**Paper Sessions Agenda**
**Society for Industrial Archeology 2005 Conference**
**Milwaukee, Wisconsin**

**Session A. 9:00 AM – 10:30 AM**

**Panel A1: Rail**

Chair: Richard Greenwood
Rhode Island Historical Preservation and Heritage Commission

**Recording the Milwaukee Road Shops: The Company's Largest Midwest Facility**

John N. Vogel, PhD
Heritage Research, Ltd.

The shops of the Chicago, Milwaukee & St. Paul Railroad had originally been located at Humboldt and North Avenue, in the City of Milwaukee. They moved to the west end of the Menomonee River Valley, however, in the early 1880s. This was a more accessible location for the growing railroad. The basic shops in the new complex, both for motive power and cars, were in place and operating by 1882. Throughout the remainder of the nineteenth century the shops saw few changes, although the railroad itself grew from one that claimed 2,231 miles of track to one that held almost 6,500 miles.

The first part of the twentieth century saw the railroad continue to grow, as did the shop complex itself. In 1920, the freight car shop, which had been constructed of wood, burned. It was replaced in 1929 by a new, then contemporary building that was 1000 feet long and 195 feet wide. It was a design that employed brick, glass and steel, as well as a year round climate control system. Indeed, it was a dramatic contrast to those structures built 50 years earlier. By 1930, the railroad had grown to include 10,284 miles of track. It had also reached the west coast. In 1937, approximately fifty-five years since the original five-building complex had been constructed, the shop complex had grown to include over 1,250,000 square feet of floor space, employ 2,818 people and occupy 160 acres of land. The last major building constructed in the complex was shortly after World War II when a new passenger car shop was needed. The shop complex continued to operate into the 1980s, when the Milwaukee Road declared bankruptcy. It was subsequently shut down over time. Today, only two smokestacks, associated with the complex's old power house remain.

The Milwaukee Road shop complex, nevertheless, is significant. It was there that the railroad built cars from scratch. That included freight cars, as well as passenger cars in general and the cars for the unique Hiawatha Trains in particular. The Milwaukee Road was also unique because it built from scratch much of its motive power. In fact, over 500 steam engines were built at the complex in the west end of the Menomonee River Valley.

With the complex now gone, it is worth recalling and studying the activities that the railroad pursued in its Milwaukee Shops. I was fortunate enough to have an opportunity in the early 1980s to study the entire railroad shop complex, and document, generally to HAER standards, those buildings in the southern third of the complex. This was done when the State of Wisconsin was considering building a prison on the site. As a result of this work, I have a significant amount of information on the complex, as well as perhaps the most complete photographic documentation generated before the complex was removed.

**A History of the Schenectady Plant and Operations of the American Locomotive Company and its Predecessors**

Richard T. Steinbrenner
On Track Publishers, LLC

The American Locomotive Company was a formidable part of American industrial history. Formed from eight nineteenth century locomotive builders in 1901, it instantly became the nation's largest builder. This was a rank that it held until the massive conversion to the diesel locomotive immediately after World War II. During its remaining decades it maintained a significant share of the business until an unfortunate series of corporate mergers and relentless competition in a shrinking domestic market resulted in its closing of production in 1969.

Throughout its history, ALCO's centerpiece of operation was its Schenectady Works. The first plant was built in 1848 under the banner of the Schenectady Locomotive Engine Manufactory. After building just 13 locomotives, this venture failed in 1850. The original Schenectady investors took over the plant in 1851 and reorganized as the Schenectady Locomotive Works. This operation prospered and enjoyed growth until it became second only to the Baldwin Locomotive Works by the end of the Century.

This paper details the growth of the Schenectady Works in both production and engineering prowess. Part 1 covers the period of 1848 to 1920 and identifies the progression of steam locomotive technology that resulted in the closing of many 19th Century builders, leaving the battleground to two giants, ALCO and Baldwin.

Today, of the steam locomotive builders, the most intact plant is Schenectady, and several of its most notable buildings remain in operation by various tenants – a true testament to the past.

**E. Francis Baldwin: Building the B&O Through Maryland and Beyond.**

Christopher H. Marston
HAER, National Park Service

E. Francis Baldwin was the B&O Railroad's principal architect during its period of greatest expansion, from 1873 to the turn of the century. His work included several monumental works in the city of Baltimore, including Mount Royal Station, Camden Yards Warehouse, and the Mount Clare Roundhouse. He was his most prolific designing smaller stations along the Main Line, the Washington Branch, the Metropolitan Branch from Washington, D.C. to Point of Rocks, and points further west. A great many of his works remain extant in Maryland, and are symbolic reminders of when the B&O Railroad was the state's economic and transportation leader.

The research in this presentation originated from a Historic American Engineering Record (HAER) documentation project at Baldwin's B&O Station at Harpers Ferry, WV. This presentation will examine the context in which Baldwin worked and provide a virtual tour of Baldwin's stations, both extant and demolished, from the Baltimore-Washington corridor, through Maryland and throughout the Mid-Atlantic region. Many of these examples are from the HABS/HAER Collection.

**Panel A2: Medicine and Morbidity**

Chair: Susan Appel, PhD
Illinois State University

**The Evolution of the Anesthesia Machine – Pharmacology, Technique and Technology**

William McNiece, MD
Indiana University & Riley Hospital for Children

When, where and by whom general anesthesia produced by inhaled anesthetic agents was first utilized remains controversial. However, it is clear that the use of diethyl ether (ether) to provide anesthesia (or probably more accurately, analgesia) to a patient at the Massachusetts General Hospital on October 16, 1846 was rapidly followed by use of ether around the world. An account of "etherization" appeared in the Boston Medical and Surgical journal on November 18, 1846. The use of ether was demonstrated in Paris and London in December, 1846. By the end of 1847, ether had been utilized in over twenty countries across the globe.

Nitrous oxide had been used to provide anesthesia for dental extractions in 1844. However, an unsuccessful demonstration of its use as an anesthetic at Harvard Medical School limited its use for about twenty years. By late 1847, chloroform had also become recognized as a clinical anesthetic with initial use in an obstetric population.

These three agents were all that were available until 1923 when ethylene was followed soon by divinyl oxide (divinyl ether), cyclopropane, trichloroethylene and a number of ethers. Fluorine chemistry advanced in the 1940s. This along with other halogen chemistry brought forth a new generation of anesthetics beginning in 1951. With one exception, all currently used inhalational anesthetics are halogenated hydrocarbons, primarily fluronated ethers. The one exception is nitrous oxide, now at about 160 years of clinical use and counting.

These various anesthetic agents have a wide range of characteristics. Some are liquids at room temperature, some are gases at room temperature, where for still others, it depends on just how warm the room is. Some are explosive or flammable while others are not. Some have clinical use at less than 0.2% of an atmosphere while others require over 100%. Costs range widely so for some reuse (rebreathing of exhaled anesthetic) is economically important while for others reuse is economically unimportant. Delivery of anesthetic gas mixtures at an intermittently positive pressure also became important with the evolution of anesthetic technique particularly after the 1940s.

The evolution of anesthetic pharmacology and anesthetic technique could not have occurred without an evolution in the technology of anesthesia machines. The October 16, 1846 ether demonstration utilized a glass chamber containing an ether soaked sponge over which the patient inhaled air. Within a year, John Snow had developed an ether inhaler that provided for better saturation of the inhaled air with ether vapor as well as compensating for the cooling effects of ether vaporization. His later apparatus also included valve mechanisms to direct gas flow. Joseph Clover focused more on chloroform administration and developed an apparatus that provided for the preparation of a reservoir of chloroform in air, which was then administered to the patient through a flexible hose and facemask. Much simpler administration equipment was also utilized. A number of "inhalers" were developed for the administration of ether or chloroform in air.

Liquid nitrous oxide (in a tank) became available commercially in the United States in 1872. Compressed oxygen was also available but its clinical use was still suspect in 1888. The use of nitrous oxide in tanks made the anesthetic much easier to transport but added new technical problems of pressure reduction and icing of valves. Gasometers, reservoir bags, and warming devices were initially used to address these problems gradually evolving to pressure reduction valves and purer gas supplies. With time, apparatus to blend nitrous oxide and oxygen and also to add ether to the mixture evolved.

Gas flow meters were initially introduced in 1912. The initial technology allowed only rough estimation of gas flows. As new agents were introduced in the 1920s, more accurate meters also began to be utilized.

The introduction of halothane into clinical practice in 1956 occurred soon after the introduction of a new method of vaporizing liquid anesthetic and blending it with a bypass flow of gas. This new method allowed the anesthetic concentration to be controlled much more accurately which was essential to the clinical use of halothane. The vaporizer could be utilized for the administration of a number of different anesthetic agents, a major advantage at a time when a number of different anesthetic drugs were being introduced into clinical practice. An alternate technology for the more accurate delivery of volatilized anesthetic was the agent-specific, flow and temperature compensated vaporizer. Initially, this technology was limited in acceptance because separate vaporizers were needed for each anesthetic agent. With time, the agent specific, flow and temperature compensated vaporizers supplanted the universal vaporizers.

The introduction of desflurane into clinical practice in 1993 added yet another technical challenge. Desflurane boils at 23.5$^{o}$C (74.3$^{o}$F) with the result that depending on the actual room temperature, the compound may be a liquid or a gas.

The presentation will focus on the technological evolution of the anesthesia machine but will include some comments on the parallel evolution of anesthetic pharmacology and clinical care to help the audience better appreciate the relationship of technology and clinical care in the evolution of anesthesia.

**Inhaling a Microscopic Artifact: Asbestos Dust and the Vermiculate Mine at Libby, Montana**

Fredric L. Quivik, PhD
Consulting historian of technology

The vermiculite mine at Libby, Montana, supplied 80% of the vermiculite used in the United States between the 1920s, when vermiculite's value as an industrial mineral was developed, and 1980, when the mine closed. During that entire time, the owners and operators of the mine knew that asbestos was also present in the vermiculite ore body. And for at least half of that time, the owners and operators knew that the asbestos posed a serious health hazard, at least to the men who worked in the vermiculite mine and mill. Nevertheless, little was seriously done to abate the hazard until the last few years of the mine's operation. Meanwhile, residents of the community developed a comfortable relationship with the ore, with the finished product, and with the byproducts of the operation. Understanding the dust associated with the vermiculite to be only a "nuisance dust," folks in the community did not try to avoid exposure to it. As a consequence, screening of Libby residents by the Agency for Toxic Substances and Disease Registry has found that hundreds of persons, many with no occupational or family connection to the vermiculite operation, have developed asbestos-related diseases.

Based on my experience working as an expert witness for the U.S. Department of Justice in the Superfund litigation wherein the United States sought to compel W.R. Grace, the owner of the mine, to pay the Superfund remediation costs, this presentation will seek to understand the relationship a community may develop with an artifact such as industrial dust. I will develop that understanding by exploring the "meaning" that vermiculite dust came to have in the life of the community and how that meaning changed over time. The paper will include a brief history of the vermiculite operation and an overview of the Superfund response. I will conclude by suggesting that, while a scientific understanding of asbestos dust now gives us, and the people of Libby, an abstract awareness of what it may mean to the health of people who breathe it, daily experience with the dust has instilled in the people of Libby many other meanings as well, ranging from “nuisance” in the past to today’s powerful significance like: agent of death, emblem of corporate irresponsibility, or destroyer of community economic well-being.

**The Underclass and Infirm in the Industrial Age: A View from the Milwaukee County Poorhouse Cemetery**

Sean P. Dougherty, Department of Anthropology, Indiana University
Norman C. Sullivan, Department of Social and Cultural Sciences, Marquette University

Milwaukee underwent a migration of labor during the late nineteenth century with the population growing at an average of 48% from 1870 to 1930. An expanding population generated social problems including homeless people, the chronically ill, people maimed in industrial accidents and orphans. Eleemosynary institutions were established to house the bereft and the ill who, at the end of their lives, were interred in an almshouse cemetery. The remains from the cemetery have been the focus of a long term project with the overall aim of characterizing the biological experiences of recent immigrants in an industrializing community.

The almshouse cemetery sample is overwhelmingly biased towards males. The age profile is significantly skewed with more than 90% of the subadults dying before completing the first year of life. All age classes are at least represented among the adults, but this profile is also skewed with a majority of individuals having an age of beyond 40 years. Unusually high rates of trauma and infectious pathologies have been observed in the adult sample. These data serve to illustrate the rigors of life among laborers with an infirmity that likely rendered them unable to continue participation in the workforce.

**Panel A3: Midwestern Bridges**

Chair: Perry S. Green, PhD
University of Florida

**Preserving and Restoring Three Milwaukee Type Bascule Bridges**

Bob Frame, PhD
Mead & Hunt, Inc.

This presentation focuses on the city of Milwaukee's initiative to preserve and restore three National Register-eligible bascule bridges: State Street Bridge (1924), Kilbourn Avenue Bridge (1929), and Cherry Street Bridge (1940). Each is an excellent example of the Milwaukee Type bascule design, which was first employed in the Emmber Lane Bridge (nonextant) in 1904. Each crosses the Milwaukee River within a short distance of each other in the northern end of Milwaukee's commercial district. Each bridge represents a different architectural presentation of the basic Milwaukee Type bascule engineering design and each presented different challenges to the city in its rehabilitation program.

In 1996 representatives of the city, FHWA, WisDOT, Wisconsin SHPO, and the Advisory Council signed a programmatic agreement (PA) to implement a preservation plan for selected surviving bascule bridges in Wisconsin, including the three bridges discussed in this presentation. The PA was the culmination of WisDOT's efforts to manage its historic bascule bridges, which began with a statewide survey in 1986 by Jeffrey Hess and this presenter. In 1996 an intensive survey reassessed the remaining bascules, made determinations of National Register eligibility, and prepared a Historic Preservation Plan for Bascule Bridges (HPP). The PA codified recommendations in the HPP.

To carry out the stipulations of the PA, Mead & Hunt was commissioned to prepare city Site Designation Applications (SDA) and Historic Structure Reports (HSR) for the three Milwaukee bascules discussed here. The HSRs include guidelines for city rehabilitation projects for each bridge. This presenter has prepared two of the three HSRs. To date, the State Street Bridge has been restored under the provisions of the PA . Kilbourn Avenue Bridge will undergo a major rehabilitation and restoration project in the near future. Cherry Street Bridge was restored and, in part, reconstructed in the 1990s, but an electrical and mechanical rehabilitation project is planned for the future.

**Bridging the Centuries**

Bob Teske
Richard Teubert
Kevin Abing
Milwaukee County Historical Society

In order to partially mitigate the loss of the North Port Washington Road Bridge and the Greentree Road Bridge spanning the Milwaukee River, and in order to encourage a greater appreciation for the significant role played by bridges in the growth and development of metropolitan Milwaukee, the Milwaukee County Historical Society is organizing a traveling photographic exhibition documenting the history, technology, and aesthetics of the major spans which have connected the city's East and West Sides, as well as its North and South Sides, over the last 150 years.

Design, construction, and distribution of the exhibition by the Historical Society is being underwritten by a total of $10,000 contributed by the Wisconsin Department of Transportation, as stipulated in the Memoranda of Agreement governing the replacement of the North Port Washington Road and Greentree

Road Bridges.  The traveling exhibition will be completed, installed at the Milwaukee County Historical Society, and made available for presentation at other venues during the course of the next year.

Staff members from the Milwaukee County Historical Society will discuss the approaches taken to preparing this exhibition, including the selection of photographs, writing of text, and design of computer-generated panels.  Staff will also discuss the placement of the exhibition at local schools, libraries and museums.

**Transporter to Vertical Life:  The History of Duluth's Aerial Lift Bridge**

Richard M. Johnson, P.E.
HNTB Corporation

Minnesota Point or "Park Point" is a scenic park area located on a peninsula that extends into Lake Superior from Minnesota.  To provide access to the port of Duluth for the iron ore ships that traveled across the Great Lakes, a canal was cut through the peninsula in 1871.  In the late nineteenth and early twentieth century there was a great demand for a safe reliable means to cross the canal.  After exploring many alternatives, a transporter bridge (suspended gondola bridge) was considered the best solution and eventually constructed.  Although this was not a new concept, it was unique in the United States. Duluth's transporter bridge was patterned after a suspended car bridge in Rouen, France.  As travel demands across the canal increased in the twentieth century, a need to effect a more efficient land based transportation solution was met by converting the transported bridge to lift bridge.

In the fall of 1870, the city began the excavation of a ship canal across Minnesota Point.  Work was completed by the winter of 1871.  Residents of Minnesota Point continued to travel across the canal, during the open season, in row boats, and during the closed season on the ice, or, for a number of years, on an improvised suspension foot bridge.

Completed in 1905, Duluth's new Aerial Transfer Bridge carried up to 62-1/2 tons including automobiles, horses and wagons, and pedestrian traffic.

After about 20 years of operation, it became obvious that the Aerial Transfer Bridge could not keep up with increasing demands. Again several designs for an alternate bridging scheme were examined, rejected, and re-examined, until a final aerial lift bridge plan was selected. The new design incorporated major structural elements of the original bridge, including the fixed head span and the two towers, reducing both cost and construction time.

The old head span of the transporter bridge was raised 42 feet higher and strengthened it for its new role. New towers were also built, but inside the old ones. The vertical lift span was built new with two lanes for vehicles, including streetcars, and two walkways for pedestrians. There was no toll or fare for using the new bridge when it was completed in 1930, and there is none today.  Rehabilitation occurs every 15 to 20 years to maintain the bridge.

**Session B. 10:45 AM – 12:30 PM**

## Panel B1: Maritime and Associated Industries

Chair: Robert Stewart
Historical Technologies

### The Apex of Wooden Shipbuilding: The Great Lakes Bulk Carrier *Appomattox*

Keith Meverden
Wisconsin Historical Society

The close of the nineteenth century brought with it the twilight of wooden ship building. Advances in steel ship construction eclipsed the wooden vessels in size, weight, and cost. Michigan shipbuilder Captain James Davidson, however, continued to not only build wooden vessels at a time when most shipyards were converting to steel, but pushed the accepted limits of wooden vessel construction while maintaining a competitive commercial edge.

In 1896, the Davidson shipyard launched the 319-foot *Appomattox*, the largest wooden steamer ever to ply the Great Lakes, and possibly the world. Following centuries of refinement in wooden ship construction, Davidson's vessels were the product of the most advanced wooden technologies witnessed by the shipping industry. In 1905, blinded by heavy industrial smoke emanating from Milwaukee, the *Appomattox* ran hard aground north of the Milwaukee harbor entrance. Unable to be freed, the *Appomattox* was stripped and abandoned.

Today, the *Appomattox* lies in 20 feet of cold Lake Michigan water, with major hull sections well preserved. The remains of the *Appomattox* illustrate the apex of wooden ship construction techniques, incorporating the use of steel reinforcements to provide rigidity to flexible wooden hulls.

### The Canneries of Los Angeles' Fish Harbor: Rise and Fall of an Industry

Andrew Schmidt
Katy Lain
Jones & Stokes

The American tuna canning industry did not exist until a small sardine cannery at the Los Angeles Harbor began marketing tuna as an alternative in 1903. Technological advances, changing tastes, and capital investment by canning companies and the Harbor Department, propelled Los Angeles into a world leader in tuna canning by the 1950s. Starkist and Chicken of the Sea plants were based in Los Angeles' "Fish Harbor." Along with smaller operations, the canneries employed 5000 workers and produced 9 million cans of tuna in 1958 alone.

However, as a labor-intensive industry dependent on raw materials hundreds of miles away, the Los Angeles tuna canning industry fell prey to the same global economic forces that shifted much of America's heavy industries overseas during the 1970s and 1980s. Two vacant yet extant plants – the Pan Pacific Cannery and the Canners' Steam Company – illustrate the daily operations of this once vibrant industry during its zenith in the 1950s.

**The *Fish Hawk*: The Persistence of Wood in Atlantic Fishing Vessel Design**

Andrew Lydecker
Panamerican Consultants, Inc.

At the turn of the century, menhaden fish, or "pogie" as they are nicknamed, swam in large schools all along the Atlantic seaboard. Menhaden fishing in the Port of New York, as a profitable industry, began in the 1860s. Initial efforts to develop menhaden as food failed because of its oiliness - profit instead was made by processing the fish oil for use in tanning and paint production, with the resulting scrap processed as a fertilizer. Steamers for servicing the trade were built specifically as menhaden trawlers and began appearing in large numbers in the 1870s. Their hulls were wooden with most members being made of oak and pine. The menhaden steamer's basic design survived until quite recently, with vessels built in the latter part of the century powered by diesel engines and built of steel. Initially thought to have been constructed in the early twentieth century, the *Fish Hawk* was determined, through archival research in 2004, to have been constructed in 1949 by an employee of the J. Howard Smith Company. Working at the Smith plant in Beaufort, North Carolina, Mr. Elmo Wade constructed some fifteen vessels for the Smith Company between 1945 and 1957. The significance of the *Fish Hawk* lies in the fact that by the middle of the twentieth century, most, if not all, menhaden processing companies, including the J. Howard Smith Company, were building their trawlers from steel. The fact that wooden construction was being used so late is significant in and of itself, but the vessel is also an example of the construction methods of Elmo Wade. Investigations in 2004 determined that Mr. Wade used somewhat unconventional methods in the construction of his vessels, including the lack of cant frames at the bow and stern, the use of sawn rather than steam bent timbers to construct curves, and the inclusion of decorative elements not expected on a vessel likely to be subject to constant use and abuse. This paper will discuss the archeological remains of the *Fish Hawk* and examine the persistence of it and similar wooden vessels in the face of the changing technology of the industry.

**Uneasy Spirits: Salvage Archaeology at an Early Distillery**

Richard Greenwood
Rhode Island Historical Preservation and Heritage Commission

Rum was a valuable commodity in eigthteenth century domestic and foreign trade and distilling became one of the most prevalent industries in the port towns of New England as Yankee merchants increased their profit margin by producing their own rum from Caribbean molasses. Following a sharp drop in the market for rum in the early 19$^{th}$ century, distilling declined dramatically. The physical record of this early industry was largely obliterated as other uses usurped its waterfront locations.

In the fall of 2000, the remains of an 1802 rum distillery on the Bristol, RI waterfront were uncovered in the course of a redevelopment project. The salvage archaeology that followed provided a valuable look into this early and little-documented industry.

## Panel B2: Extractive Industries

Chair: Tom Garver
Art critic and historian, former director Madison Art Center

### Pit Charcoal Production Archaeology in Nevada and California

Ronald L. Reno, Geoarch Sciences, Inc.
Susan Lindstrom, Consulting Archaeologist
Allika Ruby, Far Western Anthropological Research Group
Rob McQueen, Summit Envirosolutions, Inc.

Massive amounts of fuel were required for extensive smelting industries in the western United States. In places where mineral coal was not available for making coke, charcoal was used for fuel. Although permanent stone, brick, or adobe kilns were commonly used for this purpose, these features are far outnumbered by temporary earth-covered kilns called charcoal pits. Excellent preservation and good ground visibility in many of these areas allows for inspection of complexes with hundreds of charcoal pits and related features across past industrial landscapes. This poster compares major nineteenth-century complexes near Eureka (Nevada), Truckee (California), and the Coso Range (California). These complexes were managed by a variety of ownership systems and worked by individuals including Chinese, Mexicans, and Swiss-Italians. A combination of archival study, surface recording, excavation, and dendrochronology reveals intricate interior construction details, nuances of the range of variability and similarity of construction methods, and periods of use.

### A Smelter's Life: Lead Smelting in the Upper Mississippi Valley as seen from the British Hollow Smelter Site (47GT510)

John H. Broihahn
Wisconsin Historical Society

Galena utilization by American Indian communities began at least 3500 years ago and smelting is evident by the mid-seventeenth century in the Upper Mississippi Valley Lead and Zinc District. Indian women miners and male smelters expanded their activities through the eighteenth and nineteenth centuries as the demand for lead increased and the area was drawn into the international economy.

Camp-hearth, hopper and crib smelters slowly gave way to the log furnace and eventually to the diffused ore-hearth and reverbertory technologies as Euro-American and European settlers flooded into the area. Archeological and archival investigations at the scotch-hearth British Hollow Smelter site (47GT510) revealed it could have been constructed as early as 1838, but was probably built between 1847 and 1850. It operated on a regular basis through the Civil War. It opened again in the early 1870s, closed, and then was operated one last time in 1885-1886. The smelter was primarily a family business having a minimum of seven owners or operators, all but two being affinitive kin.

The limestone construction, the vaulted ceilings, the buried chimney flue, and a building site created by excavating into the toeslope of a ridge make this furnace unusual and reflect a Trait Unit Intrusion of English/Yorkshire derivation. While it is unique in physical layout and in other aspects of its construction, it seems typical in many respects to smelters that operated in the UMVLZD during the early and middle years of the nineteenth century. Construction materials, container glass, ceramics, faunal remains, personal items, and wrought iron and steel tool and machinery parts have been recovered from undisturbed contexts at the site.

**Brownstone Quarries of the Apostle Islands in Northern Wisconsin**

Nancy Farm Männikkö, PhD
Midwest Regional Office, National Park Service

This paper describes the history and current condition of four brownstone quarries found on three islands located within the boundaries of Apostle Island National Lakeshore in northern Wisconsin: the Bass Island Brown Stone Company quarry and Breckinridge quarry on Basswood Island, the Excelsior Brownstone Company quarry on Hermit Island, and the Ashland Brownstone Company quarry on Stockton Island. These Apostle Islands brownstone quarries served as a proving ground for the nineteenth century upper Great Lakes sandstone quarrying industry. Scientific testing conducted by the Smithsonian Institution in 1869 validated the use of Lake Superior sandstone in construction of the new Milwaukee County Courthouse, and led to a surge in brownstone quarrying throughout the region. Within a few years, stone from the Apostles and other quarries in the region found its way into structures nationwide. At the peak of the brownstone boom hundreds of quarries operated in Minnesota, Wisconsin, and Michigan. Tastes in building stone changed quickly, however, and by the early 1900s all four Apostles quarry sites lay abandoned.

**"Sugar Mines" of the Caribbean: Technology, Environment, and the Impact of Agro-Industrialism in the Periphery**

Marco Meniketti, PhD
Michigan Technological University

Agro-industrialism in the Caribbean was a driving force in the Atlantic economy during the seventeenth and eighteenth centuries. As an institution, the sugar colonies had far-reaching impact on the emerging world system out of proportion to their size. Colonial landscapes from this period reveal the intricate web of influences that bound peripheral regions to the core state. Archeological evidence from Nevis, a once vital node of the British sugar industry in the Lesser Antilles, is presented to illustrate how tropical based agro-industrialism propelled the rise of capitalism. Several mill complexes on the island are compared to illustrate aspects of technological development, landscape change, and economic interdependency. Parallels are drawn between the descendant communities of these "sugar mines" and communities of more traditional mining contexts.

**Panel B3: From the First Superhighway through the Interstate Act: Roads as Indicators of Changing Highway Policy**

Chair: Bruce Seely
Michigan Technological University

With the approaching fiftieth anniversary of the landmark legislation that made possible construction of the Interstate highway system, it seems important to recognize that he 1956 act did not mark the origin of this most famous highway program. Highways built before 1956 clearly demonstrate this fact. And an examination of these earlier roads helps to set the achievement of the Interstate system in its proper context. The present system represents the culmination of highway policy and the interaction between the federal government and the states that began with the very first superhighway – the 1923-1932 approach road to the Holland Tunnel in New Jersey – and which continues on a few segments of Interstate highway even today. This panel will examine from two perspectives technical antecedents to the passage of the 1956 Federal-Aid Highway Act that enabled large-scale construction of the famous Interstate system, and then discuss the history of the 1956 legislation itself as a response to these technical contexts.

**America's First Superhighway: New Jersey Leads the Way**

Mary E. McCahon
Lichtenstein Consulting Engineers, Inc.

Long before 1956, the state of New Jersey designed and constructed the nation's and possibly the world's first superhighway – one intended for unrestricted, high-speed through use. The approach road to the Holland Tunnel, planned and built between 1923-32, was the first time in this country that economic theories of location and operation were applied to the planning and design of an unrestricted-use, limited access, vehicular highway, a concept that was not successfully repeated until the Pennsylvania Turnpike in the late 1930s. The highway was a brilliant solution to urban traffic congestion designed and completely funded by the state of New Jersey because of the restriction of federal funds in urban areas. The highway set the precedent and the standard for the planning and design of all subsequent high speed highways. The presentation will explain the evolution of this seminal achievement and the context of urban highway design and federal policy prior to the mid 1930s.

**Turnpikes, Expressways, and Bypasses, 1936-1955: The Birthing Grounds for the Interstate Highway System**

J. Patrick Harshbarger
Lichtenstein Consulting Engineers, Inc.

During the mid-1930s, many state and city governments began moving beyond the traditional emphasis on improving existing roads and streets to planning superhighways. The economic depression and then World War II prevented much actual on-the-ground progress, the Pennsylvania Turnpike (1938-41) being a notable exception. In the postwar years, construction began in earnest with each state and city following its own tendencies and patterns, addressing needs identified by traffic studies, often sponsored under federal planning grants. For example, Georgia started on an expressway system for Atlanta, while Maine built a turnpike to carry the heavy seasonal traffic between Kittery and Portland. North Carolina began carrying out a plan to build more than sixty bypasses to take state routes around small towns and cities and get through traffic off of the state's "main streets." Irrespective of high hopes, many states and cities struggled; the most difficult problems were as much political and financial as technical. Businessmen and property owners fought limited access in the courts, city officials argued over the precise location of the roads, many highways were below capacity from the day they were built because of the exponential growth in automobile usage, and engineers underestimated high costs and lengthy construction schedules. Even more importantly, state and city governments discovered that they simply could not afford to build the expensive highways under the existing federal-aid funding arrangements. By the mid-1950s, many urban expressways, in particular, were in a decidedly incomplete state after nearly a decade of work. Despite the problems, the planners and engineers laid the figurative and literal foundations for what eventually would become interstate highway routes, even though agreed-upon national construction and design standards did not yet exist. By the time the Federal-Aid Highway Act of 1956 passed Congress, more than twenty percent of the 41,000 mile-long system had already been built or located. This paper will look at the advances and the limitations of these formative years of interstate highway development prior to 1956, including looking at the design and physical features of the turnpikes, expressways, and bypasses (e.g., bridges, interchanges, pavements, roadway geometry) from actual surveys in several states.

**The Interstate Program: The Legislative Response**

Bruce Seely
Michigan Technological University

This paper will explore the background to the passage of the legislation that launched the world's largest public works history project. It will track the policy history from the late 1930s and the publication of the famous report, *Toll Roads and Free Roads* through the 1950s, identifying the various key steps on the way to a final policy formulation in 1956. The paper emphasizes the role of the leadership of the Bureau of Public Roads in shaping this outcome, and the pivotal steps in finding the funding mechanism that allowed the bill to pass. It will pay special attention to the role of the Clay Committee in this process. And throughout, the paper will draw upon the background of the previous two papers in demonstrating how the 1956 legislation rested upon ideas and goals developed over the preceding two decades.

**Session C 2:30 PM – 4:15 PM**

**Panel C1: Methods**

Chair: Nanci Batchelor
Withum, Smith & Brown

**The Archaeology of the Pullman Community: An Ongoing Collaboration in Industrial Archaeology**

Jane Eva Baxter, PhD DePaul University
Scott J. Demel, PhD Field Museum of Natural History

In 2004, DePaul University began a long-term project in the Pullman neighborhood located on the south side of Chicago. The former company town is often touted as the first planned industrial town in America. Archeological investigations in the community are focused on exploring the dynamics and experiences of labor in a late nineteenth and early twentieth century industrial community, as well as assisting community-based historic preservation groups in the interpretation of their past. To meet these broadly stated research goals, archeological investigations are to involve industrial, domestic, and public areas of George Pullman's planned community. The 2004 season included survey and excavation work among some of the former industrial structures, and the Hotel Florence in the center of the Pullman community. This poster details the preliminary results of the 2004 season as well as a presentation of the goals and plans for this long-term research project.

**Multidisciplinary Approaches to Understanding Industrial Sites: Examination of the Van Winkle Mill in Northwest Arkansas**

Alicia B. Valentino
University of Arkansas

Articles published in *IA* during the past several years have suggested new directions for the field of industrial archeology. Using a multidisciplinary approach, many of these topics, including labor history, landscape and environment, and technology will be examined at the nineteenth-century Van Winkle Mill in northwest Arkansas. During its operation, this Mill was the most advanced sawmill and gristmill operation in the Ozarks.

Today, the site lies in ruins with few above surface remains. This preliminary report on the approaches utilized in the investigation of these remains illustrates the potential of varied approaches to understanding an industrial site.

**Industrial Forensics: The Managerial and Operating Ethos of a California Sawmill**

Efstathios I. Pappas
University of Nevada, Reno

Industrial archeology as a discipline provides a multitude of tools and approaches to researchers interested in the nature of capitalism, managed productive enterprise, and technology. One of the most valuable aspects of this discipline is the ability to reconstruct the physical layout, operations, and strategies employed in different industrial installations. Forensic analysis as used in this discussion refers to specific material culture analysis which attempts to date, explain use wear, reconstruct industrial processes, and managerial strategies employed in industrial work places. The use of this type of analysis has the potential to yield data for particularistic studies of a single industrial site as well as place these sites within a broader historical context. For this paper, forensic analysis will be used to illuminate the "patchy" nature of American industrialization where older forms of production such as this case study co-existed with the increasingly modern modes of production.

This study examines a small scale sawmill located in the vicinity of Cantara Loop on the Southern Pacific Railroad near the town of Shasta, California. This mill complex, locally known as Welsh Mill, and its support networks are a well preserved archeological example of a rough cut sawmill which operated roughly between the 1890s and 1910s. Although very little in the way of documentation exists to illuminate the nature of this mill, the physical evidence provides a great deal of information to those who are skilled in the analysis of industrial artifacts, systems, and archeology. From fieldwork and additional research, it is clear this lumbering concern demonstrates a number of attributes which indicate relatively small scale activities being conducted on a small budget.

Through the forensic analysis of Welsh Mill, one may better understand the nature of work at this facility, as well as the managerial ethos under which the mill was constructed and operated. The equipment, technology, and general layout of the operation all point toward a management strategy which resulted in the under-capitalization of the mill due to an actual lack of funding, or a managerial ethos which stressed adaptive reuse, expedient repairs, and a desire to invest as little as possible into the physical plant of the sawmill. This apparent thrift and "make do" attitude is clearly recorded by the use wear, site layout, and technology which survived. The use of equipment, such as the stationary steam engine, which had already seen perhaps thirty years of service prior to the construction of Welsh Mill, and the homemade roller network built of locally available materials provide evidence to support this assertion. It is also clear that this complex had the capacity to produce a relatively large volume of timber products, although these products would have been mostly rough cut or semi-finished lumber at best. The capacity of the drying yard, tramway, and remaining sawdust pile indicate that a large amount of timber was produced for local markets. Thus, production was limited not in terms of volume, but instead by the lack of more sophisticated technologies to produce a wider range of products.

In addition, the managerial ethos stressing thrift was not as thrifty perhaps as the operators might have hoped. To be sure, very little was spent in the mill's initial construction, and it appears that little was spent for the purchase of new or more efficient machinery during operation. However, the use of antiquated technology and used equipment made this production highly labor intensive. Thus, the continued operation and maintenance of this operation most likely proved to be an increasing burden throughout the active life of the facility. The layout of the mill necessitated a great deal of manual manipulation of materials between steps and most certainly did not reflect a rational plan for expedited materials handling. The use of homemade apparatus, or the inefficient mill layout for material flow would have resulted in mounting labor costs which gradually would have outstripped the cost of better designed and executed systems and technology. Thus, perhaps it is no surprise that operations at this mill ceased during the late 1910s. The use of labor-intensive techniques, coupled with a crumbling and poorly designed physical plant would have made it impossible to compete with larger more efficient operations.

Thus, by conducting in-depth material culture analysis, it is possible to understand and reconstruct the managerial techniques used to construct and operate industrial installations. Welsh Mill is an example of an earlier form of industrialism which predated modern engineering, scientific management, notions of efficiency, and sophisticated cost accounting. Instead, this mill is a reminder of an era when industrialism was still part of a vernacular process, where expediency and rule of thumb methods of production held sway in the face of increasingly modern global economy.

**Historic Charcoal Manufacture in Nevada: Using Dendrochronology as a Research and Dating Tool**

Robert McQueen
Summit Envirosolutions, Inc.

The Roberts Mountains, thirty miles north of Eureka, Nevada, are a well-documented and researched charcoal manufacturing district (circa 1870-1890). Providing an invaluable resource to the Eureka Mining District, the pinyon forests on the Roberts Mountains were denuded by a largely Italian immigrant labor force. In the summer of 2003, Summit Envirosolutions, Inc. excavated several sites containing charcoal pits. A primary excavation goal was the recovery of expended charcoal for dendrochronological dating. Results will compliment previous studies in the area and continue to refine our understanding of this industry.

## Panel C2: Made in the Midwest

Chair: TBA

### Passenger Elevator Manufacturing in the Mid-West: 1870 to 1910

Lee E. Gray, PhD
University of North Carolina at Charlotte

The history of the passenger elevator is often told in terms of the story of a single business enterprise: the Otis Elevator Company. This has occurred, in part, as a direct result of Otis' business practices during the latter part of the nineteenth century. By 1898 Otis Brothers had completed much of their attempted consolidation of the elevator industry and, as a result of these efforts, they founded the Otis Elevator Company. This new corporation encompassed Otis Brothers (Yonkers), the Whittier Machine Company (Boston), the Stokes & Parrish Elevator Company (Philadelphia), Morse, Williams & Company (Philadelphia), Smith, Hill & Company (Quincy), the McAdams & Cartwright Elevator Company (New York), the Graves Elevator Company (Buffalo), the Standard Elevator Company (Chicago), the T.W. Eaton Elevator Company (Chicago), and the Crane Elevator Company (Chicago). By 1901 the following additional companies had also "joined" Otis: the Elektron Manufacturing Company (New York), the Fraser Electric Elevator Company (San Francisco), the Plunger Elevator Company (Worchester), the O'Donnell Elevator Company (Cleveland), the Moon Elevator Company (St. Louis), the Burdett-Rowntree Manufacturing Company (Chicago), Gieger-Fiske & Koop (Louisville), the Gardner Elevator Company (Detroit), the Cahill & Hall Elevator Company (San Francisco), and A.J. McNichol & Company (San Francisco). Thus, instead of a diverse history, represented by the stories of numerous individual companies, a single history, that of the Otis Elevator Company, dominates and constitutes much of our understanding of elevator history.

This paper will provide an overview of elevator manufacturing in the mid-west both in reference to the companies that eventually joined Otis and those, like the H.R. Reedy Company (Cincinnati) who were steadfast in their refusal to join "the trust." The vitality of these companies and their contribution to elevator history will be measured through an examination of elevator patents and the significance of the systems developed by mid-western manufacturers compared to those developed by their eastern rivals. The patent study is derived from the examination of approximately 3000 elevator patents awarded between 1850 and 1900. The significance of the companies' inventions and elevator systems is also measured through the analysis of manufacturers' catalogs and contemporary accounts in the engineering, architectural, and popular press. This paper will reveal that, at times, mid-western firms were clearly industry leaders (the development of the hydraulic elevator in the 1870s) and that they also quickly responded to challenges from Otis and other eastern firms (the development of the electric elevator in the 1890s and the development of traction elevator in the early 1900s). Although the pivotal role of the Otis Elevator Company (both pre and post "trust") in the history of the passenger elevator cannot be denied, this paper will clearly demonstrate that their mid-western rivals played an equally important role in the history of vertical transportation in the nineteenth century.

### Use it or Lose it: A Discussion of the Innovative Re-Use of Historic Industrial Facilities in the Milwaukee Area

Thomas H. Fehring, P.E.
NorCENergy Consultants, LLC

The size and scope of many historic industrial facilities makes their preservation prohibitive, unless the facility can be recycled for other productive uses, following the end of the economic life for which the facility was originally constructed. This paper illustrates this point by reviewing some of the creative reuses of industrial facilities in the Milwaukee area. It also reviews some of the area facilities that were lost because adaptive reuses could not be found.

It is hoped that the illustrations will provide some innovative insights that will foster preservation of other industrial facilities in the United States.

**The Mitchell-Lewis Motor Company and Early Automobile Manufacture in Wisconsin**

Emily Pettis
Mead & Hunt, Inc.

This paper is based on information obtained from research collected when completing the Determination of Eligibility and HABS-level archival documentation for the Mitchell-Lewis Motor Company property in Racine, Wisconsin. The complex has since been demolished.

Racine, Wisconsin, emerged as a manufacturing center following the Civil War. Between 1880 and 1900, wagon making was the second-largest industry in Racine. In the early twentieth century dozens of automobile companies were established across Wisconsin. Because Racine was one of the foremost wagon-manufacturing cities in the country, it was natural for the early automobile industry to take root. Machinists and skilled laborers at already established industries tinkered with new technology and created some of Wisconsin's earliest automobiles.

One of the first automobile manufactures established in Wisconsin, the Mitchell-Lewis Motor Company, evolved from H. Mitchell Wagons. Founded by Henry Mitchell in 1855, it was the only wagon-making company in Racine to survive the automobile revolution. Other automobile companies operating in Racine included the Pierce Engine Company and Nash Motors.

The Mitchell-Lewis Motor Company complex included the corporate headquarters building, constructed in 1909, and several interconnected industrial buildings constructed between 1900 and circa 1930 that accommodated the manufacture of automobile components and the assembly of automobiles. The buildings were typical of those used by early auto manufacturers and represent a property type that is becoming increasingly rare in Wisconsin.

**The Hersey & Bean Lumber Company's Mills of Stillwater, Minnesota**

Julie Kloss
Two Pines Resource Group, LLC

In the summer of 2004, Two Pines Resource Group conducted archeological investigations at the sites of the Hersey & Bean Lumber Company's sawmill (21WA91) and planing mill (21WA92) in Stillwater, Minnesota. During the Phase II fieldwork, the footings and foundations of the main sawmill's engine, flywheel, and gang-saw were uncovered; the ruins of the planing mill were documented; and the remains of the lumber company's store/office building were recorded. This paper will discuss the layout of the mill complex within the context of the environmental setting.

**Panel C3: Transportation Solutions Past and Present**

Chair: C.H. "Chas" Hague, P.E., S.E.
Consulting engineer

**Water Supply, Recreation and Transportation: Layered Landscapes in New York City's Highbridge Park, 1840s – Present**

Allison S. Rachleff
Earth Tech

Since its establishment in the mid-nineteenth century, Highbridge Park in northern Manhattan along the Harlem River between West 155th Street and Dyckman Street, has played a significant role in New York City's industrial history. In the 1840s, the city constructed its first water supply system, the Old Croton Aqueduct, which extended from the Croton River in Westchester County, and entered Manhattan via the above-ground Roman-style Highbridge Aqueduct in a parcel of land that would be incorporated into the future Highbridge Park. In the 1890s, the city constructed the New Croton Aqueduct to augment the capacity of the Old Croton Aqueduct, and similar to its predecessor, the new aqueduct tunnel entered Manhattan in the central portion of Highbridge Park where water pumping structures were also constructed. Around the same time, in 1889, the city completed construction of the Washington Bridge, a two-span steel structure that traversed the Harlem River north of the aqueducts. The Harlem River Seawall and Harlem River Speedway, a waterfront road flanking Highbridge Park and constructed for carriage rides and horse racing, were also built in this era.

By the 1930s, modernizing the urban road network became a major preoccupation of city planners and Highbridge Park became the site of multiple transportation engineering advancements. Under the leadership of Robert Moses, who at various points from the 1930s to 1960s served as New York City Parks Commissioner, Triborough Bridge Authority Commissioner, and New York City Construction Coordinator, construction began to transform the Harlem River Speedway into the Harlem River Drive. This roadway would eventually convey traffic from northern Manhattan and Highbridge Park, across town to the recently completed George Washington Bridge, a Hudson River crossing that linked New York City to New Jersey.

After World War II, engineers, landscape architects and architects were spurred by the passage of the Federal-Aid Highway Act of 1956 and Moses' ability to obtain federal, state, and local funds to implement plans for a system of beltways, expressways, and parkways leading to and from the city. A key component of the plans included bridges and ramps that proliferated along and across city waterways. A close examination of the multi-ramp Highbridge Interchange, constructed in 1952 in the central portion of Highbridge Park, will provide a lens through which one can examine the ingenious solutions that designers devised to erect elevated highways in diverse urban settings, while preserving existing land uses and infrastructure. Construction of the interchange necessitated reconfiguration of water supply and landscape features in Highbridge Park. Ramp TE of the interchange, designed by New York City-based consulting engineers Andrews, Clark & Buckley and Hardesty & Hanover, was built as a serpentine, single-cell, three-span continuous reinforced concrete box girder viaduct that carried traffic from the nineteenth-century Washington Bridge to trans-Manhattan tunnels beneath West 178th Street and West 179th Street. The tunnels, constructed before and after World War II, conveyed traffic across town to the George Washington Bridge.

Following construction of the Highbridge Interchange in the 1960s, federal interstate highway funds were used to construct the Cross Bronx Expressway (I-95) and Alexander Hamilton Bridge (1962). The new bridge carried the expressway over the Harlem River to the central portion of Highbridge Park and the newly constructed Trans-Manhattan Expressway (I-95), an open-cut expressway that replaced the West

178th and West 179th street tunnels. Like its predecessor tunnels, the Trans-Manhattan Expressway carried traffic across town to the George Washington Bridge.

By placing the Highbridge Interchange and innovative Ramp TE in context with its nineteenth- and twentieth-century surroundings, this paper will examine the unique role that Highbridge Park has played in the history of New York City's infrastructure. Furthermore, this paper will put particular emphasis on the impact that post-World War II highway construction had on the central portion of Highbridge Park, which manifested itself in the construction of the Highbridge Interchange in the 1950s, and I-95-related structures in the 1960s. Through a close examination of this layered landscape, this paper will demonstrate how seemingly incompatible uses functioned side-by-side to facilitate state-of-the-art transportation solutions in a dense, urban environment.

**Bridging the Landscape of Early 20th Century America with Patented Concrete Arch Bridge Designs – Daniel B. Luten and the Luten Bridge Companies**

Perry S. Green, PhD
University of Florida

Throughout most of the nineteenth century, construction and maintenance of roads and bridges were left to local governing authorities since they were not critical to the well being of the community. Most road traffic of that time was local and consisted primarily of slow moving horse drawn wagons and carriages. What changed around the turn of the century was the increasing weight of farm equipment, especially tractors, and the eventual demand to own and drive motorcars. The lightweight iron trusses and short timber stringer spans that had been the predominant types of bridges built in the U.S. from about 1850 to 1900 were no longer capable of carrying these new loads as noted by the many bridge failures that occurred. The first use of reinforced concrete for bridges was in 1875. As the idea that an inhomogeneous material of concrete and steel could behave monolithically became better understood, the use of this new material started to play an important role in the growing demand for stronger, more durable, cost-effective and aesthetically pleasing bridge structures. Daniel B. Luten, one of the most influential bridge engineers in the U.S. in the early part of the twentieth century, tirelessly promoted the use of reinforced concrete arch bridges of his own patented design. He was a masterful entrepreneur and through a nationwide network of associated companies that he established, he designed some 17,000 bridges over a twenty-year period, which were built from Massachusetts to California as well as Canada and Mexico. Luten has possibly done more to promote the use of reinforced concrete highway bridges by municipal, county, and state governments than any other individual, as the U.S. entered the automobile age.

**Crossing the Tracks: A Pedestrian Underpass along the Transcontinental Railroad**

Robert C. Leavitt, MA RPA
Western Cultural Resources Management, Inc.

By 1866, railroad surveyors had identified the route of the transcontinental railroad through western Nevada's Truckee Meadows. The initial town site for what is now Reno was surveyed in April 1868, the first lots were sold on May 9. A generation later, crossing the railroad in downtown Reno was definitely dangerous. In late 1901, the Southern Pacific completed a pedestrian under-crossing at Virginia Street to carry traffic below their right-of-way. Its life was short. The Virginia Street grade crossing was paved in 1912; safety gates were installed the following year and the subway fell into disuse. Fire insurance maps for 1912 list it as "abandoned." Although it was formally boarded up in 1927, one local firm was allowed to use the tunnel to store automobile tires and a local transit company rented an entrance structure as a waiting room. one entrance structure was used as a transit bus waiting room. In the fall of 2004, the tunnel was finally removed, during construction of another attempt to ease the conflict between rail traffic and that of the local community. In addition to the history of the Reno pedestrian subway, this paper looks at its transformation from desired asset to white elephant and discusses the results of archeological investigations associated with its final transformation to construction fill.

**Arkansas State Highway and Transportation Department Historic Bridge Management System**

Robert W. Scoggin
Arkansas State Highway & Transportation Department

The Historic Bridge Management System (HBMS) developed by the Arkansas State Highway and Transportation Department utilizes a geographic information system to effectively manage the Arkansas Historic Bridge Inventory, enhance mitigation and marketing during the Historic Bridge replacement process. The HBMS has centralized all Historic Bridge data including photographs, videos, historic documents and plans into one geo-referenced database.