for a two-piece top chord constructed with a tube connected at mid-span with a sleeve. The tubes were bent at the hip and the vertical ties secured over the tubes on the center-span side of the hip.
Apr. 2, 1895	536,680	Colby Avery	Queen-post and Howe trusses with round, hollow, compression members.

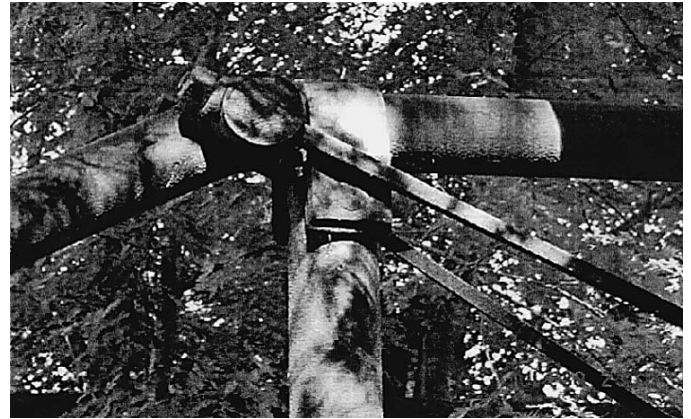


Detail from Ova Bogardus's patent of 1874, showing the pipe used for the upper chord in cross section.

rying water and gas. Inevitably someone seized upon the idea of using this readily available, mass-produced product for the compressive members of a truss. Pipes were manufactured in a variety of different diameters, and each diameter in turn was available in a number of different wall thicknesses. An efficient size was available for a large variety of stresses.

One seldom finds round steel columns used in multi-story buildings, as attaching framing members to a round surface is awkward. Special connectors, costly to fabricate and labor intensive to install, must be used. The same problem beset tubular pipe-like truss members. Flat-sided rectangular shapes lend themselves to uncomplicated connections. Wood trusses use timbers sawn into rectangular shapes. Iron and steel trusses use plates, angles, channels, and I-beams, all of which have flat sides to facilitate connecting them to each other.

19th-century Patents. Whether an early truss patent called for "hollow tubes" or used the word "pipe" is not relevant. Truss patents do not tell users where or how to acquire the materials necessary to build them, any more



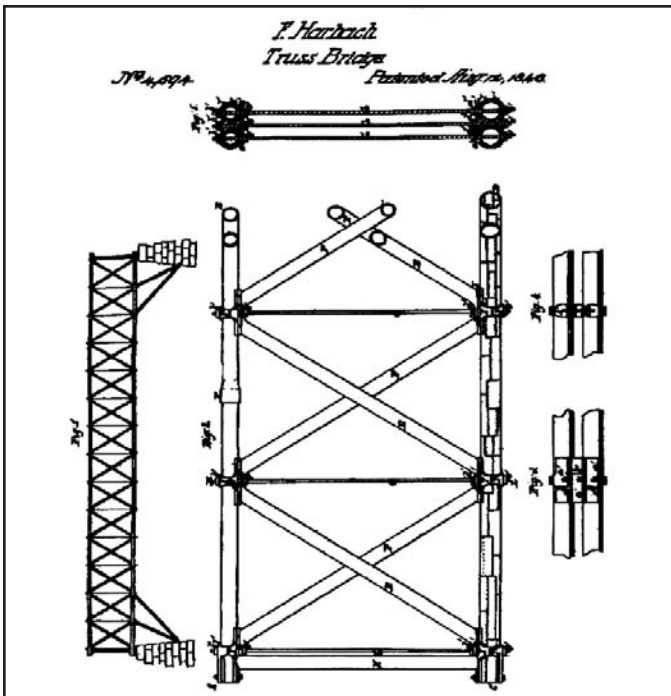
Detail of a truss bridge using pipe for the top chord and vertical, built by the Trout Brothers in Illinois, ca. 1892-97.

Illinois DOT, Carl Tracy

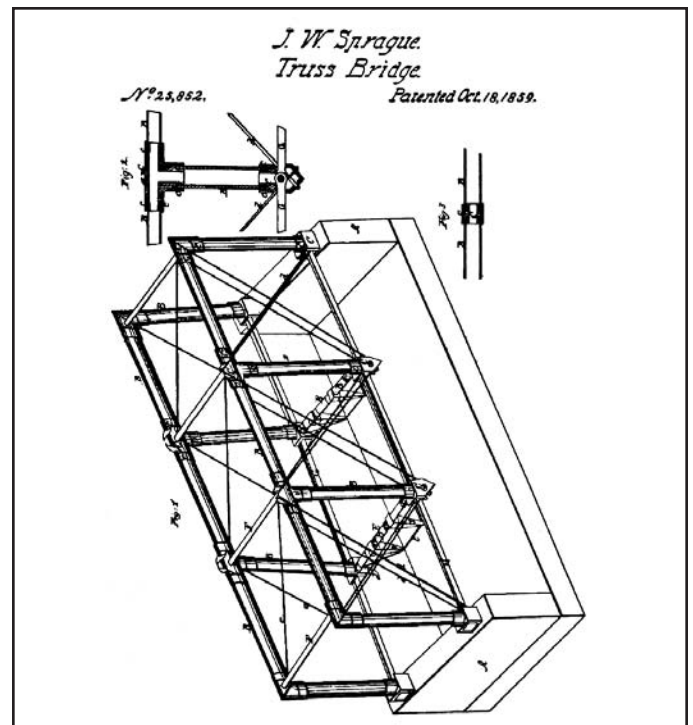
than they size the actual members. Patents present a concept, leaving it up to the user to finesse it in order to obtain a situation-specific solution. The bridge contractor interested in using a patent calling for a hollow-cylinder member would determine whether it was obtainable from pipe stock or had to be custom made.

The oldest American patent calling for the use of a round hollow (pipe-like) member as part of a truss bridge appears to be Frederick Harbach's 1846 proposal for an all-metal version of a Howe truss, which called for both the top compression chord and the compression diagonals in the web to be made of hollow tubes. The diagonals were cast with bearing plates at each end to facilitate connections. The top chord, however, was a true pipe with its abutting sections joined together with the bell-and-spigot joint invented in 1785 in

(continued on page 18)



Frederick Harbach's truss bridge patent of 1846 is believed to be the first to use pipes with abutting sections joined together with the bell-and-spigot joint.



Joseph Sprague's 1859 patent. The first to call for the use of wrought-iron pipe.

Excavations at Van Winkle's Blacksmith Shop

During the summer of 2005, archeology students from the University of Arkansas excavated the remains of a 19th-century blacksmith shop at Van Winkle's Mill in the Ozarks. Peter Van Winkle settled in the area in 1845 and shortly thereafter constructed the region's first steam-powered sawmill and gristmill. The mill complex also included housing for the Van Winkle family and the slaves who worked the mills, a garden, and ancillary facilities. During the Civil War, the Van Winkles fled to Texas with their slaves. In their absence, Confederate forces burned every structure to the ground. When Van Winkle returned following the war, he rebuilt bigger and better, including a larger steam engine with 24-ft. flywheel and three boilers. He also established three satellite mills. Following Van Winkle's death, the mill went to his son-in-law, J.A.C. Blackburn, who sold the mill property and the machinery in 1902.

Fieldwork in 1997 began with a site survey, during which the crew identified twenty-four features, and performed limited testing at the Van Winkle house site. Work extending into 1999 focused on slave and freedmen quarters. Continued work into 2003 included a cultural resource inventory of Van Hollow, where the site is located, and a survey of the mill complex remains. The inventory resulted in the identification of additional features, including a gasoline-powered portable mill site, a mule paddock, and the blacksmith shop.

Geophysical testing of the mill site proper, including electrical resistance, magnetic susceptibility, and ground penetrating radar, yielded poor results, likely due to soil degradation and flooding. The results from the blacksmith shop area, on the other hand, indicated the remains of the forge. Excavations at the blacksmith shop focused on the forge and included magnetic fractioning to enable the development of a cursory hypothesis of the locations of various work areas. Mill excavations concentrated on the flywheel pit and the boiler base.

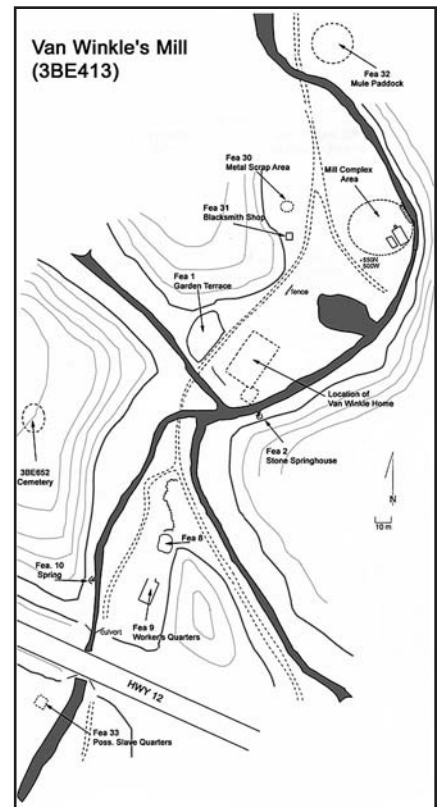
Excavations in 2005 uncovered most of the blacksmith shop in an attempt to 1) define the layout of the structure; 2) reveal the entirety of the forge box; 3) collect objects made by the blacksmith to determine skill; and 4) test the magnetic fractioning conducted to identify work areas. The fieldwork met each of these objectives.

Continued excavations of the back stone wall of the shop revealed a 45-degree turn in the northwest corner, and no turn in the southwest corner.

The arrangement of larger rocks suggested that posts set on rocks supported the side and front walls while a substantial stone backwall prevented erosion from the slope behind the shop.

Near the center of the shop was the forge box, a roughly square structure with a stone footprint and brick walls, as indicated by the brick rubble lying all around the forge. The stone chimney has since fallen in a linear pattern behind the box.

Use of magnetic fractioning in 2001 helped locate work areas in the shop using hammer scale and iron shavings pre-



Forge box at the Van Winkle blacksmith shop.



45-degree turn in the shop's northwest corner.

sent in the soil. Soil samples were collected and the percentages of hammer scale or iron shavings were ascertained for each sample. This was charted throughout the shop, differentiating heavy iron-working areas from non-iron-working areas. The magnetic fractioning done in 2001 indicated that the anvil was situated southwest of the forge box, and the 2005 excavations found a feature probably associated with the anvil.

One of the most interesting elements of the excavation was the discovery of the antebellum occupation level. As excavations proceeded, what was thought to be subsoil was actually a layer of sterile deposits intentionally placed on top of the burned pre-Civil War occupation. Upon Van Winkle's return to the hollow, workers covered the pre-Civil War layer with subsoil and reconstructed the building. The discovery of the two discreet strata enabled us to note a change in the fuels used in the shop. Prior to the Civil

War charcoal was the fuel of choice, while following the war the smith switched to coal. Although there is no agreeable date for the switch from charcoal to coal (some claiming the 1840s and others the last quarter of the 19th century), the use of coal itself constitutes a technological change in the field of blacksmithing. These two occupation levels have much potential for our analysis of pre- and post-war use of the shop and the rate at which new technologies reached the Ozarks.

Van Winkle's Mill is an important site in the developmental history of northwest Arkansas. Although analysis of the blacksmith shop is not yet complete, the excavations have already yielded important data about pre- and post-Civil War technology and have the potential to tell us about the role of the blacksmith in the hollow and amongst the local community.

Alicia B. Valentino

BRIDGE PATENTS & PIPES (continued from page 21)

England by Thomas Simpson. Given the date of the patent, the pipes would have been butt-welded rolled cast-iron.

Thirteen years later, in 1859, Joseph Sprague patented a Pratt configuration truss that utilized wrought-iron "tubular sections"... "firmly connected" by "tubular clutches" or "rings of iron" for the top chord and verticals. The web

diagonals were iron rods and the bottom-chord members iron bars. Since the web compression members in a Pratt are vertical, Sprague's proposal would have been a bit easier to build than Harbach's.

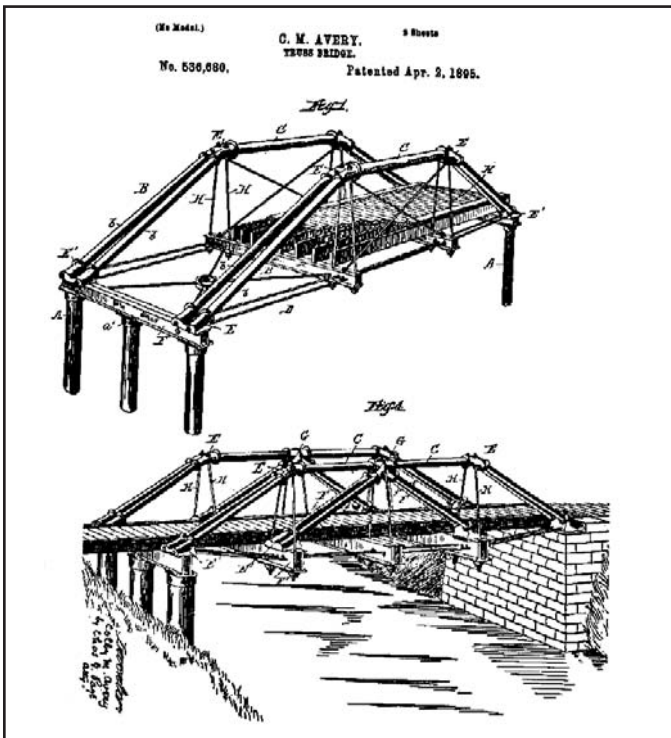
Following the Civil War, there was a proliferation of truss-bridge patents of all types, reflecting a diversity of ways of arranging, fabricating, and connecting truss members. A fair number of the late-19th-century, truss-bridge patents reference pipes or hollow members. The accompanying table presents some of the more interesting examples.

There are also examples of 19th-century non-patented truss configurations that used pipes for their compression members. The Trout brothers built several of these pipe trusses in Illinois during 1890s. The later the date, the more likely that true out-of-the-plumbing-supply-house pipes would be used rather than custom-made members.

While many engineers and inventors patented trusses with pipe-like members, the evidence is strong that the cost and difficulty of making connections discouraged the use of pipes, and it did not become a dominant approach to truss fabrication. Surviving examples are exceedingly rare. After the age of truss bridge building had past, economic welding of steel became a reality in the mid-20th century. Welding ultimately made the use of pipe sections for trusses feasible, and many examples of welded pipe trusses can be seen today.

The 19th-century experiments with pipes and hollow cylindrical tubes for the compression members of trusses, illustrates the differences between theory and practicality. Practicality won. Although a pipe member weighs less than a traditional assemblage of flat-surfaced members, the cost of fabricating special connection pieces, plus the additional on site labor required to install them, exceeded the initial saving incurred due to their lighter weight. The inherent complexity of joining the pipe segments to other members of the truss ultimately led to their disuse until the relatively recent reincarnation of welded "pipe trusses."

David Guise



In 1895, Colby Avery patented a pony-truss bridge using pipe-like members. Later patents were more likely to use off-the-shelf plumbing pipe, touting the economy of a widely available material. The difficulty of the connections, however, made them far less practical than standard pin-connected trusses using members built up from channels, angles, and bars.

Rehabbing Happy's Bridge

The East Chilhowie Street Bridge spanning the Middle Fork of the Holston River in the town of Marion, Virginia, was built in 1885 by the King Iron Bridge Company of Cleveland. Known historically as the Depot Street Bridge, it is now commonly called "Happy's Bridge" because of the adjacent Happy's Restaurant. The bridge originally offered an improved connection between the train depot and the town's business district. Today, it carries motor vehicles and is also used by bicyclists and pedestrians traveling Marion's History Walk, River Walk, and Park Boulevard trails.

The bridge is a wrought-iron, Pratt, through-truss constructed of pin-connected eyebars and members built-up from angles and other standard sections riveted and bolted together. The truss is representative of late-19th-century bridge-building technology that utilized shop fabrication and shipping of preassembled parts to the site for erection.

Happy's Bridge reportedly is the oldest two-lane iron bridge in Virginia. *The Patriot & Herald*, an old Smyth County newspaper, reported in October 1885, "We are pleased to state that orders have been made for the erection of a new bridge on Depot Street at Hull's Mill. The bridge is to be made longer and much wider than the present one with a walkway on each side of it. It is to be constructed of iron." The span is approximately 80-ft. long; the clear width for vehicular traffic is 18 ft.; 5-ft.-wide sidewalks are cantilevered outside of the trusses.

The leaders and citizens of Marion take great pride in this landmark structure. The Mayor and Town Council could have demolished it and replaced it with a standard modern bridge, but they had the vision to preserve it as a valuable



Happy's Bridge, Marion, Virginia. Fabricated by the King Iron Bridge Co. in 1885.

piece of the state's history using a TEA-21 (Transportation Equity Act for the 21st Century) grant through the Virginia Department of Transportation. The bridge is an important link in Marion's recreational trail system.

The bridge had been in continuous use from 1885 until 2003, at which time the load carrying capacity was deficient and the bridge was closed to traffic. The original wooden deck was long ago replaced with an asphalt surface laid over steel deck pans. The porous asphalt allowed water and salt to seep through, severely corroding the stringers and truss connections. To make matters worse, all bridge members had multiple layers of lead-based paint.

Rehabilitation proceeded as follows: the asphalt deck, deck pans, and severely corroded stringers were removed; then the contractor rigged a working platform underneath the bridge. The platform allowed the construction crew to work without entering the river and also eliminated the need for certain environmental permitting. The bridge was encapsulated for removal of the lead-based paint; then a primer and intermediate coats of paint were applied. The general contractor, Inland Construction Co. of Bristol, removed and replaced the corroded members and bearing plates, added reinforcing plates to corroded areas of the floorbeams, and placed new stringers, steel deck pans, and a 7-in.-thick, reinforced-concrete deck. The work took six months to complete with a cost of \$436,560. Design was by Thompson & Litton, an engineering, architectural, and surveying firm established in 1956 with headquarters in Wise, Virginia.



Inside the cocooned bridge, workers removed lead-based paint and applied new paint.

Charlotte Sacre & Scott N. Wilson

Salem-Shotwell Covered Bridge

Alabama had only 12 surviving covered bridges, though more than any other Southern state. Now it's down to 11 due to a falling tree that crushed the Salem-Shotwell Bridge, a Town-lattice truss. Neill Herring [SIA] reports on the salvage of the bridge's pieces and the hoped-for restoration. There is a good possibility that Alabama may be able to secure federal funding since the national historic covered bridge preservation program sponsored by Sen. Jim Jefford (I-VT) was passed by Congress and signed by President Bush in August.

A tree next to the Salem-Shotwell Bridge on Wacoochee Creek, near Opelika fell onto the end of the structure on June 4, causing a failure of the truss and sending the entire structure into the creek. The bridge was built in 1900 by Otto Puls, a local builder, and withstood a record flood in 1901, which destroyed many other bridges in the county, including recently erected iron bridges.

John Ross, a retired mechanical engineer who lives in Opelika, was appointed by Lee County to supervise the rescue and restoration of the bridge, the pieces of which have been removed from the creek and are now under a shelter at a former Lowe's building-supply store. The use of the shelter is assured through the end of 2005. A site for erecting the bridge after it has been restored had not been selected as of September.

Ross attributes the failure of the bridge to earlier attempts at repair, in which portions of the web and the chords were replaced with ordinary untreated pine lumber that subsequently rotted, leaving the structure easy prey to the falling tree. Ross has salvaged yellow pine from the timber framing and floors of area textile mills that have been razed to provide enough material to repair the bridge, but he has expressed some reluctance to use either his material or his expertise on the project until he has some assurance as to where the repaired structure will be permanently re-erected.

The existing Salem-Shotwell site is not regarded as likely for re-installation of the bridge, as it was "neglected and unappreciated in that location," according to Ross. The bridge had been subject to vandalism, including an arson

attempt. According to local news stories, Carl Summers of the Lee County Historical Society said that he thought there might be funds available in an 80-20 match from federal grant funds for restoration, but that the bridge would have to be restored at its old site. Summers said that such an arrangement would probably cause the restoration to cost more than restoration elsewhere using only locally raised funds.

A proposal by the Opelika Kiwanis Club, which Ross finds particularly unappealing, would place the bridge in an existing municipal park on Rocky Brook Road, along with playground equipment and an amusement park railway. "The park is too crowded" to offer a suitable placement for the 76-ft. span in Ross's judgment.

An alternative site favored by Ross is on a stream now called Pepperell Creek, but which has also been known as Perryman's Creek, Frazier's Mill Creek, and Saugahatchee Creek. The Pepperell site features the intact abutments of a previous covered bridge, with a span of 61 ft. Ross estimates that given the 42-in. spacing of the pins in the Salem-Shotwell web structure, it could be shortened by about 10 ft. for placement on the Pepperell abutments. An additional advantage of the Pepperell Creek site is that it is just downstream from another notable bridge, a reinforced-concrete arch dating from the late 1920s or early 1930s, and is immediately upstream from the former Frazier's mill site.

News coverage of this story in the Alabama newspapers has been extensive and thorough, with numerous photographs of the recovery and the repairs.

Neill Herring

N.B.: At press, report came that local government officials have chosen to re-erect the bridge at an undeveloped site over Rocky Brook Creek in Opelika Municipal Park.



Salem-Shotwell Covered Bridge.



The collapsed Town-lattice trusses of the Salem-Shotwell Bridge, June 2005. The trusses have since been salvaged and will be repaired and re-erected at a new location.

NOTES & QUERIES

Info Sought on Tread-Wheel Mills. The City of O'Fallon (MO) is researching an old grist mill said to have been powered by oxen or "young bulls" operating a tread-wheel. The era was 1820s-1830s, but the mill continued operating until c. 1867. The mill appears to have relied on animal power when the nearby creek was too low to supply waterpower. Researchers are looking for an expert, details, or drawings of such a mill and sources of information about animal-powered mills of that era and their restoration. Info: Peggy Whetzel, City of O'Fallon, Public Relations Dept.; (636) 379-5506; pwhetzel@ofallon.mo.us.

The Pennsylvania Historical & Museum Commission (PHMC) invites applications for its **2006-07 Scholars in Residence Program**. The program provides support for up to eight weeks of full-time research and study in manuscript and artifact collections maintained by a PHMC facility, including the state archives and museum in Harrisburg or any of 25 historic sites and museums around the state. Residency programs are open to all who are conducting research on Pennsylvania history. Residencies may be scheduled any time during the period May 1, 2006 to Apr. 30, 2007. Stipends are awarded at the rate of \$375/wk. Info: Linda Shopes, (717) 772-3257; lshopes@state.pa.us; www.phmc.state.pa.us.

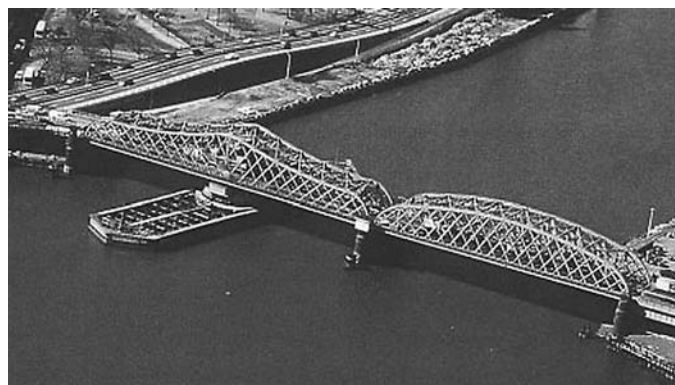
Michigan Technological University Archives and Copper Country Historical Collections is offering research support awards for the 2006 calendar year. Grants are up to \$600 and provide support for travel, food, and lodging to carry out research using the MTU collections. Topical research areas include industrial history, particularly copper mining and its ancillary industries; social history, including workforce issues; immigration and ethnicity; urban and community development along the Keweenaw Peninsula; transportation; and the environment. Review of applications begins on Jan. 23, 2006, and travel must be completed by Dec. 16, 2006. Info: University Archivist, MTU Archives, J. Robert Van Pelt Library, 1400 Townsend Dr., Houghton, MI 49931; (906) 487-2505; fax 487-2357; copper@mtu.edu.

Celebrating John A. Roebling's 200th Birthday. Roebling, best known as an American suspension bridge engineer and wire-rope manufacturer, was born in Muhlhausen, Germany, in 1806, and emigrated to the U.S. in 1831. His work culminated in the design of the Brooklyn Bridge, completed by his son, Washington Roebling, in 1883. The American Society of Civil Engineers (ASCE) will hold a symposium on Oct. 27, 2006 at Polytechnic University, Brooklyn (NY) Campus followed by a two-day Roebling coach tour that will include the Brooklyn Bridge, the Roebling (Delaware) Aqueduct, and the Roebling works in Trenton, NJ. Info: Ted Green, 76 Kingsley Rd., Kendall Park, NJ 08824; tedgreen@comcast.net.

Germany is also rolling out the red carpet for its native son with a series of events to celebrate Roebling's achievements. A postage stamp will be issued to honor Roebling; an exhibi-

tion is planned in Berlin by the International Baukademie of the Stadtmuseum Berlin (May-Sept. 2006); a symposium will be held at the University of Applied Science in Potsdam (June 9-10), and after attending the symposium those interested can travel to Muhlhausen to take part in a birthday party and visit the old houses of the Roebling (Röbling) family. There are also plans to reprint several monographs on Roebling's early life in Germany. For more info, see the homepage of the Potsdam University of Applied Sciences or Google: "Roebling" and "FH Potsdam."

The National Museum of Industrial History (NMIH) in Bethlehem, PA, is selling two CDs as a fundraising project to help preserve a diesel-electric shunting engine once used at the iron-ore unloading docks in Philadelphia. Each CD contains over 100 contemporary color digital photos. The first CD is of **Bethlehem Steel's blast furnace complex** in Bethlehem (tour site—2002 Fall Tour, Lehigh Valley) and the second CD is of **Pennsylvania RR Pier 122**, the unloading dock where ore was received for shipment to Bethlehem. Both sites will see major changes in coming years as the steel mill is redeveloped and the pier is being considered for other uses. The Bethlehem CD includes a digital copy of *The Blast Furnace Division*, a full-length 1950 book from the Bethlehem Steel Collection of the National Canal Museum. The CDs cost \$12.60 ppd. each, or \$21.08 ppd. for both. Info: NMIH, 530 E. 3rd St., Bethlehem, PA 18015. ■



The Willis Avenue Bridge, which has served NYC for over 100 years as a major connection over the Harlem River between Manhattan and the Bronx, is being replaced. At the request of the NY State Historic Preservation Office, the bridge's two main spans are being offered for re-use at a new location. The lattice trusses of both spans are constructed of heavy built-up steel members. The bridge designer was Thomas C. Clark, and the fabricator was the Edge Moor Bridge Company, DE. One span is a rim-bearing swing-span measuring 301-ft. long, 44-ft. deep at the center, and 66 ft. wide. The fixed span is 244-ft. long, 40-ft. deep at the center, and 66-ft. wide. The bridge will be available for re-use about Spring 2011. Info: Balram Chandiramani, P.E., Director of Movable Bridges, NYC DOT, (212) 788-1830, bchandiramani@dot.nyc.gov.

IA ON THE WEB

Allied Erecting & Dismantling (www.aed.cc) has video of some of their handiwork. The first clip shows the demolition of the blast furnaces at US Steel's Ohio Works.

Danbury Railway Museum (www.danburg.org). Info on Connecticut museum as well as interesting listing of railroad-related links.

Graffiti Archaeology (www.grafarc.org) traces the evolution of graffiti on tunnels, buildings, walls, and other structures in the Los Angeles area. Allows the viewer to "peel away" the layers of graffiti, in effect creating a pictorial history of the site over many decades. The digital effects are amazing. The site won a "Webby" award from the International Academy of Digital Arts and Sciences (the online equivalent of an Oscar).

Making of America (www.hti.umich.edu/m/moagrp/). The University of Michigan's digital library of more than 8,500 books and 50,000 journal articles with 19th-c. imprints. The collection's focus is American social history, but it is particularly strong in related industrial and technological subjects, like factory work and civil engineering.

Manufactured Gas Plants (www.hatheway.net). Historical background and locations of former plants in all 50 states, as well as information on how they worked and issues surrounding their environmental cleanup.

Minnesota Reflections (<http://reflections.mndigital.org>) is a digitized library of more than 6,000 historic images of people and places in Minnesota, including a large number of IA sites. The St. Paul District office of the U.S. Army Corps of Engineers contributed images from the Henry P. Bosse collection. Bosse was a Corps draftsman who took photos of the Upper Mississippi between 1883 and 1892. His images include long-vanished vistas of bluffs and coulees, rapidly growing cities, workboats pulling snags out of new channels, rock quarries, dredging operations, and construction of dams and bridges.

"Modern" Ruins Photography (www.undercity.org and www.oboylephoto.com/ruins/). Two of the growing genre of Web sites devoted to the photography of industrial ruins and underground infrastructure, like subway tunnels, sewer pipes, etc. Eye candy for the industrial archeologist.

Portside New York (www.portsidenewyork.org) is an organization that seeks to revitalize New York City's waterfront, particularly Red Hook (tour site—2002 Annual Conference, Brooklyn). The Web site describes the group's activities and plans for a maritime museum.

Raspberry Island Lighthouse (www.nps.gov/apis/rasprest.htm). Details of the \$1.3 million rehabilitation of the Apostle Island lighthouse that has guided shipping on Lake Superior since the early 1860s.

Sewer History (www.sewerhistory.org). Exhibit and historical background of sewerage conveyance systems; includes many types of pipes and pipe materials from ancient to modern.

Steam Engine Library (www.ulster.net/~hrmm/diglib). Digitized collection of historical documents relating to the history of the steam engine. Created by the History Dept., Univ. of Rochester.

"IA on the Web" is compiled from sites brought to the editor's attention by members, who are encouraged to submit their IA Web finds by e-mail: phsianews@aol.com. David Guise ■

SITES & STRUCTURES

On July 6, the **Independence Seaport Museum** (Philadelphia) successfully rescued the **45-ton, 4-cylinder, triple-expansion steam engine** of the 1901 ferry *Elizabeth*. Originally named *Lakewood*, the ferry was built at Harlan & Hollingsworth in Wilmington, DE (tour site—2004 Fall Tour). She was part of the Central RR of NJ's ferry line, carrying passengers between Jersey City and Manhattan until 1967, when she stopped operating. Her final use was as a floating restaurant on Philadelphia's Delaware River waterfront in the 1990s. Initial inspection finds the engine to be in very good condition. The plan is to clean and restore the engine for eventual display. The museum is seeking volunteers and funds to help pay the costs of the engine's rescue and restoration. Those interested in volunteering should contact Karen Cronin (kcronin@phillyseaport.org), or to make a donation, Kevin McNamara (kmcnamara@phillyseaport.org).

Tallassee Mills in Tallassee, AL, about 35 miles northeast of Montgomery, will be closing after 161 years of operation, reports the parent company, Mt. Vernon Mills, Inc. The old stone mill along the Tallapoosa River once made fabric for slave clothes and Confederate uniforms. It is believed to be the oldest continually operated cotton-cloth weaving mill in the U.S.—*Augusta (GA) Chronicle*, Aug. 14, 2005.

The **Southern Forest Heritage Museum** in Long Leaf, LA (tour site—1997 Fall Tour) has recently restored the "creek boiler house," a one-story, corrugated-metal-sided building with a clerestory roof that contains the site's only vertical steam boiler. The boiler house provided steam to the nearby pumphouse. SIA members who attended the 1997 Fall Tour may recall that the museum is located on the grounds of a 1910s sawmill that closed in 1969. The site, overgrown with woods and vines, was littered with equipment, including skidders and locomotives. The museum has made great progress in cleaning up the site and protecting the buildings and machines. The museum escaped the recent hurricanes relatively unharmed. Info: <http://forestheritagemuseum.org>. ■

CALENDAR

2006

Mar. 10: Business History Symposium, Hagley Museum & Library, Wilmington, DE. Topic: How Business Users Shaped Modern Technologies ... and Vice Versa. Info: Carol Lockman, (302) 658-2400, ext. 243; clockman@hagley.org.

Mar. 21-26: Convention of The International Committee for the Conservation of Industrial Heritage (TICCIH), Santiago, Chile. Theme: "Valorization of Industrial Heritage." Paper proposals requested by Jan. 10; Paper sessions and tours including nitrate mine, Larmahue waterwheels, and trans-Andes train trip (Rio Blanco). Info: Jaime Migone Rettig, 56-2-2017193; [ticcihchile@gmail.com](mailto:ticchichile@gmail.com).

Mar. 29-Apr. 2: Second International Congress on Construction History, Queens' College, University of Cambridge, UK. Info: www.chs-cambridge.co.uk.

Apr. 27-30: Preserving the Historic Road Conference, Boston. Info: www.historicroads.org.

May 15-19: National Park Service's Archeological Prospection Workshop, St. Simons, GA. See article in this issue. Info: Steven L. DeVore, NPS Midwest Archeological Center, Federal Bldg., Rm. 474, 100 Centennial Mall North, Lincoln, NE 68508; (402) 437-5392, ext. 141; steve_de_vore@nps.gov; www.cr.nps.gov/mwac.

June 1-4: SIA ANNUAL CONFERENCE, ST. LOUIS. Paper proposals requested by Jan. 31. See article in this issue. Info: events@siahq.org; www.sia-web.org.

June 8-10: Business History Conference Annual Meeting, Toronto. Info: BHC, Box 3630, Wilmington, DE 19807; www.thebhc.org.

June 8-11: Rails in the Rockies II; 2006 Railway & Locomotive Historical Society Convention, Albuquerque, NM. Rail excursions in northern NM and southern CO. Info: www.rhls.org.

June 9-11: Railroad Station Historical Society Convention, Helena, MT. Tours of stations, bridges, tunnels, roundhouses, and shops; annual banquet with speaker. Info: Art Peterson, 3200 Gordon Dr., Greenville, NC 27834; (252) 756-7380; stationarchives@msn.com.

June 14-17: Vernacular Architecture Forum Annual Meeting, New York. Theme: City Building. Info: vernaculararchitectureforum.org.

July 3-9: Brunel Bicentenary Week, Bristol and London, U.K. Tours and conferences explore and evaluate the engineering legacy of Isambard Kingdom Brunel (1806-1859). Info: www.ice.org.uk/conferences.

July 18-23: National Railway Historical Society Annual Convention, New Philadelphia, OH. Seminars, tours, and rail excursions. Info: Buckeye Rails 2006, 2025 Zumbuhl Rd., PMB 80, St. Charles, MO 63303.

Sept. 12-14: World Canals Conference, National Canal Museum, Easton, PA. Theme: Industry to Recreation: Greening the Coal Canals. Info: NCM, 30 Centre Sq., Easton, PA 18042-7743; www.canals.org.

Sept. 14-23: XIII Congress of The International Committee for the Conservation of Industrial Heritage (TICCIH), Terni, Italy. Paper sessions and multi-day tours to Italian industrial centers and museums. Info: Congress Secretary TICCIH 2006, ICSIM - via I Maggio, 23-5100 Terni, Italy; fax 0039 0744 407187; www.mnactec.com/TICCIH/conferences.html.

Oct. 19-21: 28th Annual North American Labor History Conference, Wayne State Univ., Detroit, MI. Theme: Technology, Environment & Work. Paper proposals requested by Mar. 1. Info: Janine Lanza, Dept. of History, 3094 Faculty Admin. Bldg., WSU, Detroit, MI 48202; (313) 577-2525; ao1605@wayne.edu.

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