Concrete Repair in the New Century

By Tanya Wattenburg Komas

The 20th anniversary of ICRI seems an appropriate time to reflect on the position of concrete repair in the larger context of the construction industry and its place in the new era of environmental responsibility. As well, it is a good time to consider the future growth of the repair industry and its ability to attract young people to enter this particular segment of the design and construction industries.

The Development of Repair and Preservation in the United States

To merely claim a place for our industry in the current environmental dialog is to diminish the fact that it is truly part of the foundation of a repair/preservation philosophy that has a long and distinguished history—a history that began long before the green building movement began. Although the everyday concerns of current concrete repair professionals and industry partners may not always leave room for such philosophical discussions, repair and reuse must be continually promoted for their intrinsic environmental, economic, and social value to ensure the industry's future potential for work and employees.

It is enlightening to consider concrete repair as we know it today from the perspective of the early development of the historic preservation movement in the U.S. that was codified in the National Historic Preservation Act (NHPA) of 1966. At the time NHPA was enacted, there was a growing acceptance that reusing existing structures was desirable on many levels. NHPA is based on the belief that "the spirit and direction of the Nation are founded upon and reflected in its historic heritage."[1] In its infancy, the application of NHPA tended to focus on nationally important historic landmarks, but it quickly grew to encompass a wide range of structure types and sites as well as professionals and trades-people from many design and construction-related fields. Individuals and organizations involved recognized long ago that preservation of the existing built environment is beneficial not only for preserving cultural heritage for social reasons, but also for limiting urban sprawl, assisting with economic growth and development, and many other reasons now at the focus of the sustainability movement.

While the burden of preservation prior to 1966 fell primarily to individuals and elite groups in the private sector, there was a realization that, due to an increasing rate of loss of historic structures, new action was needed. NHPA provided support for state and local governments and new public/private partnerships were formed. Primary among these partnerships was the unique, supportive working relationship between the federal government and the National Trust for Historic Preservation (NTHP). NTHP is the only public/private partnership of its kind at the federal level.

NHPA set the stage for financial incentives for preservation, including the Federal Historic

The Cabrillo Bridge is one of the most historic bridges in all of California. The concrete and steel bridge, which passes over California Highway 163 in San Diego's Balboa Park, was completed in 1914 for the Panama-California Exposition in San Diego. It was entered on the National Register of Historic Places in 1976. Corrosion of embedded steel reinforcement prompted repairs in 2005. The bridge is currently the active entrance to Balboa Park and the San Diego Zoo

Preservation Tax Incentives program. That program has become one of the nation's most successful and cost-effective community revitalization programs ever enacted and has spurred many concrete structure rehabilitations. In Fiscal Year 2006, 1253 projects that represented a record-breaking $4.08 billion in private investment were approved. "Taking into account new construction, which often occurs in conjunction with approved rehabilitations but is not eligible for the credit, the program leverages far greater than 5 to 1 in private to public investment in the preservation and renewal of our communities. With nearly 34,000 approved projects, the Tax Incentives program attracts private investment to historic cores of cities and Main Street towns across America, generates jobs, enhances property values, creates affordable housing, and augments revenues for Federal, State, and local governments."[2]

Most repair and preservation professionals today share a concern for preserving monumental edifices but also maintain a focus on the vernacular structures and vast utilitarian infrastructure of every day life. These are the structures and systems that enable comfortable living and help give a sense of orientation to the American people. We also know that reuse of existing architectural and civil structures makes sense economically and environmentally. Many of the arguments commonly heard in current mainstream dialogs about the need to create sustainable communities have been, for decades, the very tenants by which the repair and preservation communities have purposefully extended the life of those communities as they already exist.

In 1966, the U.S. Congress stated in the text of the NHPA that "the preservation of this irreplaceable heritage is in the public interest so that its vital legacy of cultural, educational, aesthetic, inspirational, economic, and energy benefits will be maintained and enriched for future generations of Americans."[1] This statement, issued 42 years ago, must be contrasted with the widely accepted definition of sustainability offered by the U.N. Bruntland Commission's 1987 report, "Our Common Future," which defines sustainable development as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs,"[3] and the context of the three separate but interrelated principles of sustainability that are currently recognized, including environmental, economic, and social sustainability.[4]

In other words, the principles of preservation formed long ago, which have underscored the motivation for repair projects for ages, are an intrinsic component of current efforts toward environmental sustainability, including the Leadership in Energy and Environmental Design (commonly known as LEED) Green Building Rating System. The LEED Rating System is the most widely accepted system in the U.S. for rating the sustainable characteristics of buildings, and is now a part of many academic programs including those in concrete industry management, architecture, engineering, and construction management.

LEED has been responsible for many successes in encouraging environmentally responsible building practices. However, it awards a low total of three possible points for the preservation of an entire building out of a possible 69 total points. LEED points can be obtained for many categories of repairs to existing buildings, but there currently does not exist a baseline recognition for overall building rehabilitation versus demolition and new construction. To provide clarity, consider that a potentially viable existing building could be demolished and the replacement building could obtain the highest level (Platinum) LEED rating. The Heritage Canada Foundation offers a compelling

The Freedom Tower in Miami, FL, was erected in 1925. For the first 30 years of its existence, it was home to the Miami News*, the city's first daily newspaper. It began its second life as a service center for Cuban refugees pouring into south Florida when it was taken over by the U.S. General Services Administration in 1962. After changing hands several times from the 1970s to the 1990s, it was purchased in 1997 by a prominent Cuban-American businessman and repaired and restored as a living monument to the Cuban struggle for freedom*

look at a possible scenario for the future of the repair versus replacement argument: "Currently, the challenge is to prove that an old building is so valuable that it ought to be saved; rather the owner/developer should be required to prove that an old building cannot be adapted to new use."[5] In other words, begin with building retention as the first rewarded option with the burden of proof falling to alternative options.

LEED is being expanded to include new areas such as LEED-EB (existing buildings), but it currently only addresses operations and maintenance of existing buildings. It does not address overall building rehabilitation. Although arguably somewhat limited and misapplied in certain circumstances—LEED was initially designed for commercial high-rise office buildings yet has been applied to many building types—it is being continually updated and revisited and remains a useful tool that has spurred many new environmentally sensitive buildings. In other words, some of the shortcomings of LEED are the result of misapplication rather than the fault of the evolving LEED system itself.

Beyond Green

There is much evidence that the concrete industry is committed to improving environmentally responsible material production and construction practices, as evidenced on many fronts including efforts toward reducing CO_2 emissions in the production of cement and other materials. The repair industry, with its established legacy of preserving existing structures, contributes significantly to the concrete industry's role in this effort, and has much to offer future repair professionals.

Extending the life of existing structures is the ultimate act of built environment sustainability. It reduces the depletion of additional natural resources and reduces energy consumption. Through the materials conservation and overall preservation of existing structures, we benefit from the energy that existing structures have already consumed, we can look forward to their extended use into the future, and we have the opportunity for ongoing learning about the long-term effects of environmental and other deteriorative forces and to apply that knowledge to new structures.

Concrete repair professionals, material manufacturers, and students are aware of the vast use of concrete for construction and that proper maintenance and professional repair, when needed, increases the long-term durability of the material and thus the useful life of the structures. Beyond this, we must actively participate in discussions about the implications of our work in the broadest terms and expand the potential for it in the future. An important challenge for the next 20 years of the concrete repair industry will be to help further the argument for repair over replacement and educate the public regarding the great value of repair that goes beyond present-day economics and convenience. Further, from the position of public opinion about concrete as a contemporary building material, showcasing the durability and longevity of the material through preservation of existing structures, which inherently do not typically need overly extensive intervention and often naturally possess inherent energy-saving operational attributes, can only benefit the concrete industry as a whole in the long run.

To this end, consider the concrete repair industry in terms of the NTHP's Sustainability Initiative designed "to develop a national policy for the integration of sustainability and preservation . . . The organizations currently involved are the American Institute of Architects (AIA), the Association for Preservation Technology International (APT), the National Park Service (NPS), the National Trust for Historic Preservation (NTHP), the General Services Administration (GSA), and the National Conference of State Historic Preservation Officers (NCSHPO)."[4] This effort toward integrating the practices and principles of preservation into the green building movement are directly beneficial to the concrete repair industry. It reinforces and potentially enlarges the public understanding of the need for repair professionals and products in preserving the vast existing stock of concrete structures and infrastructure.

In "Making the Case: Historic Preservation as Sustainable Development," a white paper written in advance of a research retreat for the Trust's Sustainability Initiative, conservation of energy and natural resources through building reuse is addressed in support of the idea that preservation promotes environmentally, economically, and socially sustainable development. Some of the key ideas of the Initiative that may be most interesting to the concrete repair industry are briefly summarized in the following.

Models have been developed that can calculate the energy consumption for many types of structures. A somewhat outdated but very useful model is embodied energy (embodied energy is defined as the amount of energy associated with the extracting, processing, manufacturing, transporting, and assembling building materials) yet it is largely viewed by green building advocates as insignificant. With but a few commonly touted statistics, one might be tempted to agree. With the correct facts in proper context, however, that agreement might not be so quickly forthcoming. "Over a building's life time, embodied energy amounts for approximately 16% of a building's total life cycle energy consumption; in contrast, 74% of energy use is attributed to building operations...thus, there is a

common misconception that the energy wasted in the demolition and reconstruction is quickly recovered in [new] building operations."[4] Recent research shows, however, that "a new building's life span must reach 26 years to save more energy than the continued use of an existing building...if a building were demolished and partially salvaged and replaced with a new energy efficient building, it would take 65 years to recover the energy lost in demolishing a building and reconstructing a new structure in its place."[4]

Another, perhaps more relevant, model for assessing energy cost is life-cycle analysis (LCA). It "examines impacts during a building's entire life, rather than focusing on environmental impacts at a particular stage"[4] and reveals that repairing and reusing structures is more environmentally friendly than new construction. Interpretative issues exist with both energy calculation models, but the evidence is compelling in favor of reuse for energy and other reasons as well, including that rehabilitation reduces waste generation and limits sprawl.

The Trust's Initiative addresses several perceived environmental weaknesses of historic buildings including that old buildings are often considered to be energy hogs. In reality, many historic buildings are more energy efficient than more recent buildings, particularly concrete and masonry buildings that inherently possess significant thermal mass. "2003 data from the U.S. Energy Information Agency suggests that buildings constructed before 1920 are actually more energy efficient than buildings built any time afterwards—except for those built after 2000. Even then, the improved energy performance of new construction is marginal."[4] It must be noted, however, that many inefficient older buildings certainly do exist and that misguided alterations to others have actually reduced their energy efficiency.

Window replacement is an area in which the vote is often for replacement over repair. There is a common belief that windows are a major source of heat loss and gain. "Yet retaining historic windows is often more environmentally friendly than replacement with new thermally resistant windows. Government data suggests that windows are responsible for only 10% of air infiltration in the average home. Furthermore, a 1966 study finds that the performance of updated historic windows

is in fact comparable to new windows. Window retention also preserves embodied energy, and reduces demand for environmentally costly new windows, typically constructed of vinyl or aluminum."[4] Window retention also allows scarce resources to be expended on other more pressing repair concerns.

The Trust's Initiative outlines several additional arguments for Preservation as Sustainable Development, including specific aspects of economic and social sustainability. Many references and facts are presented to support the ideas that "preservation pays" in economic terms because it spurs additional economic development, creates more jobs than new construction, increases economic competitiveness by helping create a dynamic environment that draws highly skilled workers, and is small-business friendly. Social attributes that are supported include improved cultural ecosystems, psychological well-being, social equity through inclusion of all stakeholders, social inaction and civic engagement, and quality of life.[4] For those who grew up in the concrete repair profession on a foundation of hard work in the field, these might be particularly interesting ideas to address in general as well as challenging to discuss with the younger generation who grew up surrounded by the sustainability ethos.

Equipped for the Future

If sustainability is here to stay, then some of the questions that may remain regarding interventions in the built environment may exist more in the philosophical realm than the technological one. Engineer Robert Silman, in his article titled, "Is Preservation Technology Neutral" discusses his personal experiences after many years of having clients ask if he could do "such-and-such a thing." He writes: "I realized that I can do practically anything these days in constructing and preserving the built environment. It suddenly occurred to me that the proper question to ask now was, 'Ought we do such-and-such a thing?' The inquiry had shifted from the technical to the philosophical and moral."[6]

As the design and construction industries become increasingly more complex, we need to be personally, and as a group, equipped to sit at the table and present the environmental, economic, and social arguments supporting the idea that just because we can build that incredible new building, it does not follow that we should, if viable repair alternatives involving existing building stock exist. And, conversely, that just because the technology exists for almost any level of repair, we should do it at all costs.

Continued excitement and an educated, honest approach to the philosophical and practical sides of our work, together with exciting advances in technology properly applied, would seem the perfect draw for new graduates. Indeed, as a direct result of Concrete Industry Management, some students from California State University-Chico who attended the ICRI 2007 Fall Convention in Las Vegas were overwhelmed by the incredible Projects Award winners, the depth and variety of the products and services in the exhibit hall, and the excitement and commitment of the ICRI members. They have already sought internships with ICRI member companies and a record number have enrolled in the Concrete Repair class offered at Chico State.

Concrete Industry Management student

References

1. National Historic Preservation Act of 1966, Public Law 102-575, amended in 1992, http://www.nps.gov/history/local-law/nhpa1966.htm.

2. National Parks Service, "Historic Preservation Tax Incentives," http://www.nps.gov/history/hps/tps/tax/.

3. Brundtland, G. H., and World Commission on Environment and Development, "Our Common Future," Report of the World Commission on Environment and Development, 1987, 400 pp.

4. Frey, P., "Making the Case: Historic Preservation as Sustainable Development," A Draft White Paper, the Sustainable Research Retreat, National Trust for Historic Preservation, Washington, DC, Oct. 2007, pp. 1-12.

5. Gunn, C., "Exploring the Connection between Built and Natural Heritage," Heritage Canada Foundation, Ottawa, ON, Canada, 2001, 22 pp.

6. Silman, R., "Is Preservation Technology Neutral?" APT Bulletin, 2007, V. XXXVIII, No. 4, p. 5.

Tanya Wattenburg Komas *is on the faculty of the Concrete Industry Management program at California State University-Chico, CA, and is a Corresponding Fellow of the Center for Heritage Conservation, College of Architecture, Texas A&M University, College Station, TX. She received her BS in landscape architecture from the University of California-Davis, CA, her MS in historic preservation from Columbia University, New York, and her PhD in architecture and her Certificate in historic preservation from Texas A&M University.*