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Cultural Resources Management
Information for
Parks, Federal Agencies,
Indian Tribes, States,
Local Governments and the
Private Sector

CPS/PWC/NPS: Sharing Information and Experiences

Randall J. Biallas

The report to the Director from the steering committee of the U.S. National Park Service's (NPS) 75th Anniversary Symposium held last year at Vail, Colorado recommended under the strategic objective dealing with resource stewardship and protection that:

"The National Park Service should reinforce its role as a world leader in the national park movement through . . . actions to facilitate the exchange of information . . . and protection of critical world resources."

Further, one of the steps that the working group on park use and enjoyment called for to implement this recommendation is:

"The NPS should exchange with interested parties around the world, information, methods and technology to conserve, interpret, and manage protected areas. The agency should implement a strategy that relates the results of international cooperation to the domestic mission of the NPS and its allied organizations."

In support of this recommendation, the NPS park historic architecture program held a joint "Workshop in Historic Structures" with the Canadian Parks Service (CPS) and Public Works Canada (PWC) at Waterton/Glacier International Peace Park, June 15-18, 1992. The purpose of the workshop was to improve the exchange of technical information and experiences between the Service's historic preservation professionals and those from the Canadian Parks Service and Public

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Workshop
in Historic Structures

CPS/NPS Waterton/Glacier
International Peace Park June 15-18, 1992

Environment Canada Parks Service / Environnement Canada Service des parcs

U.S. Department of the Interior
National Park Service
Cultural Resources
Park Historic Architecture

Environment Canada Parks Service / Environnement Canada Service des parcs
Public Works Canada / Travaux publics Canada

U.S. Department of the Interior
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Attestation de présence

Gilles Fortin

a participé à l'atelier des structures historiques' tenu à Waterton/Glacier International Peace Park du 15 au 18 juin, 1992.

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Waterton/Glacier International Peace Park
June 15-18, 1992

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Managing Heritage Structures in the 1990s

Current Issues Facing the CPS

Christina Cameron

It is always a pleasure to meet with our colleagues from the U.S. NPS, to discuss professional issues of mutual concern. The long relationship that we have enjoyed with our American colleagues has been a rich and fruitful one.

This particular workshop on historic structures is especially important to the Canadian Parks Service at this time. As a result of restraint and changes in conservation philosophy, we in the Canadian Parks Service (CPS) are in a period of transition. We are examining the way we have traditionally delivered our cultural heritage programmes and are searching for solutions to some long-standing issues. Your deliberations over the next few days will no doubt make a valuable contribution to this review.

Making Choices

If you will allow me, I would like to begin my remarks by discussing the issue of choice. There are few in this room who disagree with the premise that managing historic structures involves making choices.

The first choice is: "Which buildings deserve to be looked after and at what level of care?" This may seem like a strange question for a conservation agency. Nonetheless, our experience shows that we do make these choices all the time. We have several designation mechanisms for assigning "value" to our cultural resources, so that we focus on those of greatest heritage significance and leave aside others.

Our new Cultural Resource Management Policy provides us with a framework for making such choices. In the CRM policy, five principles are set down to enable us to make decisions or choices about the scale and level of treatment of historic structures. These are the principles of value, public benefit, understanding, respect and integrity. At the macro-level, these principles guide the planning process and at the micro-level facilitate the selection of appropriate conservation treatments. The planning process should result in one document clearly describing the values and the significance of a site or area and its commemorative/presentation objectives. Everyone from heritage professionals, field people and management needs to be in agreement on the conservation/presentation agenda.

There can be no doubt that this process of choice is essential, especially in times of budgetary restraint. The record of the Federal Heritage Buildings policy shows how useful this selection process can be. Of the over 2,600 buildings evaluated, over two-thirds were identified as "not heritage," thereby allowing federal departments to focus their efforts on significant heritage structures.

A more subtle issue concerns National Historic Sites, which, of course, are deemed to be Level I resources. While the historic place is undoubtedly of national significance, all the structures on that site may not necessarily be Level I resources. Questions like these arise: "Which structures are relevant?"; "Which structures serve to portray the national historic significance or commemorative intent of the site?" We need to become more rigorous in examining our sites, to determine which structure should indeed be treated as Level I resources and which ones should receive a lesser level of conservation treatment.

Determination of heritage value reflects the cultural values of societies in points of time and space, and may require re-adjustment when new information is available or society's values alter appreciably. In the case of the 114 National Historic Sites administered by CPS, about 85% were designated more than 20 years ago and 36% more than 50 years ago. Should we consider the divestment of sites that are no longer relevant or less relevant? Is it perhaps time to re-examine our conservation agenda, to prioritize our conservation work in line with society's ever-broadening definition of heritage?

The Broadening Definition of Heritage

This, then, brings us to the definition of heritage and how it has changed. The concept of heritage has grown from a narrow 19th century definition—limited for the most part to ancient monuments—through historic towns and vernacular architecture, to rural landscapes, the whole built environment and, indeed, even spiritual values. This broad definition of heritage has strong support in our communities and is reflected in the kinds of subjects being presented for consideration as National Historic Sites. I cite a few examples by way of illustration: Prairie Settlement Patterns, cemeteries, stained glass manufacturers, native mission sites, and native spiritual sites.

Implications for the Treatment of Historic Resources

What does this mean for those professionals involved in the conservation of historic structures? First of all, it clearly means that they will have to acquire new skills, in order to conserve new kinds of heritage resources, such as cultural landscapes, vernacular buildings, or piles of rocks at a native spiritual site.

Beyond acquiring new skills, that pesky issue of choice comes back into play, this time as the choice of level of treatment. Over the years, I have seen proof that conservation architects and engineers are technically able to conserve almost anything. But the idea I want to get at, with this question of choice of level of treatment, can perhaps be illustrated by thinking about veterinarians.

Veterinarians are trained to do almost anything that medical doctors can do. They have great technical expertise. But the decision to do open heart surgery on a cat, for example, is not made solely on the availability of this expertise. The cat owner is also part of the decisionmak-

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ing process. Does he have enough money to pay for it? Is the cat worth it to him?

While you may think this analogy a bit silly, the same question of choice of treatment is gaining importance in the cultural resource management field. From the client's perspective—by client, I mean the cultural resource manager—high-tech "engineering" solutions may not be in the best interests of the structure. An example that illustrates my point, which some of you may know, is the Pointe-aux-Pères lighthouse on the Gaspé coast, where "conservation" of this reinforced concrete structure has not only destroyed historic fabric but has created an effect both awkward and ungainly.

Another aspect of the client's role lies in the values attached to the cultural resource by different groups in society. Take the example of Ninstints, a Haida village site on the World Heritage List. While we have the technical expertise to stabilize the totem poles—through the use of epoxy resins—for the foreseeable future, the native people themselves (who created the totem poles in the first place) are opposed to this long-term high-tech treatment. From their perspective, the value of the poles lies in instructing and inspiring the current generation of young carvers who will continue the living heritage of totem pole creation. The old poles, from their point of view, will thus have served their purpose in handing on the cultural traditions of their forefathers, and can thus disappear without regret. Making choices in the face of these conflicting world views constitutes a major challenge for our agencies.

Another influence on the choice of level of treatment relates directly to the way in which governments usually allocate budgets. We are prone—might I suggest, accident-prone—to the mega-project syndrome. Large restoration projects are high profile, and create the illusion that "government is finally doing something about site X!" It is far easier to obtain funding for these major projects, which are of relatively short duration, than to secure small amounts of funding, over a long period of time, for necessary routine maintenance. Yet ironically, the mega-projects, despite appearances, often have a highly negative impact on the site, ranging from destruction of historic fabric to the addition of inappropriate elements. It seems to me that we need to move away from the mega-projects with their big budgets and massive intervention on cultural properties. I am more and more convinced that regular maintenance by informed custodians will ensure the long-term survival of our cultural resources. This reminds me of a visit that I made last autumn to the United Kingdom. There, I had the privilege of visiting historic sites in East Anglia with Sir Bernard Feilden. In listening to this world-renowned expert in conservation of cultural properties, I was struck by the fact that the maintenance cycle for Norwich Cathedral, where Sir Bernard served as chief architect for a quarter of a century, is scheduled on a 30-year cycle. This means that walls are repaired bit by bit, so as not to show their newness. This stands in sharp contrast to Canadian conservation practice, where we traditionally replace whole walls at one time.

Training

If we are going to shift our focus from mega-projects to routine maintenance by informed custodians, then we will have to focus our efforts on training. This training programme will need to be two-pronged, to focus first on training for heritage professionals and then to widen the scope to include all those who come in contact with historic structures.

We are dealing here not only with the technical conservation know-how and skills enhancement so integral to good practice; specialists now also require a much more comprehensive knowledge that runs the gamut from understanding the mechanisms of decay and deterioration to the role of traditional use as a character-defining feature, and that ranges from using historic maintenance practices to ensure continuity in vernacular structures to developing approaches to mediate between client requirements and the maintenance of heritage character. Greening, multiculturalism and accessibility are still other areas where the conservation specialists will require increased sensitivity and adaptability.

The future has arrived. Conservation agencies like the Canadian Parks Service already require a radically different kind of Architecture and Engineering Services, characterized by diverse and continually evolving skills and dependent for success in conservation on the education of our field personnel and our partners.

Conclusion

The choices that confront us are driven by several factors: a broader definition of heritage, changing societal values, the green movement, and budgetary restraint. It is our responsibility to keep ourselves focussed on our main goal, to conserve with respect and integrity the historic structures in our custodianship. In this endeavour, there will be no once-for-all-time solutions. What is needed is a reasonable approach to conservation by flexible historic structures staff willing to care for, and to train others to care for, a diverse and evolving heritage.

Christina Cameron is Director General, National Historic Sites, Canadian Parks Service.

CPS/PWC/NPS: Sharing Information and Experiences
(continued from page 1)

Works Canada and thereby to provide improved stewardship of the historic structures in the U.S. national park system and the Canadian park system. This issue of the CRM was produced to share the papers prepared for the workshop with a larger audience.

Neither the workshop, nor this issue of CRM would have been possible without the support of many individuals. Special thanks go to our colleagues from Canada, especially Christina Cameron, Director General for National Historic Sites of the Canadian Parks Service; Susan Hum-Hartley, Director of the Heritage Conservation Program of Public Works Canada; and to members of her staff including Ghassan Attar, Chief of Period Engineering; Gary Slippert, Head of Technical Support; and to Renee Lablanc and Nora Daigle.

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Also, thanks to Ron Greenberg, the editor of *CRM*. He swallowed hard and agreed to do this jumbo issue, made me fund it, and then pestered me to get it done.

Lastly, thanks to both my Canadian and American colleagues who shared their experiences and information by making a presentation and/or writing a paper, or simply participating.

Randall J. Biallas, AIA, is the chief historical architect of the U.S. National Park Service. He coordinated this issue of *CRM*, and served as guest editor.

Workshop in Historic Structures: CPS/PWC/NPS
Waterton/Glacier International Peace Park
June 15-18, 1992

Agenda

Sunday, June 14

	Participants arrive at Many Glacier Hotel	
7:00 p.m.	Reception, Swiss Lounge	

Monday, June 15

	Lucerne Room	
8:30 a.m.	Welcome	Gil Lusk Superintendent Glacier National Park U.S. National Park Service
	Overview and Objectives	Randy Biallas Chief Historical Architect U.S. National Park Service
		Susan Hum-Hartley Director, Heritage Conservation Program A&ES (EC) Public Works Canada
	Administrivia	Chuck Anibal Workshop Coordinator Mather Employee Development Center U.S. National Park Service
	Introductions	Participants
MANAGEMENT		
9:15 a.m.	Session 1 CPS:Managing Heritage Structures in the 1990s: Current Issues Facing CPS	Christina Cameron Director General National Historic Sites Canadian Parks Service
10:00 a.m.	BREAK	
10:15 a.m.	Session 2 NPS:Managing Historic Structures in the U.S. National Park System	Randy Biallas
11:00 a.m.	Discussion of Sessions 1 and 2	
11:30 a.m.	LUNCH	
EVALUATION, DOCUMENTATION INVESTIGATION, MONITORING, AND PLANNING		
1:00 p.m.	Session 3 CPS:The Impact of Enhanced Values on the Care of Historic Structures	Mary Cullen Chief, Architectural Analysis Division Architectural History Branch National Historic Sites Canadian Parks Service

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Sustainable Conservation in Historic Preservation

David G. Battle

"...ecology offers: the science of the relations of organism and the environment, integrative of the sciences, humanities and the arts--a context for studies of man and the environment."
--Ian McHarg, Design with Nature

Among the prominent movements of the late 1960s were the Ecological Movement and the Historic Preservation Movement. Both were conservation movements. The Ecological Movement was spreading the alarm that we are rapidly consuming the earth's resources, and that mankind's survival depends upon their conservation. The Historic Preservation Movement fostered the notion that the direction of the future lies in how well we understand the lessons of the past; therefore, preserving the tangible remains of our past is not frivolous, but important.

Twenty-five years have passed. Many ecologists believe we have reached the point-of-no-return. Others, more optimistic, were last year estimating we might have 20 years to turn the tide. This year, they say 10.

Of the two movements, historic preservation has enjoyed more public acceptance. However, it has grown beyond the mere preservation of historical monuments. It has become a form of conservation of the built environment through the adaptive reuse of buildings and other types of structures. The preservation community must now begin to follow the "sustainable design" concept in both the adaptive re-use and the preservation of monuments. It also must explore the educational opportunities for furthering environmental concerns that these resources represent.

The notion of ecological sensitivity in the built environment is not new. Books such as Ian McHarg's *Design with Nature*[1] occupied an early and prominent place in my own architectural library. Unfortunately, during the past 25 years, many of us, myself included, lost sight of these ecological concerns in our effort to learn and develop the field of historic preservation. However, it is no longer enough to concern ourselves only with preserving the past for posterity. Unless we can assure the world that there will even be a viable future, what is the point of preserving the relics of the past? I suggest that, as a corollary to the notion of "sustainable design," cultural resource conservators must develop and subscribe to an ethic that we might call "sustainable conservation."

There are at least five ways that "sustainability" applies to historic preservation. First, historic preservation is intrinsically a form of sustainable conservation. The built environment "represents the embodied energy of past civilizations."[2] Where historic resources can have a viable continuing use, historic preservation is conservation in every sense of the word. Second, the interpretation of historic structures often provides opportunities to include lessons about the environmental excesses and exploitations of the past. Third, historic resources are visitor attractions. We must make sure that in developing these resources for public visitation, we do not add to the problem. Fourth, our technical efforts to preserve them must not contribute to the degradation of the environment. Finally, we must consider the ways that we, as conservators, practice our professions. Example can be a powerful teacher.

Sustainability as a design principle is in its infancy; as a historic preservation ethic, it is non-existent. We have yet to define the questions, so there are few answers. Nonetheless, all journeys start with the first step. Let us begin!

In the hope of starting a dialogue leading to the development of a sustainable conservation ethic, here are some thoughts.

Reuse

- Existing structures consist of energy that has already been expended, materials that have already been mined or harvested, components that have already been manufactured. One criterion for measuring the suitability of a proposed use might be how many of **those** resources the use can retain.
- Re-usability may become a major preservation criterion. Can we afford the energy to preserve non-useful resources (remembering that interpretation, research and recreation are useful)? Among the criteria for re-use ought to be the potential for economical heating and cooling. Many older buildings were designed to take advantage of natural light and non-mechanical ventilation. We may be unable to afford the preservation of newer buildings whose "contribution to the historic scene" is their only significance, particularly if they rely heavily on energy consumptive systems for continued use.
- A large proportion of the buildings we preserve consists of vernacular architecture. Much of what we value in these buildings are their response to the climate, natural setting and locally available building materials. It is not just nostalgia that draws us to these buildings. They really **are** more comfortable and humane places to live and work. Their usefulness as models for new buildings only adds to their value.
- In some instances, it may become necessary for land-use planning to take precedence over the historic scene. Particularly with some of our historical industrial sites, the historic scene may be an ecological disaster that needs to be repaired. On the other hand, we should not lose sight of the educational opportunities such a site might present if no further harm comes from leaving it alone.

Interpretation

- The vernacular response to climate, setting and materials provides opportunities for presenting positive lessons in ecologically sound design. Conversely, many of our industrial historic sites contain opportunities to discuss ecological excesses of the past.

- Many historic structures contain materials from sources that are today endangered. This particularly applies to woods. Historic structures can provide an occasion to discuss the plight of these endangered species. It also enhances the explanation of why the preservation of the original materials *in situ* is so important.
- Historic structures can provide opportunities to discuss the fact that, prior to the 20th century, most structures were built of locally available materials. Obtaining these materials and erecting the structures required relatively low energy consumption. By contrast, many modern structures consist of materials from all over the globe, obtained at an enormous cost in energy and resulting in the rapid depletion of worldwide resources.
- There is an opportunity to discuss the **architecture** of historic buildings. Features such as broad eaves, double-hung windows, door transoms and high ceilings were means of providing comfortable living spaces when high-technology, energy-consumptive means were unavailable. Historic buildings provide an opportunity to show that these features **do** work, and are applicable to modern buildings.
- Probably the largest percentage of our historical resources consist of museum objects. These are most commonly presented to the public through museum and visitor center displays. In these facilities, there are opportunities to further demonstrate a commitment to sustainable design. This can expose visitors to sustainable design concepts and products in ways that they can easily translate to their own lives. The use of fluorescent light bulbs, low-volume toilets, timers and sensored switches of various types come immediately to mind.

Development

- "The proposed development plan must take into account the total impacts of development in the widest possible context and must seek and implement effective mitigation for those impacts."[3]
- Historic resources are objects of visitation. Getting people to them has an effect on the environment. It requires roads, trails and visitor facilities. Some means of transportation is usually necessary, accompanied by energy consumption and pollution. We must weigh the environmental cost of presenting a resource to the public when deciding which, and how many, resources should be made available.
- How many pyramids or room blocks must be cleared for proper interpretation? Usually, the very act of presenting a resource to the public exposes it to increased risk of deterioration. This must be countered with increased maintenance activity. Consider the energy cost of maintenance along with historic importance when deciding what or how much to preserve and present.

Preservation

- We must take a more global view toward what is of cultural and historical importance to humanity. We cannot afford to physically preserve everything we already have, to say nothing of resources to come. We must set new priorities for the types of treatment we accord our resources. The knowledge embodied by these resources is one of their primary values. Recording this knowledge is one of the most sustainable forms of conservation available to us, yet it is one of the most neglected.
- We must take care that our treatments do not harm the environment. Pay particular attention to the use of pesticides, fungicides and other toxins. We also must ensure that we remove and dispose of the toxic materials such as lead-based paint and asbestos that exist in many historic structures in an environmentally safe manner.
- We must find alternatives where traditional preservation or maintenance might consume non-renewable resources. Among such alternatives are the use of used or recycled materials, or the planting and husbandry of endangered plant material for future harvesting as replacement materials.
- Serious thought must be given to the conservation of museum objects, in historic building settings as well as in museums. Though it is desirable to maintain these objects at constant temperatures and humidities, can we ecologically afford to do this with mechanical HVAC systems? Are there more natural and less consumptive ways to achieve this?

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Agenda (Continued)

1:45 p.m.	Session 4 PWC:Heritage Recording: A Low Cost Recording Practice	Robin Letellier Chief, Heritage Recording Services, A&ES (EC) Public Works Canada
2:30 p.m.	Session 5 NPS:New Techniques for Recording Historic Structures	John Burns Deputy Chief HABS/HAER Division U.S. National Park Service
3:15 p.m.	BREAK	
3:30 p.m.	Session 6 NPS:Autocad and Historic Photographs	Kristen Marolf Historical Architect U.S. Grant NHS U.S. National Park Service
4:00 p.m.	Discussion of Sessions 4, 5, and 6	
4:30 p.m.	Session 7 NPS:Graphic Documentation of Stone	Rebecca Stevens Regional Historical Architect National Capital Region U.S. National Park Service Keith Newlin Preservation Specialist Denver Service Center U.S. National Park Service

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The Impact of Enhanced Values on the Care of Historic Structures

Mary Cullen

The electronic world is developing an exciting new process. A simple message fed into a network is analyzed, combined, repackaged and comes out the other end different from what was fed in. This is the Value-Added Network (VAN) and its enhanced and massaged messages are requiring increasingly sophisticated users. At Canadian Parks Service-National Historic Sites (CPS-NHS), the concept of a value-added network is not a new one. Values in our historic sites have steadily changed over time, reflecting the perceptions of different contemporary observers. In recent years this process has accelerated and values have become more complex. Today our professional staff require greater effort both to sort out historic value and to integrate it into the planning and delivery of conservation programs.

Three value trends are evident: an increase in the diversity of values at any one site; a focus on the contextual value of built heritage; and an emerging consciousness of the value of historic structures as they relate to commemoration history.

The first trend, the diversification of values, has come from many sources. Official changes in value can be traced through the Historic Sites and Monuments Board of Canada (HSMBC) recommendations for individual sites. Laurier House in Ottawa, for example, was originally designated in 1957 as the home of two prime ministers of Canada and, 30 years later in 1987, received recognition for its Second Empire design and its contribution to the urban landscape. At Dundurn Castle in Hamilton, Ontario, this layering of values is marked by three designations–one to owner/entrepreneur/politician Alan MacNab, a second to the house as an outstanding example of the picturesque aesthetic, and a third to the Dundurn Castle landscape.

The majority of National Historic Sites have acquired new values in the management planning, Federal Heritage Review (FHBRO), and other processes. Batoche was designated in 1923 for its association with the major battle of the North-West Rebellion where Métis forces were defeated by Canadian troops. Today it is also valued as the centre of Métis settlement and culture on the South Saskatchewan River. When the 1856 Quebec Customs House was designated for its historical and architectural importance in 1972, continuity of use was not a value integral to its designation. Yet, it was precisely this added value that FHBRO and Customs and Revenue used so effectively to save the building from museum fate.

Through the diversification process, old values have seldom been discarded. Like the connoisseur appreciating a fine Mozart concerto, CPS continues to discover new facets to savour in its old sites. Meanwhile, new sites are being acquired and budgets are shrinking. The program is in the process of applying CRM principles to rank these values and to direct the greatest care to historic resources of the highest value. At Batoche, for instance, the church and rectory, already named National Historic Sites, would be level 1 resources. The

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Sustainable Conservation in Historic Preservation
(continued from page 9)

Practice

- As professional conservators—architects, engineers, landscape architects, curators and others—we can affect the economics of ecological sustainability. We can specify recycled or remanufactured materials in our projects. We can require certificates of origin or other documents to provide reasonable assurances that materials are not from endangered species, or destroying rain forests and native habitats to mine or transport them. We can refuse to employ products whose manufacture entails unhealthy or unsafe working conditions.
- Finally, we must consider the way we, as conservators, live and work. How many trees do all our reports consume each year? Are we taking advantage of the computers and modern telecommunications equipment the "information age" affords us? Where do we work? Can we walk to work, or at least get there on public transportation? Is it a healthy environment? Can we presume to urge ecological responsibility on others if we do not practice it ourselves?

Ecological sustainability and historic preservation are complementary. In large part, the historic events and cultural values we commemorate were shaped by mankind's response to the environment. We have opportunities to present the lessons of the past and to shape the course of the future. This may necessitate some compromises with traditional preservation practices. It will certainly require some changes in our own attitudes and sensitivities.

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[1] McHarg, Ian L. *Design With Nature.* The Natural History Press, Garden City, NY., 1969.

[2] National Park Service. *Draft Guidelines for Sustainable Resort Development.* St. John, U.S. Virgin Islands, 1991.

[3] Ibid.

David Battle is chief, Historic Architecture, Western Team, at the Denver Service Center, U.S. National Park Service.

Métis vernacular structures and ruins of the village would be level 2 resources and, as such, would compete with level 1 resources at other sites for funding. And what about the relationship between all the Batoche buildings and the landscape, never mentioned by the Board, but now seen as crucial to the interpretation of the Batoche story? Is this a level 2 resource and how will this determination be made? Are we in danger of entrenching the old values in this tearing and sorting exercise? To date, the full implications for the care of historic structures are unclear.

A second value-added trend and the dominant theme of recent years has been the increased focus on the context of built heritage. This is a strange new concern for a system now celebrating 75 years of commemorating historic places. What is problematic about today's accent on place, however, is the contribution of various structures to the whole, and the still more sticky issue of defining the whole.

In complexes where buildings define the context, the sheer number of deteriorating historic structures is raising questions about how many and which structures are needed to convey heritage character. This applies, for example, in industrial complexes like the McLean Saw Mill; agricultural complexes, like experimental farms; and in military complexes, like Department of National Defense bases with large concentrations of wartime structures. Architectural and Engineering Services (A&E) recently addressed this question in a proposed intervention to demolish 9 of 11 World War I hangars at CFB, Borden, Ontario. This hangar line has been designated to be of national historic significance and is a critical grouping, of early aviation architecture. Defense proposes to keep hangars 5 and 11, both in good structural condition, but far apart in location and perhaps the least typical in their existing fenestration and sheathing. A&E, in consultation with the Architectural History Branch, is recommending that a minimum of 7 hangars be kept to preserve representivity and the concept of the group. If the group or contextual values of this line do not prevail, a full photographic survey and salvage recording may be the only documentation left of this historic complex.

Recognition of the contributing value of myriad secondary structures to sites and parks is another context issue. These structures do not emerge as cultural resources per se in the various CPS evaluation processes and are therefore not part of the identified inventory for protection. About 55% of the Rideau Canal structures evaluated in the Federal Heritage Review process fell into this "contextual value" abyss. Missing from present planning processes is an overall heritage character statement for the site or area as well as a linking statement describing the contribution of these structures. The program needs to articulate the salient characteristics of these structures, such as form, siting, materials, as well as the dynamic forces that make them fit their context so well. It can then use this statement to guide care and development and to ensure the long-term conservation of distinctive areas.

Canadian Historic Sites have been very successful in creating a sense of place but very few of them have been designated for that reason and the integration of overall character statements in management planning is only beginning. In some sites, either for administrative or other reasons, overall character is either unclear or will clash with public/tourist expectations of what the landscape should be. We learn, for example, that television crews recently traveling to Dawson expected to find a theme-park style frontier gold-rush town; instead they discovered Klondike National Historic Sites scattered amid a town of vacant lots and trailer parks, a town whose frontier flavor was mainly demonstrated in the liberal interpretation of municipal design guidelines. Similarly, pilgrims to Green Gables, the inspiration of L. M. Montgomery's famous story, see the house as an element in a literary landscape, a contextual value which perhaps never can be linked to care under current CRM standards.

At CPS-NHS the increasing diversity of values and the focus on contextual issues have been enjoined by debate on the merit or the value of historic structures as they relate to commemorative history. In a recent evaluation of 1937-40 reconstructed buildings at Fort George, the Federal Heritage Buildings Review Committee identified historical value in their association with 1930 commemoration as expressed in the frontier aesthetic. This value, which is only an element in the overall CPS determination of value, has been variously interpreted by CPS staff. Some see the assigned 1930s commemorative value as a material or artifactual one proscribing major changes in the buildings. Others see it in terms of its symbolic or message value, intended to convey the meaning of the historic place but having no intrinsic value itself. This view would argue that it was the Fort George site that was designated of national significance in 1921 and that the reconstructions are simply an interpretive tool.

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Agenda (Continued)

5:15 p.m.	END OF SESSION	
8:00 p.m.	Optional Presentation on Glacier National Park	Glacier NP staff
Tuesday, June 16		
	Take Workshop Photograph	
8:30 a.m.	Session 8 NPS:Computerized Maintenance and Major Deficiency Condition Assessments: The NPS's Inventory and Condition Assessment Program (ICAP)	Gary Thompson ICAP Project Manager Engineering and Safety Services U.S. National Park Service
10:00 a.m.	BREAK	
10:15 a.m.	Session 9 PWC:CPS Asset Management Process	John McBain Chief, Recapitalization Management, A&ES (EC) Public Works Canada
11:15 a.m.	Discussion of Sessions 8 and 9	
11:45 a.m.	LUNCH	

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The Impact of Enhanced Values on the Care of Historic Structures
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The reconstruction discussions raise the contentious issue of values that impact on other values. Its outcome could have particular import for Louisbourg, the site of the largest French fortress and naval base in North America and Canada's largest reconstructed historic site, completed in the 1960s. About one-fifth of the original town and fortifications have been reconstructed to the 1744 period and the complex is widely recognized for the knowledge it conveys of l8th century building techniques and materials. Issues to be addressed will be safeguarding the scholarly integrity value while improving physical condition and letting the site evolve as part of the interpretative mandate.

While debate on the value of reconstructions continues to influence interventions, and consensus on the issue remains to be achieved, the long-term survival of many reconstructions will probably be determined on a case-by-case basis and by other values. A case-in-point is the Officer's Quarters at Fort Anne, an eclectic blend of military, maritime and residential colonial revival architecture which was the 1930s response to the rehabilitation of the 1797-98 structure. Sited on a rise of land, the Officer's Quarters with its amazing chimneys and surprising 1930s garb has become the symbol of Fort Anne and it is this landmark value which more than anything may influence future interventions. [1]

The enhanced values of our National Historic Sites then are stimulating new questions about the neglect and the care of historic structures. That care will relate directly to the clarification of the values at each site. The challenge will be to avoid the entrenchment of existing values inherent in the assessment of individual historic structures. Only by redefining the significance of the entire site, will levels of care respond adequately to changing conceptions of value.

Mary Cullen is chief, Architectural Analysis Division, National Historic Sites, Canadian Parks Service.

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[1] For additional reading about reconstruction in the Canadian Parks Service, see *CRM*, Vol. 15, No. 5.

Workshop in Historic Structures: CPS/PWC/NPS
Waterton/Glacier International Peace Park
June 15-18, 1992

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New Techniques for Recording Historic Structures

John A. Burns

The Historic American Buildings Survey/ Historic American Engineering Record (HABS/HAER) Division of the National Park Service is the primary architectural and engineering documentation program in the Federal Government. Since its inception in 1933 as the first Federal preservation program, the mission of the Historic American Buildings Survey (HABS) has been the documentation of the historic built environment of the United States. Following its founding in 1969, the Historic American Engineering Record (HAER) has produced similar documentation for sites of industrial and engineering significance. Graphic documentation in the form of architectural measured drawings and large format photographs, and written data in the form of historical and descriptive information are the primary types of documentary recording. These materials are in standard formats and sizes, are in the public domain, are easily reproducible, and are archival. They are made available to the public through the Prints and Photographs Division of the Library of Congress. Over 25,000 structures have been documented by the two programs.

The National Historic Preservation Act directs the Department of the Interior to set standards for archeology and historic preservation, one component of which is architectural and engineering documentation, popularly known as HABS/HAER standards. In accordance with the direction to set national standards for architectural and engineering documentation, HABS/HAER has developed a photogrammetric capability and set up a CAD-photogrammetry laboratory within the division. Photogrammetry is the science of measuring using photographs. Computer-aideddrafting, or CAD, is a generic name for computer software programs that can be used to produce line drawings for architects and engineers. When used together, they form a powerful tool for architectural and engineering documentation.

In addition to establishing HABS/HAER guidelines for photogrammetric recording of historic structures, another purpose of the CAD-photogrammetry laboratory will be to establish standards for the photogrammetric documentation of historic structures within the U.S. national park system. In developing this capability, we evaluated various approaches to photogrammetry and devised a methodology for using photogrammetry to record historic structures. The chosen system meets the *Secretary of the Interior's Standards and Guidelines for Architectural and Engineering Documentation* (HABS/HAER standards).

Stereophotogrammetry

HABS first started experimenting with photogrammetry as a documentation technique in the mid-1950s, when state-of-the-art photogrammetric recording relied on glass plate photographs, taken in pairs using extremely precise metric cameras designed primarily for mapping. The paired glass plates, called stereopairs, were produced with the camera axes parallel so that the illusion of an optical model could be created and, when viewed through a photogrammetric plotter, measurements taken. The principle is a highly sophisticated extrapolation of a stereopticon or a child's Viewmaster.

With all photogrammetric measuring, some dimensional information in the field of view must be known, whether measured targets or objects of known dimensions. The known dimensions, along with camera locations in relation to the subject and other camera stations, and optical characteristics of the camera are together known as survey control. The survey control, analogous to the field records for a hand-measured structure, is necessary to produce accurate dimensions from the photographs.

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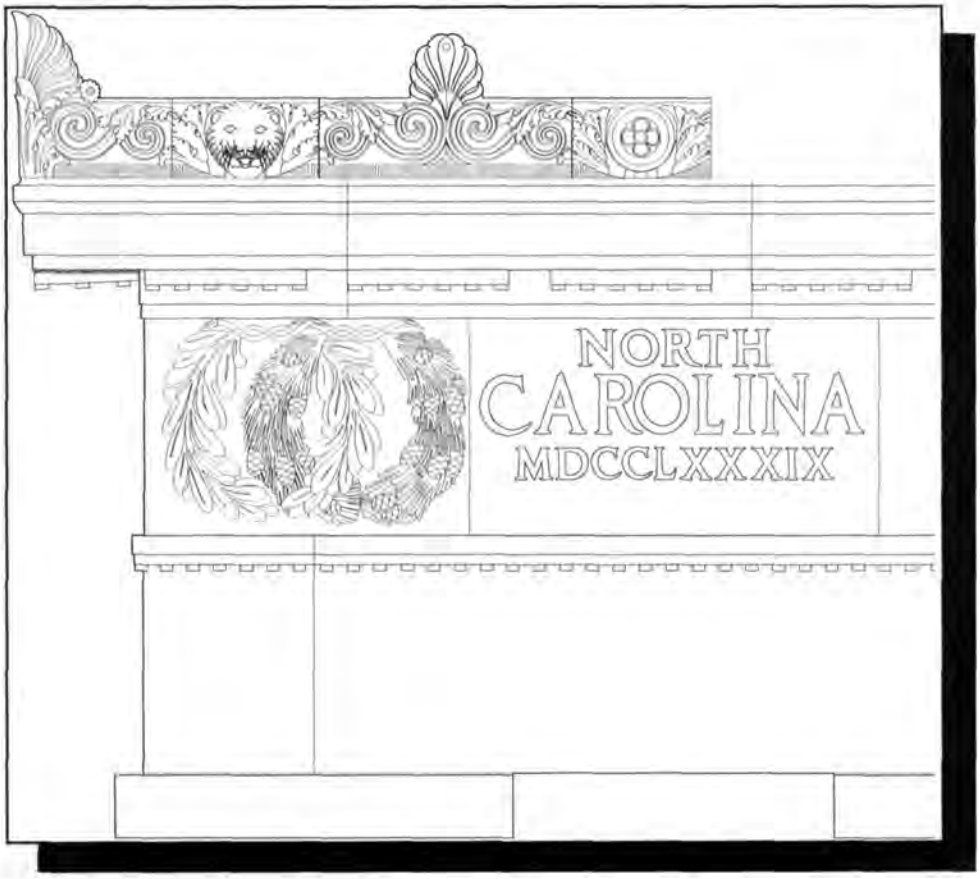


New Techniques for Recording Historic Structures
(continued from page 13)

The predominant type of plotter used through the 1970s provided direct output from the photographs in the form of pencil plots. Stereopairs were aligned in the plotter to re-establish the original camera orientation and geometry. When viewed through the eyepieces, a measuring mark could be moved over the surface of the optical model. A mechanical connection between the measuring mark and the plotting table caused the pencil to move and produce the plot. These pencil plots were traced in ink to produce the HABS photogrammetric drawings of the period.

Metric cameras more suitable for architectural, or close-range, photogrammetry were developed with wide-angle lenses. Some smaller format cameras, known as stereometric cameras, were actually two metric cameras permanently mounted at the ends of a rigid metal bar. Stereometric cameras reduced the amount of survey control data required because of their fixed base length and orientation, simplifying the field work. Their relative convenience came at the expense of a small image size, too small, in fact, to meet HABS/HAER standards.

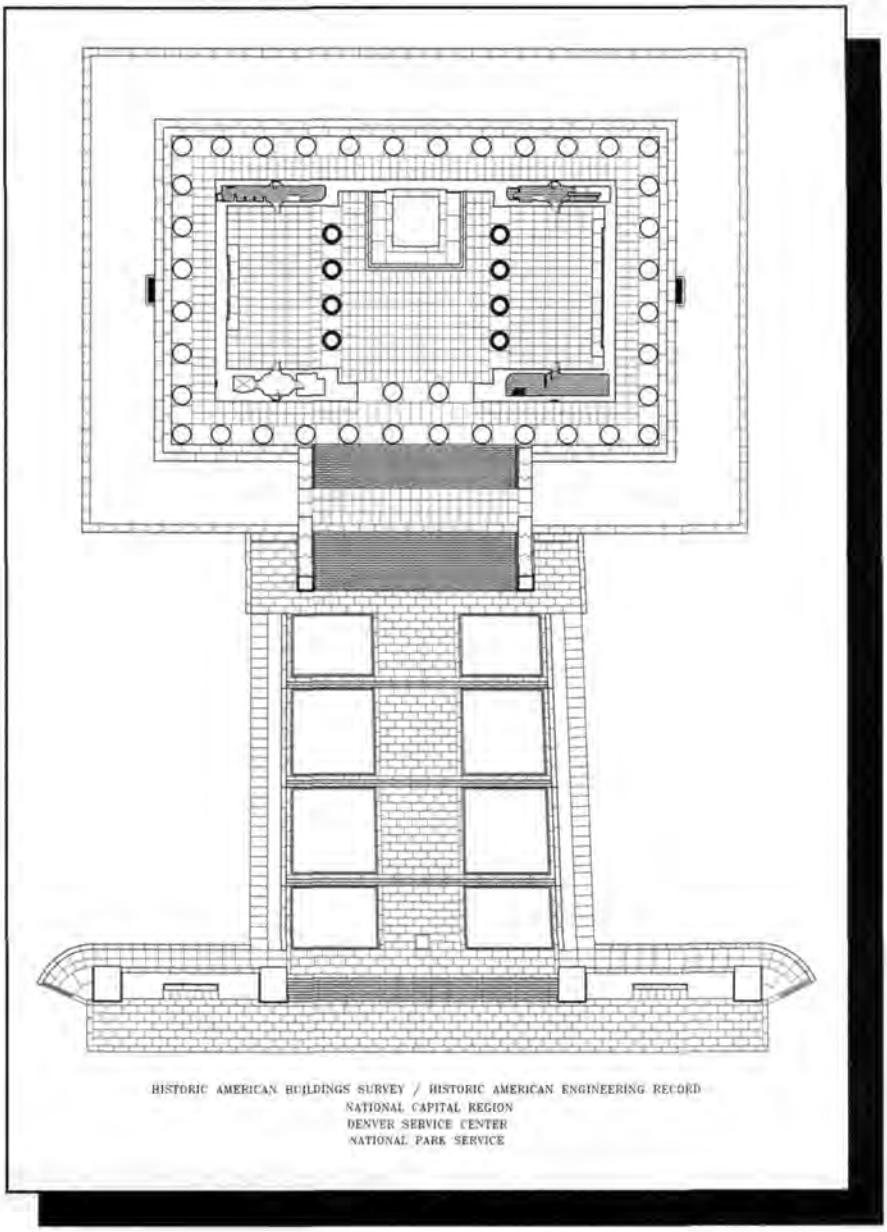
Another improvement in photogrammetry was the analytical plotter, which allows far more flexibility in terms of the types of cameras used and survey control techniques than the older analog plotters. The mechanical link between the plates and the plot was replaced by electronics. Today, the analytical plotter represents state-of-the-art technology and is highly accurate, but is extremely expensive. It produces digital output that can be converted to DXF or CAD files.

CAD-Photogrammetry

A further development in architectural photogrammetry came with the increased capabilities of desktop computers. Rollei, a European company, developed a photogrammetric system that uses convergent film images, as opposed to glass-plate stereopairs, produced on less expensive semimetric cameras, and computer software with mathematical algorithms that extract dimensions from the images by digitizing from photographic enlargements. The inherent flexibility of the film is offset by a reseau grid (a pattern of cross hairs) superimposed on each negative. The output from the system is digital computer files that can be recognized by computer-aided-drafting (CAD) programs such as AutoCAD. A major advantage is that the system is significantly less expensive than glass-plate photogrammetry.

HABS/HAER leased the Rollei version of this CAD-photogrammetry system, including a Rolleimetric 6006 camera, in 1989 to demonstrate its capability to produce HABS/HAER documentation. Among the structures recorded were Old Faithful Inn and other National Historic Landmarks in Yellowstone National Park, endangered NHLs at Monmouth Battlefield State Park in New Jersey, and damaged historic buildings after the Loma Prieta Earthquake in California. The experiments proved the viability of the system in meeting HABS/HAER standards, although the Rolleimetric 6006 camera produced negatives too small (21/4" x 21/4") to meet HABS/HAER Standards. When the large-format Linhof semi-metric camera was introduced, HABS/HAER decided to purchase a CAD-photogrammetry system.

The HABS/HAER CAD-photogrammetry laboratory currently includes five computer work stations linked in a network, with a high resolution digitizing table and the photogrammetric software loaded on one of the stations. The work stations are Hewlett-Packard Vectra 486/25T computers with 8MB RAM, 80MB hard drives, 1.2MB 5.25" floppy drives, and 20" high resolution monitors, while the file server is a Compaq Deskpro 386/20 with a 300MB hard drive. A 300MB tape backup and an unin-



terruptible power supply help to protect the system. The operating language is MS-DOS 5.0, the network software is Novell Netware, Version 2.2, and the CAD program is AutoCAD, Release 11—all National Park Service standards. A CalComp 1042GT eight-pen plotter is used for working prints while the final, archival, plots of the measured drawings are made on a laser plotter by a reprographics service. A Versatec "B" size (11" x 17") laser plotter is used for small plots. With the exception of the photogrammetric cameras and digitizing software, all the hardware and software are readily available, off-the-shelf products.

The photogrammetric camera system is the Linhof Metrika 45 with two lenses, a 90mm and a 150mm. The Metrika is a semi-metric camera that produces negatives meeting HABS/HAER Standards (it produces 4" x 5" negatives on 5" roll film). The 90mm lens is considered a wide angle, the 150mm a normal focal length. Both lenses have click stops on their focusing rings so they can be locked at known focal distances. A glass plate with a reseau grid is held against the film by a vacuum at the moment of exposure so that the grid is superimposed on the negative. The optical characteristics of the lenses and reseau grids are measured and plotted so that the optical distortions in the camera do not compromise the accuracy of measurements taken from the photographs. This camera calibration data is part of the survey control. They were the first cameras of their type sold in the United States.

In use, a structure is photographed from a minimum of three camera stations, usually from left-of-center, center, and from right-of-center. Targets are placed in the field of view as common reference points among the photographs. At least one known dimension must also be visible in common among the three views as well as a minimum of seven other points in common. Dimensions are extracted by digitizing from enlargements of the photographs. An Altek AC30 Datatab 24" x 36", high resolution (0.001" resolution with ±0.003" absolute accuracy), continuously variable backlit digitizing table, with a bulls-eye reticle pickup sensor and 5X magnifier, is used to digitize the enlargements. The digitizing software is Desktop Photogrammetry's Photocad-Multi for three-dimensional measurements and Photocad-Single for two-dimensional (planar) measurements. Both programs operate from a pull-down menu within AutoCAD and the resulting drawings are AutoCAD files. The software uses mathematical algorithms to locate the known points in three-dimensional space. Once the three-dimensional model is established and verified, other points can be digitized and measured from the photographs and a CAD drawing produced.

In use, we have found that CAD-photogrammetry drawings that include decorative features, such as the relief carvings in the frieze of the Lincoln Memorial, require an enormous amount of memory because you are essentially plotting topographic lines by connecting a series of points with short lines. The ornament for a single block of the Lincoln Memorial requires 2MB of memory, making the whole drawing file enormous and slowing down the CAD program. The result is that we are producing CAD files far larger than architects normally produce (i.e. orthographic drawings) and more similar to civil engineering CAD files that include topographic data. We are exploring software solutions such as freezing portions of the drawings, turning off layers, etc. We are also increasing the RAM memory in the work stations. However, these will provide only incremental increases in speed so we have decided to purchase a UNIX workstation with two terminals for use with the largest of our drawing files. The increase in computing power from an MS-DOS 486/33 to a UNIX machine is significant, but they are expensive. We expect that most CAD needs will continue to be met by our existing 486/25 and 486/33 computers with the additional 16MB of RAM. The UNIX terminals will be reserved for the largest drawing files requiring the most computational power. AutoCAD is available in a UNIX version and the UNIX terminals can be connected to our existing Novell network, so we do not have compatibility problems.

Independence Hall

Stereophotogrammetry was the technique chosen for measured drawings of Independence Hall. Forty-five measured drawings were produced under a contract for $201,000, or slightly under $4,500 a sheet. Three sets of 6.5cm x 9cm glass stereopairs were made, with 390 pairs in each set (105 exterior and 185 interior). The original HABS measured drawings and one set of the plates were transferred to HABS/HAER on May 11, 1992, in a ceremony at Independence Hall. Photomylars and the second set of plates were retained by the park and another set of photomylars was sent to the Technical Information Center in the Denver Service Center. The third set of

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Agenda (Continued)

CODES

1:15 p.m	Session 10 PWC:Building Code Application to Existing Structures	Lyne Fontaine Senior Conservation Engineer Heritage Conservation Program, A&ES (EC) Public Works Canada
2:00 p.m.	Session 11 NPS:Protecting Buildings for Life: A Fire Safety Equivalency System	Tom Solon Historical Architect Delaware Water Gap NRA U.S. National Park Service
2:45 p.m.	Discussion of Sessions 10 and 11	
3:15 p.m.	BREAK	
3:30 p.m.	Session 12 NPS:Park Roads and Highway Standards: Going-to-the-Sun Road	Rodd Wheaton Chief, Cultural Resources Rocky Mountain Region U.S. National Park Service Dennis Holden Vehicle Maintenance Operator Glacier National Park U.S. National Park Service

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plates was retained by the contractor. (Also see *CRM*, Vol. 14, No. 3, "Photogrammetric Recording of Independence Hall.")

Lincoln and Jefferson Memorials

In cooperation with the Denver Service Center (DSC), which helped support the purchase of the photogrammetric and CAD equipment, HABS/HAER is working on a project to document the Lincoln and Jefferson Memorials, using CAD-photogrammetry for some of the recording. The final HABS measured drawings will be plotted from AutoCAD files, while the DSC and its contractors will use magnetic media copies as the basis for their treatment drawings for restoration work.

The project for the two memorials is currently budgeted at $430,000, including the measured drawings plus traditional large-format photography. Of the total budget, $105,000 was planned for equipment purchases, principally the CAD workstations. Twenty-six HABS drawings will be plotted for the Lincoln Memorial and twenty-five for the Jefferson Memorial, although the total number of drawings that could be plotted from the AutoCAD files is almost unlimited. Calculating a per-sheet cost is thus difficult. For just the fifty-one HABS drawings, the cost would be $8,400 a sheet. However, if one removes the initial equipment purchases and calculates unit costs on the basis of the hundreds of drawings that could be plotted at many different scales, the per-sheet cost drops precipitously.

Conclusion

The *Secretary of the Interior's Standards and Guidelines for Architectural and Engineering Documentation* (HABS/HAER standards) govern the type of records gathered for the HABS and HAER collections. As a documentation technique, photogrammetry for the most part meets or exceeds these standards. Certainly in terms of accuracy and archival stability, glass-plate stereopairs are acceptable. Some of the characteristics of photogrammetric documentation are less than ideal in relation to HABS/HAER standards. The requirement for standard sizes and ease of reproduction is difficult to meet. Most stereometric and some semi-metric cameras produce negatives too small to meet the HABS/HAER Standard for large format photography. Since glass is fragile and therefore difficult to reproduce, HABS/HAER has made film copy negatives and paper prints of the glass plate photogrammetric images in the collection as user copies. While these copies show what is in the images, they are not capable of being used to produce accurate measurements. Access to the original glass plates requires special permission. In contrast, the film negatives produced in semi-metric cameras are easy to reproduce and, because of the riseau grid, do not compromise accuracy when enlarged and printed.

HABS/HAER has avoided producing photogrammetric images without plotting them into measured drawings because the dimensional information in the photographs would not be accessible, and therefore not meet HABS/HAER Standards. Further, the HABS/HAER Standard for the ability to independently verify the information in a photogrammetric drawing is limited because of the technologies and equipment involved. Unlike hand-measuring, where dimensions are recorded in field notebooks and are available to researchers, the photogrammetric images and survey control data are the only field records for structures recorded photogrammetrically.

Photogrammetry is a highly useful tool for recording historic structures. As with any tool, it performs some jobs better than others. Among its advantages are:

- It can be used to produce accurate measured drawings meeting HABS/HAER standards.
- It can document structures that are too large, irregular, or dangerous to measure by other means, or are inaccessible. Reducing or eliminating the need for scaffolding can reduce recording costs significantly.
- Photogrammetric images of structures can be made without plotting the drawings at a relatively low cost. Note that this type of recording does not meet HABS/HAER standards.

Among its disadvantages are:

- Photogrammetric measured drawings are expensive.
- The camera records only what it can "see." Getting the camera in the necessary locations can be a difficult challenge. Areas hidden from view must be recorded by some other means.
- Floor plans are more efficiently measured by hand.
- The dimensional information in the images is not easily accessible and thus difficult to verify. Architects who make extensive use of the field records for measured drawings will find this a significant limitation.
- Glass plates are fragile and difficult to reproduce. Film images do not have this problem, however.

The development of CAD-photogrammetry technologies has brought the capabilities of photogrammetry closer to the end-user. The costs for CAD-photogrammetry equipment and software, while expensive, are significantly less than traditional metric cameras and plotters. The technology is more user-friendly. Using semi-metric cameras in the field is straightforward. CAD programs are widely used by architects and engineers and the applicant pool for HABS/HAER summer projects is increasingly CAD-literate. HABS/HAER believes that CAD-photogrammetry will become an important and essential tool for documenting historic architecture and engineering.

John A. Burns, AIA, is deputy chief of the Historic American Buildings Survey/Historic American Engineering Record Division, U.S. National Park Service.

Heritage Recording: A Low-Cost Recording Practice

Robin Letellier

Within the process of cultural resources management, heritage recording is the function of producing precise and reliable technical information describing the assets being managed by the Canadian Parks Service (CPS).

Heritage Records are routinely used by historians, archeologists, conservators, period architects, landscape architects, period engineers and interpreters for conservation research, analysis, design and maintenance activities. They are also used by project and program managers for short and long-term planning. Equally as important is that they provide the archives with posterity records.

This activity can be complex in that it requires skilled **heritage recorders** that understand the needs of conservationists and the projects at hand, in order to design an effective "heritage recording process." This process generally takes into account the clients short-term research and investigation needs, the longer-term project objectives, the accuracy of information required and the recording techniques that will produce cost-efficient results. The product delivered for each project is a technical dossier composed of measured drawings, photographs, asset and condition descriptions, and other technical information that satisfies the data requirements of the conservation project.

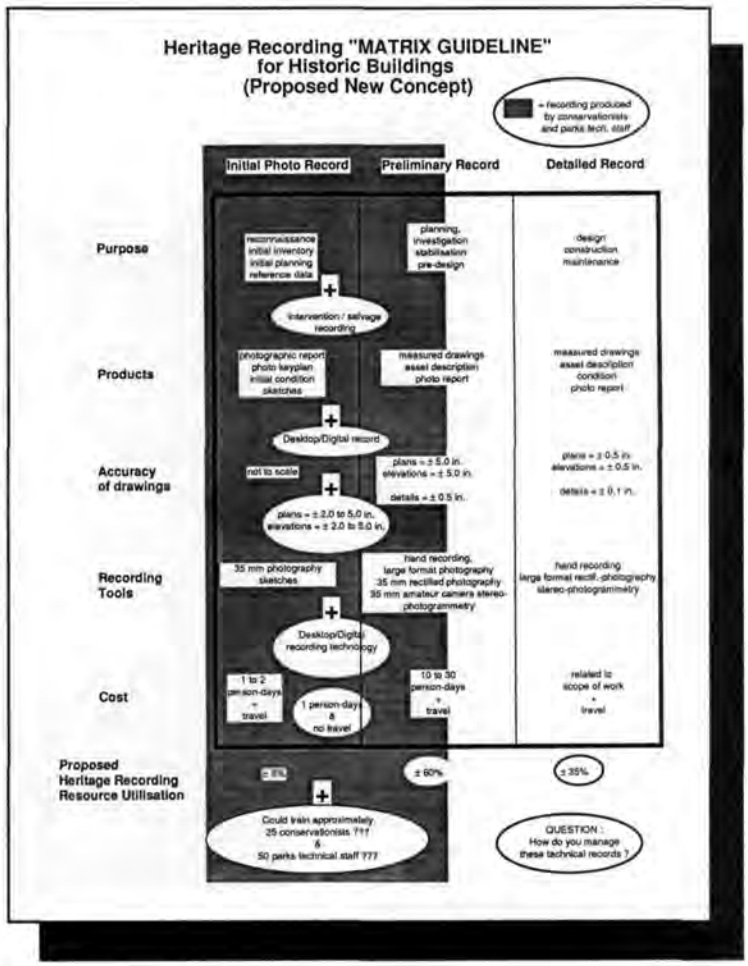
Because most conservation projects are different in nature, one of the many challenges in managing a recording project is to accurately define the scope of recording and a cost-effective product. To address this, Heritage Recording Services, in co-operation with ICOMOS Canada, has developed a Guideline for the Recording of Historic Buildings. The concept of"Levels of Recording" was introduced in this document as a "Matrix Guideline" for project managers and conservationists to communicate their specific needs to heritage recorders. This concept is currently being adapted to the CPS recording process.

Proposed New Heritage Recording Practice

Over the past five years, the CIPA (Comité International de Photogrammetrie Architecturál), in co-operation with ICOMOS and the ISPRS (International Society for Photogrammetry and Remote Sensing) has been promoting the development of new digital recording technologies for cultural resource management purposes. During CIPA's 14th International Symposium last fall, approximately 90% of the presented papers related to digital recording methods of various accuracy levels. Of these methods, new low cost recording techniques and related software were presented as state-of-the-art tools for recorders and conservationists to use daily on their personal computers. When refined, these technologies will allow, amongst other possibilities, the "scaling, rectifying, cutting, pasting and CAD overlay" of digital images into heritage recording reports. These "desktop heritage records" could then be incorporated digitally into conservation reports.

In recent years, Heritage Recording Services began evaluating the integration of the above-mentioned low-cost recording methods to address the "initial photo record" level of recording defined in the illustration. Based on the resource reductions most of us are experiencing, that is to "do more with less," and based on the ease of use and low cost of this new technology, Heritage Recording Services is currently investigating the possibility of involving conservationists and technicians, located in regional offices and parks, to participate more in the recording process. It is felt that significant benefits and savings could emerge from expanding the practice of "low accuracy recording" within CPS's conservation activities.

Robin Letellier is chief, Heritage Recording Services, Public Works Canada–A&ES(EC).



Autocad and Historic Photographs

Kristen R. Marolf

Surveying and accurately documenting significant historic structures has been, and continues to be, a challenge to preservationists as we search for more accurate and efficient methods of producing truly useful and longlasting documentation. The high-tech documentation process of scanning paper documents to computer-aided-drafting (CAD) files is relatively new to the field of architecture and few preservationists have realized the availability of this time-saving device.

Until recently, the only means of converting large-format documents to CAD files was by tracing the documents with a digitizer. Using this method, a drawing was mounted on a tablet and lines were transferred to AutoCAD by picking each crowded point with the crosshairs of a digitizer. Although the older technology of tablet digitizing has proven to be more efficient than working on mylar overlays, this process is still comparable to the time-consuming task of redrawing a document from scratch.

Personal computer (PC)-based scanners remove the need for large-format digitizer tablets. The scanners automatically digitize paper documents by creating video display image files (gray scale raster files). Using the image files, the computer operator can zoom in on crowded points and lines, creating a clearer resolution of the image's elements. Because the raster files are compatible with third-party software programs, raster images can be converted to vectors for modification with CAD programs and output to plotters.

Paper drawing ➜ Scanner ➜ Conversion software ➜ CAD file

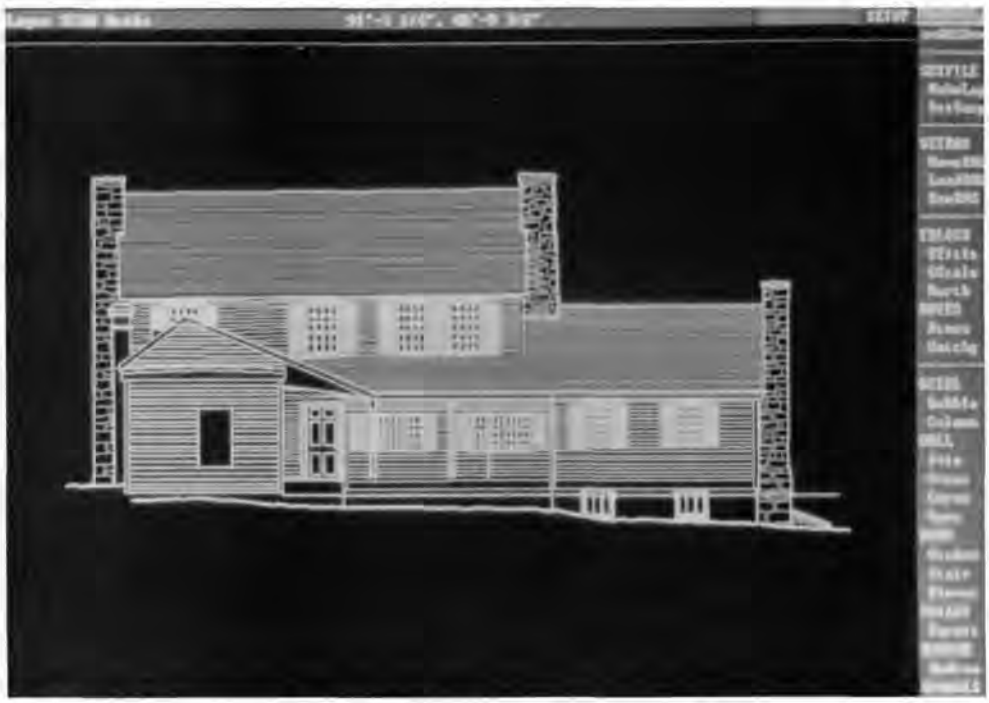
Using the prescribed technique as stated above, St. Louis animation and CAD scanning firm Manzer, Sanchez and Associates (MSA) scanned and converted the 1991 Historic American Buildings Survey (HABS) plan drawings of historic White Haven, at Ulysses S. Grant National Historic Site. At that time, the firm informed us that photographs of buildings and sites could also be scanned for conversion to CAD, opening the door to the possibility of constructing accurate two-dimensional drawings from photos.

In studying the chronology of White Haven, evidence of two significant additions to the house was discovered. Historic photographs and 1940 HABS documentation provide proof of existence but give no vertical measurements and only a few floor plan measurements. These structures are believed to have been intact at the time of Grant's occupation but were later demolished. The possible need for rebuilding the additions requires the production of construction documents which accurately represent the original structures. It would take an enormous effort to synthesize these documents by hand with the few measurements obtained, but by taking advantage of current technology, production of this documentation is simplified.

To start the process of creating new documents, 1991 HABS drawings of White Haven's elevations and several historic photographs were taken to MSA for scanning. Once the elevations were scanned, converted or biased, and fully vectorized by "heads-up" (on screen or interactive) digitizing, the process of recreating the lost additions as two-dimensional drawings could begin.

Using footprint dimensions from the 1940 HABS documents and a few vertical dimensions taken from the existing building, MSA constructed baselines or plot points for the additions on the newly created AutoCAD elevations. When the plot points were set, a historic photo could be scanned to display a gray scale raster image of the photo on the monitor. The scanning technician rubber-banded or biased (stretched to scale) the image by matching points of the image to the established plot points. Two different software packages were then used to set the image in proper proportions. First, a program which removes perspective and shrinks everything proportionately was used (i.e. RxImage). Second, another program (i.e. AutoIcon which comes with the RasterX

(continued on page 19)



After the new lines are added to the drawing with aid of the scanned photo and AutoCAD, the north elevation of White Haven gives the appearance of the home before the 1940 demolition of the addition.

Graphic Documentation of Stone

Rebecca L. Stevens
Keith Newlin

If a picture is worth a thousand words, then the picture we're getting of the Lincoln and Jefferson Memorials is worth a thousand megabytes. One part of a comprehensive evaluation of the memorials is a stone survey conducted by the National Park Service (NPS). The survey includes graphic documentation of each decorative stone. Through this survey, we've learned about the idiosyncrasies of different marbles and are beginning to see their different deterioration patterns. We've learned to document these characteristics. We've learned to orchestrate a stone survey on a massive scale, which is no easy task.

We are in the fourth year of a comprehensive evaluation of the Lincoln and Jefferson Memorials. The NPS goal is to better manage the aging process of these American icons.

Documenting the Stone

The general conditions evaluation noted failures of architectural stone as only a stone erosion issue. A study of stone erosion rates was underway when a 40-pound piece of column capital fell approximately 40' to the stylobate steps of the Jefferson Memorial. This failure was unexpected. It demanded a thorough evaluation of the condition of architectural and structural stone. We were fortunate that the stone erosion study was in progress at the time of the failure. The conclusion of the erosion study was that carved stones were eroding faster than flat vertical stones. Because of this and because of our visual observations of stone conditions, we decided to individually examine each decorative stone and every stone with an exposed horizontal plane. Vertical surfaces would be documented and analyzed on a statistical bases.

Another factor driving the stone survey is the unrecorded treatment of various stones on the memorial. Some of these treatments have been very successful; some have failed terribly. No accurate record of these treatments has been kept. No analysis of the treatments has been made.

We suspect that many stone cracks may have developed at the phase of initial construction. Newspaper articles from the 1920s construction alarmed the public

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Autocad and Historic Photographs
(continued from page 18)

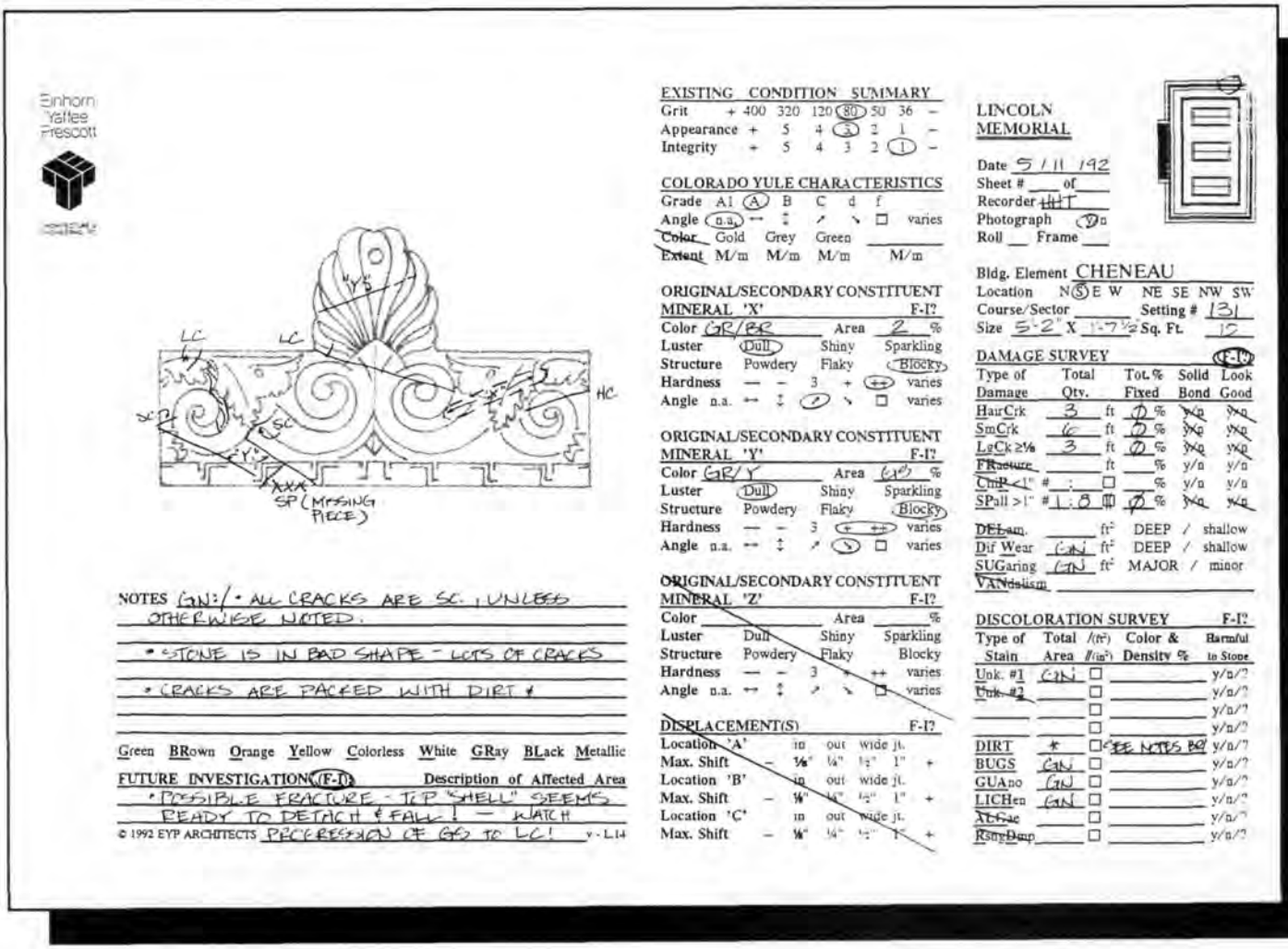
board or hardware needed for displaying an image on a monitor) worked with AutoCAD to display the photo and adjust the x and y directions separately. The computer then forced the image to pass through the plot points. This procedure uses standard perspective methods by reversing the perspective to find the vanishing point in the photo and projecting the objects to the picture plane. The process could be done manually but would require many hours of constructing perspective lines on overlays of the photos.

Finally, the lines on the image are ready to be traced in true scale. The scanning technician uses AutoCAD to draw the lines, creating a very useful two-dimensional document of the demolished structure. In White Haven's case, the roof slopes of both additions were determined and drawn using scanned photo images and experimenting with typical roof pitches. Siding was easily placed on each elevation. Wherever a clapboard on the photo image matched up with a baseline, a point was picked and a line extended to the opposite baseline. Windows and doors were less difficult to place on the elevation because their locations were known from the 1940 HABS documents. The heights of these elements were problems to be solved but could be found in the same manner as the siding placement. It was helpful that the left-hand casing of one of the doors in our historic photographs is extant. Paint marks from the siding are still visible on the casing and distances could be measured on the piece to verify the height of the door. Major elements were easily reconstructed on the new elevations as were smaller details such as individual bricks.

Although constructing AutoCAD drawings from photographs makes our job less arduous, there are limitations. The scanner does an excellent job of reproducing photos on monitors, but the photo being scanned must be clear and as sharp as possible. If this is not the case, the scanning technician may have difficulty placing the image against the baselines properly. Three-point perspectives and extremely acute angles in perspective may make it difficult to get accurate measurements from images. If at all possible, photos taken straight-on should be used to minimize the effect of perspective. Also, the scanning technician should not only be able to manipulate data with the computer, but should have some knowledge of building construction technology and know the basics of perspective drawing.

Setting limitations aside, the vectorized CAD files can be edited, copied and transferred. New documents, such as chronology, structural or detail drawings can be created from the files. Furthermore, files always remain workable. Layers can be turned on and off, and new information can be added. The result of this product is an amazing and practical tool that can be used to the preservationist's advantage.

Kristen Marolf is a historical architect at the Ulysses S. Grant National Historic Site, St. Louis, MO.



Einhorn Yaffee Prescott

EXISTING CONDITION SUMMARY

Grit	+	400	320	120	(80)	50	36	–
Appearance	+	5	4	(3)	2	1	–
Integrity	+	5	4	3	2	(1)	–

COLORADO YULE CHARACTERISTICS

Grade	A1	(A)	B	C	d	f
Angle	(n.a.)	↔	↕	↗	↘	□ varies
~~Color~~	Gold	Grey	Green			
~~Extent~~	M/m	M/m	M/m			M/m

ORIGINAL/SECONDARY CONSTITUENT MINERAL 'X' F-I?

Color GR/BR Area 2 %

Luster (Dull) Shiny Sparkling

Structure Powdery Flaky (Blocky)

Hardness — – 3 + (++) varies

Angle n.a. ↔ ↕ (↗) ↘ □ varies

ORIGINAL/SECONDARY CONSTITUENT MINERAL 'Y' F-I?

Color GR/Y Area (1%) %

Luster (Dull) Shiny Sparkling

Structure Powdery Flaky (Blocky)

Hardness — – 3 (+ ++) varies

Angle n.a. ↔ ↕ ↗ (↘) □ varies

ORIGINAL/SECONDARY CONSTITUENT MINERAL 'Z' F-I?

Color Area %

Luster Dull Shiny Sparkling

Structure Powdery Flaky Blocky

Hardness — – 3 + ++ varies

Angle n.a. ↔ ↕ ↗ ↘ □ varies

DISPLACEMENT(S) F-I?

Location 'A'		in	out	wide	jt.	
Max. Shift	–	1/8"	1/4"	1/2"	1"	+
Location 'B'		in	out	wide	jt.	
Max. Shift	–	1/8"	1/4"	1/2"	1"	+
Location 'C'		in	out	wide	jt.	
Max. Shift	–	1/8"	1/4"	1/2"	1"	+

LINCOLN MEMORIAL

Date 5/11/92
Sheet # ___ of ___
Recorder HT
Photograph (7)
Roll ___ Frame ___

Bldg. Element CHENEAU
Location N (S) E W NE SE NW SW
Course/Sector ___ Setting # 131
Size 5'-2" X 1'-7½ Sq. Ft. 12

DAMAGE SURVEY (F-I?)

Type of Damage	Total Qty.		Tot.% Fixed	Solid Bond	Look Good
HairCrk	3	ft	(0) %	~~y/n~~	~~y/n~~
SmCrk	6	ft	(0) %	~~y/n~~	~~y/n~~
LgCk ≥1/8	3	ft	(0) %	~~y/n~~	~~y/n~~
~~FRacture~~	___	ft	___ %	y/n	y/n
~~ChiP~~ <1"	# ___	□	___ %	y/n	y/n
SPall >1"	# 1.8	(□)	(0) %	~~y/n~~	~~y/n~~
~~DELam~~.	___	ft²	DEEP / shallow		
Dif Wear	GN	ft²	DEEP / shallow		
SUGaring	GN	ft²	MAJOR / minor		
~~VANdalism~~	___				

DISCOLORATION SURVEY F-I?

Type of Stain	Total Area	/(ft²) /(in²)	Color & Density %	Harmful to Stone
Unk. #1	GN	□		y/n/?
~~Unk. #2~~	___	□		y/n/?
___	___	□		y/n/?
___	___	□		y/n/?
DIRT	*	□	SEE NOTES BQ	y/n/?
BUGS	GN	□		y/n/?
GUAno	GN	□		y/n/?
LICHen	GN	□		y/n/?
~~ALGae~~	___	□		y/n/?
~~RUnDown~~	___	□		y/n/?

NOTES GN: / • ALL CRACKS ARE SC. UNLESS OTHERWISE NOTED.
• STONE IS IN BAD SHAPE - LOTS OF CRACKS
• CRACKS ARE PACKED WITH DIRT *

Green BRown Orange Yellow Colorless White GRay BLack Metallic

FUTURE INVESTIGATION (F-I?) Description of Affected Area
• POSSIBLE FRACTURE - TOP "SHELL" SEEMS READY TO DETACH & FALL! — WATCH

© 1992 EYP ARCHITECTS PROGRESSION OF GO TO LC! v-L14

Graphic Documentation of Stone

(continued from page 19)

about cracks in the frieze of the Lincoln Memorial; construction correspondence note defects. And original metal pins were found within the crack seams of a column volute at the Jefferson Memorial. The locations of these early failures were noted only generally in construction field notes. It is necessary to correlate the past failures with current conditions in order to avoid unnecessary treatment of the architectural fabric.

Many individuals have proposed treatments for the stone problems at the memorial. To test and recommend the proper treatment for the stone, the NPS must make an accurate inventory of existing conditions, and study of the causes of the conditions before any treatment can be recommended with confidence.

Some method of recording the existing conditions of treatments of individuals stones was deemed necessary for future maintenance and management tracking. This link between our stone survey and future care will be made with the Service's computerized Inventory and Condition Assessment Program (ICAP.)

Planning the Survey

A three-phase approach to the stone survey was adapted. We planned a three-tiered approach to ensure minimal loss of historic fabric. The phasing also gives team professionals, managers, and the public time to comment on our methods and findings. The three phases of the survey are:

1. visual recordation of features, defects, repair, and other conditions;
2. non-destructive testing on stone that exhibits characteristic of failure based on the visual survey;
3. destructive testing to verify the results of the non-destructive testing.

The graphic documentation of each stone and its characteristics requires considerable effort. Organizating this project and achieving the best methods of access took more time than expected (approximately 18 months). The shear size of the memorials and their highly public nature were the challenge of this survey project. We also lacked stone surveys on structures of similar magnitude to use as models. We had to decide what physical attributes to inspect; how to record our observations; how we would analyze the information; what attributes to record that may be valuable in the future; and how to most effectively, safely, and economically access the stones (a major effort of the visual survey).

The National Park Service Advisory Panel for the Preservation of the Lincoln and Jefferson Memorials met and determined, in general, what conditions to inspect.

One reference used was *A Glossary of Historic Masonry Deterioration Problems and Preservation Treatments.*[1] Cracks, discoloration, spalling, algae, moss, damage, and veining were some attributes that the panel thought should be recorded. We soon found that the general information in reference books on masonry is not exacting enough to guide detailed stone inspections.

The final characteristics and conditions to record were refined through an interdisciplinary effort. Architects, tradesmen, quarry personnel, geologists and historians contributed in deciding the attributes to report. The information gathered will help us reach informed conclusions about the stone conditions and lead to sound stone treatment. We encourage anyone doing a stone survey to use not just the architects or engineers to design the survey parameters.

Eight thousand stones are being individually surveyed. The amount of data we will gather forced us to organize, analyze, and access the facts using computerized information management. The general organization of the survey was based on the element/feature categories of the ICAP. The particular characteristic of different stone types required that we customize the form for each structure and each part of the structure.

An important requirement of a visual survey is close-range viewing of each stone and all exposed surfaces of the stones. There were several complications in achieving this requirement at these structures. The terrace around the Lincoln and Jefferson Memorials cannot support heavy concentrated loads, like those of a hydraulic lift or traditional scaffolding. Management requested that the memorials remain open throughout the investigation and preservation work. In addition, the access system could not cause damage to the building fabric or be attached to the structures for support. We had to consider that architect and managers, people not accustomed to climbing rigging or working at heights, would be using the access system. It had to be easy for them to use. As in all projects, safety and money were factors to consider when deciding the access method to use. Planning for access to the building features during a stone survey of a large structure should begin early. It is integral to the success of the project.

The NPS commissioned a study to explore the feasibility of various access methods. We finally selected aluminum scaffolding. The following methods are being used:

- movable towers to inspect the columns and entablatures;
- cantilevered scaffolding over the entrance to the Lincoln Memorial steps to inspect the entablature and to catch small stone fragments;
- stationary scaffolding to inspect the portico and inner dome of the Jefferson Memorial;
- a boatswain's chair to view the outer dome of the Jefferson Memorial.

Designing the Survey Form

As mentioned, the decision about what characteristics to record was done in cooperation with many people. But how to record these characteristics and how to assure consistency in recording was left to the architecture firm and a few members of the preservation team.

The final survey was designed by an architecture firm collaborating with the NPS. To perfect a boilerplate form we made many revisions. The Lincoln sheets are in their 18th version; Jefferson forms are in their 14th version. The things we considered in developing a survey form were:

1. exact features and conditions to record (too little information may make it necessary to resurvey areas while too much information may waste time and money without gaining any more usable knowledge);
2. short term and future use of the data;
3. ease of gathering information in the field (is it easier to use small computers or paper forms?);
4. management, analysis, and retrieval of data;
5. how to format the survey form (on a computer screen or on paper);
6. production and replication of data field and forms;
7. inspection scheduling and field work logistics;
8. skills and knowledge of the survey team (was the team going to be architects, preservation specialists, or perhaps students? Do they have drawing or photographic abilities?).

The buildings were divided by their classical features and according to ICAP features. The original stone setting drawings were discovered and verified as usable. The stone setting numbers allowed us to correlate the original construction field notes with current conditions and made it easier to assign a unique number to each stone.

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Agenda (Continued)

4:15 p.m.	Session 13 PWC:Constructing a Replacement Covered Bridge at Point Wolf	Brian Gallant Architectural Technologist A&ES (EC) Atlantic Region Public Works Canada
5:00 p.m.	END OF SESSION	
8:00 p.m.	Optional Session: Canadian/American Videos	
Wednesday, June 17		
TREATMENT		
8:30 a.m.	Session 14 PWC:Upgrading HVAC Systems in Historic Buildings	Lauren Gruszecki Conservation Architect Heritage Conservation Program, A&ES (EC) Public Works Canada
9:15 a.m.	Session 15 NPS:New Mechanical Systems for Historic Structures	Al O'Bright Historical Architect Midwest Regional Office U.S. National Park Service
10:00 a.m.	Discussion of Sessions 14 and 15	

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Graphic Documentation of Stone
(continued from page 21)

Our survey form evolved into a one-page check list that fits on a clip board. The survey team of architects can use it even while swinging from a boatswain's chair. It only takes a few minutes to fill out including sketching the stone's characteristics. The graphic image will be scanned into a computer and will eventually be linked to ICAP. The check list and written information will be manually entered into the ICAP.

Each stone face has an individual survey form prepared in WordPerfect 5.1 and are landscape-printed with a laser jet printer. The sketch of each stone face is copied in half tone on the form. The stone's location on the building plan or elevation and its number is printed onto the sheet. All the survey forms by building, location and feature were prepared in advance. The survey forms are assembled from the prepared file. The architects need only bring to the memorials the forms for the stones they are surveying that day.

The form is divided in sections of similar conditions. For example, on the Lincoln Memorial the form is arranged into the existing condition summary, Colorado yule characteristics, original/secondary constituent minerals, displacement, damage, and discoloration. The forms were developed to record all identifiable inclusions (constituent minerals) and repairs. The list of inclusions was provided per marble type, by a U.S. Geological Survey mineralogist.

Grading standards have changed from the time these memorials were built. We thought it was important to correlate the historic stone to today's standards, so that current knowledge about the marble could be applied to our condition analysis. Every attempt was made to figure out if modern economic grading techniques could be applied to the visual survey.

The Lincoln Memorial is primarily Colorado Yule marble. The quarry at Marble, Colorado, was contacted for modern quarry samples. The Jefferson Memorial is Vermont Danby marble. The quarry at Shelburne, Vermont, was also approached. Both quarries willingly provided samples. The samples were used to make a preliminary survey for comparison to the existing marble. We were fortunate to have a former quarryman of Danby Marble provide two days of onsite inspection to classify the Jefferson Memorial marble. His knowledge about the marble saved us time and helped us refine the Jefferson survey form. Unfortunately, the Colorado Yule mine reopened in 1990 after being closed for several decades. No experienced and knowledgeable quarryman was available to help us with the Lincoln Memorial. We recommend contacting, if possible, an experienced quarryman to help with the development of a stone survey.

The survey form was designed to aid in consistent recording and in uniformly assessing conditions. Samples of the different stone conditions or attributes were identified so that during the survey conditions could be compared to the sample areas. Another example, surface roughness, which is a general indication of the amount of erosion, is compared to different sand paper grits and noted on the form. The survey team members carry small samples of sand paper to judge the roughness.

The knowledge, experience, and job training of a survey team are important to the accuracy and consistency of a survey. Our survey team had experience with large marble building stones and was trained on the specific characteristics of the memorials' stone. The team members are instructed not to speculate about the cause of a condition, but to record only their visual observations of the stone condition. These steps help us keep the survey as objective as possible.

At each stone, the surveyor fills in the date, the photograph roll and frame, his/her name section of the form. The building element, location, course, setting number and size are on the sheet before the surveyor goes to the site.

The list of attributes was field tested and the list expanded or shortened to fit the field conditions. The preliminary stone survey form was field tested with the mineralogist and the architects; changes were made only after agreement by the team members. Anyone doing a major stone survey should plan plenty of time to develop the survey and design the survey form.

Using the Data

The visual survey is the first phase of the stone condition analysis. The visual survey identifies those stones with conditions that need further investigation. These stones will be tested using nondestructive methods such as impact echo resonance. The non-destructive investigation is the second phase. The third phase will be destructive investigation. Stones that are questionable in structural integrate will be core drilled.

We also will run computer analysis of the combined data to see if we have patterns of problems. These may help us determine the larger causes of conditions such as stone displacement or stone discoloration.

At the completion of the survey we will have a clear picture of the memorial stone conditions. From this we will study the causes and recommend actions, if any, to take on individual stones or on the complete building.

We are convinced that the condition survey is a critical step in the preservation of the Lincoln and Jefferson Memorials. We must know the problems and their cause before we can undertake a solution. The information we gather will be an invaluable tool for the long-term care of these national memorials.

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[1] Grimmer, Anne E., A Glossary of Historic Masonry Deterioration Problemsof Preservation Treatments, Department of the Interior, National Park Service, Preservation Assistance Division, 1984.

Rebecca L. Stevens, A.I.A., is the regional historical architect for the National Capital Region, U.S. National Park Service.

Keith Newlin is the project coordinator with the Eastern Team of the Denver Service Center, U.S. National Park Service.

Building Assessments: The Presidio Challenge

Cary P. Feirabend

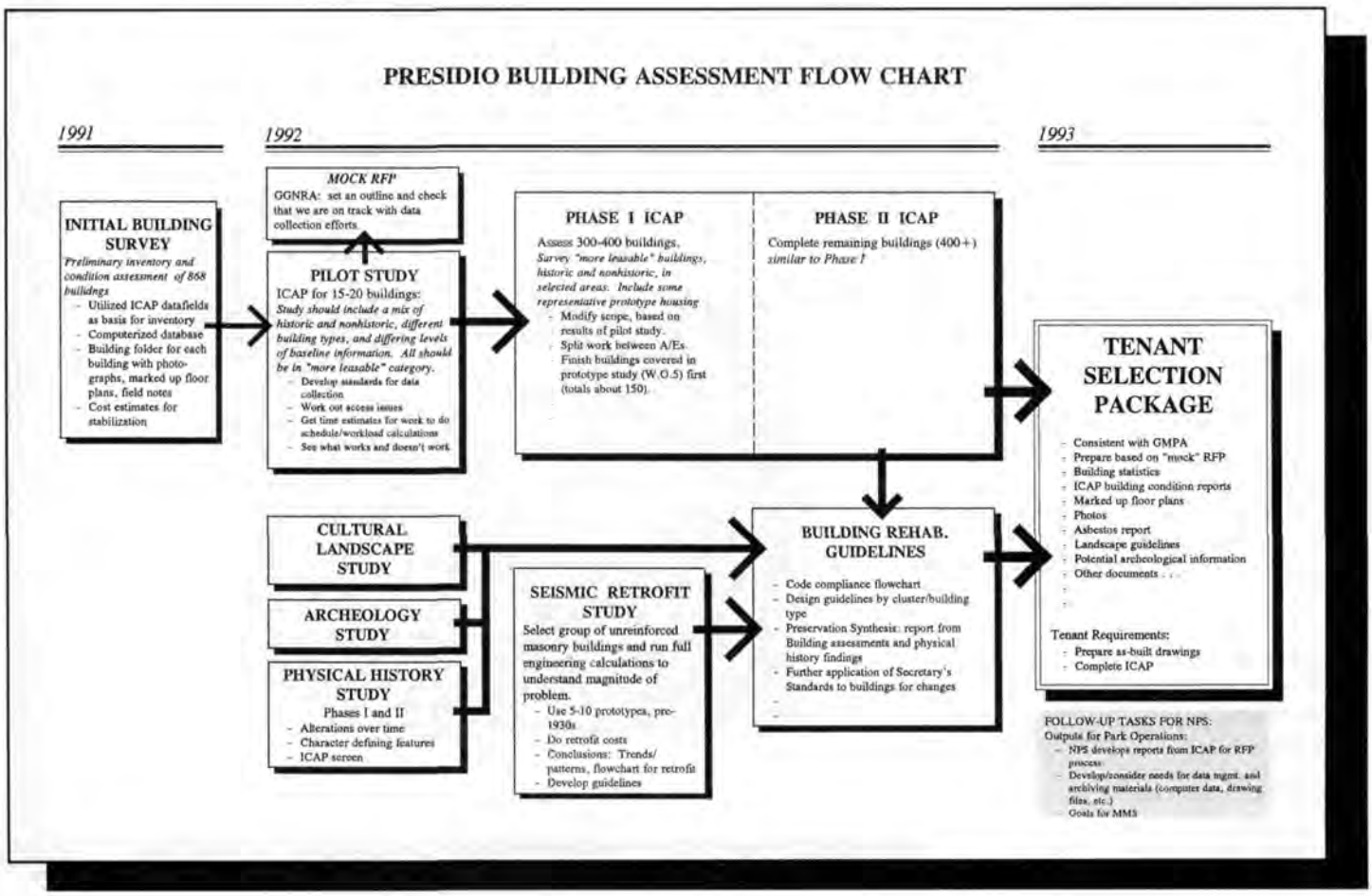
At the edge of the Golden Gate in California lies the Presidio of San Francisco, a National Historic Landmark whose military history spans more than 200 years. Scheduled to close as an Army base by 1995, the Presidio will become part of Golden Gate National Recreation Area (GGNRA); as a result, the National Park Service (NPS) is preparing a General Management Plan Amendment for GGNRA to determine the Presidio's future as a park unit. As part of this planning process, an intensive data collection effort which includes a preliminary building inventory and condition assessment, has been underway.

The Presidio, currently headquarters for the Sixth U.S. Army, is a 1400-acre "city within a city" composed of over 860 buildings, of which approximately 500 are historically significant. The Presidio's role in military history has resulted in a vast range of military architecture and engineered structures that span its development. The types of facilities here today include two hospitals, a major research institute, 1200 housing units, a golf course, a 1920s airfield and associated structures, an intact array of harbor and coastal defense structures dating from 1796 through World War II, a Mission Revival style coastal artillery sub-post, a former U.S. Coast Guard station, brick cavalry stables, a commissary, post exchange, gas station, and other support facilities critical to the operation of the Presidio as a distinct community. Other resources include a national cemetery, the last free-flowing creek in San Francisco which is also the post's water supply, remnant native plant communities, unique recreational and scenic resources, potentially significant archeological sites, and a historic planted forest.

In sum, the Presidio contains a wide variety of military architectural styles dating from the Civil War era to the present, constructed of virtually every known building material. As the inheritor of this spectacular landmark in a few years, the NPS initiated a "cold audit" of the Presidio's built resources to understand what exists today; to identify what is historically significant and merits preservation; to understand the overall condition and deficiencies of the resources; and to be forewarned of the magnitude of any problems and future capital costs.

Due to the time and budget constraints of planning, the NPS was forced to design an expedient and creative data collection program for the 865+ buildings that would not be a throw away, one-shot project, but rather, an effort that could be built upon in the future as additional fund-

(continued on page 24)



Building Assessments: The Presidio Challenge
(continued from page 23)

ing becomes available. The first step was to identify the long-range goal for building data.

What would be required to properly manage and take care of these resources? It was determined that a full Assessment Report, as defined in the Service's Inventory and Condition Assessment Program (ICAP), and a physical history report for historic structures, would be the ideal goal; yet, this could not be accomplished all at once in the given time frame. So, working back from this goal, immediate objectives were identified that stipulated a multi-phased program that would be flexible to change over time, answer immediate questions for planning and management, and be affordable. It was also critical that the product be compatible with other existing NPS databases, as well as AutoCAD; provide enough information to guide treatment recommendations (from removal to restoration) for buildings (historic significance aside); satisfy many interested parties, from technicians to managers to real property specialists, with an adequate level of information to conduct preliminary analyses such as capital and operational costs; render a sense of magnitude of the condition of the resources Presidio-wide; and be able to be accomplished in approximately nine months for under $300,000.

With this in mind, then, a survey form was developed by the NPS using data fields from the ICAP as a starting point. This would ensure a smooth upload or data dump into ICAP in the future. Additional fields specific to planning needs and the Presidio, such as "army departure date," were added to the survey.

The building questionnaire was divided into several sections, the primary one being the building component/feature identification and assessment portion. The sections are:

General Information: building number, name and locational information;

Significance: date of construction, dates of alterations, National Register status, historic and contemporary uses;

Character-Defining Features Text: descriptive text for historic buildings;

Areas and Uses: statistical information such as square footage per floor, number of floors, overall condition, and service access;

Building Specific Information: such as construction type, occupancy load information, and status of drawings;

Feature Condition Assessment: material identification, condition assessment, and major deficiencies for the site, foundation, structure, exterior, interior, roof, and utility systems; fire/life safety, and accessibility deficiencies.

BUILDING INFORMATION SHEET

OFFICERS' QUARTERS, OFFICER FAMILY HOUSING
Address: FUNSTON AVENUE
Planning Area: Main Post

Total Sq. Footage: 3,936 SF
Current Use: multiple dwelling (incl. duplex)
Construction date: 1862 Historic? Y
Overall Condition: Fair
Number of Floors: 2.0
Floor Areas: First: 0 SF
Basement: 0 SF
Additional: 0 SF
Housing Units: 2
Service Access: N

SITE
Condition: Fair
FOUNDATION
Condition: Fair
Type: Masonry-Concrete
STRUCTURE
Condition: Fair
Type: Wood-Frame

EXTERIOR WALLS
Condition: Fair
Type: Wood-ClapBoard
INTERIOR WALLS
Condition:
ROOF
Condition: Poor
Type: Asphalt-Shingle

PLUMBING
Bldg. has plumbing? Y
Condition:
HVAC
Bldg. has heat? Y
Condition:
Distribution: Steam
Fuel: Natural Gas
AC: None

ELECTRICAL
Bldg. has electrical? Y
Condition:
Bldg. has meter? Y
LIFE SAFETY
Fire Egress: N
Fire Detection:
Fire Suppression:
Handicapped Access: N

PRESIDIO OF SAN FRANCISCO Bldg. 8: 04/28/92

Additional Text and Areas for Further Study: a text field for additional notes that did not fit the field form format;

Housing: for housing structures, additional features such as number of units, type of units per building, and communal facilities were identified;

Inspection Information: date of inspection and names of surveyors.

A local architectural firm, Architectural Resources Group, was contracted to conduct the field work and complete the forms and database fields. The final products of this first round of data collection included a computerized database and individual building folders for each building. Each folder contains the field survey forms, photographs, marked up floor plans, existing Army data, cost estimate work sheets and assumptions, and computerized building reports. The computerized database is a clippered program using dBaseIII Plus. Reports for queries are generated through Report Writer software program.

The computerized database has been used frequently to generate reports for commonly asked questions related to planning and management. The database is now linked to an AutoCAD mapping program to graphically illustrate the information. Types of queries include:

- Highlight buildings that have poor or critical roof conditions. This can be used to urge the Army to take immediate action on some of the buildings prior to their departure.
- Display for each planning area, the total available building square footage per current use category with recommended capital costs for stabilization.

In such a manner, the database has been an invaluable planning and analytical tool. The ability to access this information readily through these types of queries, complimented by a graphic map display, has been instrumental in analyzing the Presidio's resources at large. The overall trends this survey highlighted are that the buildings are generally in fair condition; they typically have life/safety code violations and poor roofs; the historic housing have the highest degree of interior integrity; the majority of floor plans are outdated; and only a handful of buildings are handicapped accessible. The flexibility of the computerized database allows planners to cut through the data at various levels of detail—Presidio-wide, by planning area, as well as building specific—depending upon the question at hand.

However, this is only the beginning. At this point in the process, as planning is well underway, the next step for building data collection will be directed toward the needs for preparing tenant selection packages. The existing database has already been successfully uploaded into ICAP, yet also continues to be used to answer questions daily about the Presidio's buildings. The next steps for data collection will be completion of ICAP, some sample seismic assessments, hazardous material assessments and management strategy alternatives, better cost estimates for repair and rehabilitation, physical histories for historic structures, elaboration on the character defining features for preservation, and the development of design guidelines for future users.

Given the constraints and challenges of this project, the initial Presidio building survey was extremely successful. The entire project, which included the field survey work, data entry and stabilization cost estimates for 865+ buildings, was concluded in a nine-month period at a cost of less than $330 per building. Though some will argue that the amount of information gathered for the General Management Plan far exceeds what is typically done, the Presidio is well on its way to mastering a thorough building condition assessment program, which will ultimately support the maintenance management operations. A project of this scale is unprecedented for the NPS; but perhaps it can be viewed as a model for future planning efforts for sites and districts laden with numerous built resources and as a means of achieving a long-range data collection goal through a phased, flexible process.

Cary P. Feirabend is a historical architect on the Western Team at the Denver Service Center, U.S. National Park Service.

Agenda (Continued)

10:30 a.m.	BREAK	
10:45 a.m.	Session 16 NPS:Effects of Extreme Snowfall on Historic Buildings at High Elevations	Laurin Huffman Regional Historical Architect Pacific Northwest Region U.S. National Park Service
11:30 a.m.	Session 17 NPS:Seismic Retrofit of Historic Buildings	Terry Wong Chief, Structural Engineering Western Team Denver Service Center U.S. National Park Service Carey Feierabend Historical Architect Denver Service Center U.S. National Park Service
12:15 p.m.	LUNCH	
1:45 p.m.	Session 18 Identifying and Replicating Historic Edge Tool Marks on Log and Heavy Timber Buildings	Bernie Weisgerber Regional Historic Preservation Specialist Region One U.S. Forest Service

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CPS Asset Management Process

John McBain

The Canadian Parks Service (CPS) owns, operates and maintains more than 15,000 fixed assets located, quite literally, from coast to coast to coast. It is commensurate with the responsibilities of a major custodian to know the extent of its holdings and their condition.

Indeed, in today's climate of shrinking resource budgets and continuing fiscal restraint, it is essential that an owner of this magnitude also know in advance the extent and timing of capital funds that will be required to manage such a large asset base.

This paper briefly outlines the activities of the CPS in this area, and introduces several issues both central and unique to the recapitalization management of cultural assets.

A glossary of some of the terms used in this paper is appended.

Asset Management Process and Recapitalization Planning

To provide an enhanced asset management tool within CPS, Architectural and Engineering Services (A&ES) has developed the Asset Management Process (AMP) for use at the field, regional and headquarters levels of CPS. AMP is a comprehensive approach to asset management activities which integrates maintenance and recapitalization processes, sharing a common database and related linkages. The process is supported by operational manuals, technical guides, PC based software and dedicated A&ES asset management staff located in the regional and headquarters offices.

The two primary components of AMP are the Maintenance Management System (MMS) which deals with routine maintenance activities, and the Recapitalization Management Process (RMP) which deals with higher cost, less frequent component, and asset replacement. The topic of this paper focuses on RMP. Figure 1 illustrates the inter-relationship between the two components of AMP.

Briefly stated, the concept of RMP is based on regular inspections and reporting which indicate the condition of the asset, and forecast both amount and year of capital fund requirements. This approach is similar to that used by the NPS Inventory and Condition Assessment Program (ICAP). Inspectors rate the condition of an asset and its components on the basis of four criteria and four rating levels. One rating matrix is used for all assets. It is considered essential that a common "language" be established for all asset categories. The condition rating matrix is illustrated in figure 2.

In concert with rating the condition of the asset, the inspector is asked to forecast the amount and timing (year) of capital funds needed for remedial action required due to the condition of the asset. Using these primary pieces of information, CPS can more accurately prioritize and plan for its capital requirements at all levels of the organization. The field level can identify what funds are required for specific action, regional offices can use site reports to prepare regional roll-ups to aid in the allocation process, and headquarters can use national reports to justify programwide resource requirements. It must be emphasized that many factors are taken into account prior to making capital asset investment decisions. RMP addresses one of the factors by providing a valuable tool which concisely and consistently indicates condition and technical requirements.

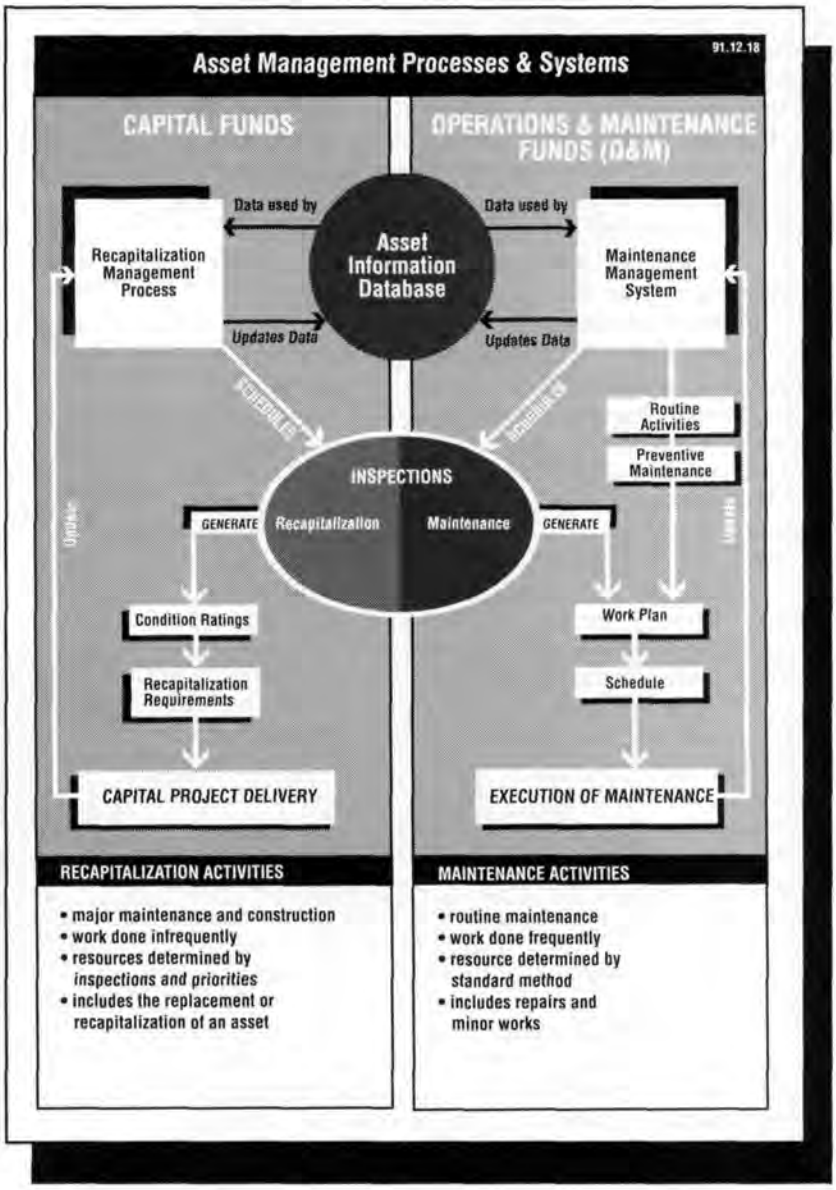

Figure 1.

Asset Management Process

Recapitalization Management Process

Asset Condition Rating

Ratings	Criteria			
	Health & Safety	Risk to Asset	Level of Service	Urgency
Good	Normal Risk	Normal O&M Procedures	Normal Operation	6 Years +
Fair	Slight Increase in Risk	Minor Deterioration	Reduced Operation	3-5 Years
Poor	Significant Risk	Significant Deterioration	Restricted Operation	1-2 Years
Closure	High Risk	Major Deterioration	Non-Operational	Immediate Action Req'd

Architectural and Engineering Services for Environment Canada
Asset Management Process

01.04.24

Figure 2.

In these applications, RMP becomes more than a capital works planning tool, it is a communication tool; assisting managers to communicate needs, urgency and type of action required for their assets in a manner consistent from one site to another.

RMP Development

Recapitalization Management Process is currently in the second stage of development. The first stage, titled "Phase 1," was completed over three months, ending in February 1992. It was a short-term national "blitz" wherein managers in all regions were asked to review their inventory, confirm basic information, and rate the overall condition of the asset using the RMP Condition Rating Matrix. Phase 1 serves CPS at the macro level only, indicating total replacement costs, and overall asset condition on a regional and national basis.

Phase 1 data is presently being tabulated for release in a national report. It also served as an excellent 'proving ground' for the final direction and development of RMP. General Works and regional technical staff who participated in Phase 1 have provided specific input for this year's development plans.

The next stage of RMP will complete the development and implementation to realize the total concept of the process. In addition to indicating the overall condition of the asset, inspectors rate the condition of the components of an asset, and forecast the timing and amount of resources required to complete necessary remedial action. Importantly, resource needs will then be based on specific conditions and remedial actions. It will not be necessary to make theoretical projections using life cycles and recapitalization rates.

Recapitalization Planning Issues for Cultural Assets

The timing for performance of asset management activities for cultural asset is as significant or more so than that for contemporary assets; however, there are distinct differences in the manner in which they are managed. As one experienced A&E heritage specialist noted early in RMP development, 'While you are developing a process for recapitalization, you must realize it is our objective NOT to recapitalize cultural assets.' This sage observation notwithstanding, a recapitalization planning tool is, after all, about money. Such a process must also apply to all assets, cultural or not, because it provides a common tool to express the condition, relative need, and the amount of resources required for the asset. It is only logical then, that this process could be used as one of the tools for allocating capital resources for assets; cultural assets must be part of this process.

With that fundamental precept established, several more complicated issues are raised to the fore. Four of the more prominent ones are described in the paragraphs that follow.

Replacement Costs. Many approaches to asset based resource allocation, including RMP Phase 1, use asset replacement cost estimates. Always problematic in application, RMP emphasizes it is an estimate of replacement cost, not value. Nonetheless, how do you estimate the cost to reconstruct the Quebec City fortifications? In like materials, detail and methods? More importantly—why? The latter question is answered first—because it is part of a method used to allocate resources. It is not defended as a good method, but a viable method until something better is available.

In the case of RMP Phase 1, replacement costs are used because it is a macro perspective. As described previously, full RMP will replace this approach with asset specific funding requirements. Phase 1 estimates were prepared assuming contemporary methods of construction would be used to re-build assets to match their current composition.

System Complexity. System development in today's large organizations is faced with a fundamental question about degree of complexity. How much will the system be asked to do? How will it serve the field, region and headquarters? For cultural assets, how will it serve both General Works staff and architectural and engineering staff?

In the case of RMP, these questions are answered by three basic principles. The first stems from the realization that the concept of the paperless office and computers easing workload is a myth—data swamp is a reality. Computers have increased the amount of paper mail, electronic mail, and tasks that staff and managers must complete each day. Within CPS there was an increasing awareness that if all system development continued unabated, staff soon would not have enough time to complete primary duties. For this reason, RMP has been specifically designed to stay as simple as possible—we are always trying to walk the line between collecting enough data to be meaningful, yet not so much to be burdensome. Second, RMP is not intended to replace site or asset specific investigations; to the contrary, it relies on them. It will provide a consistent format to report the results and needs of those investigations, or flag the requirement for such an investigation. Format allows roll-up and analyses on a national basis. And third, the project team have worked closely with General Works staff to develop a process that suits their level of need. Regional and headquarters applications will use reduced amounts of information, but the process must first serve the field staff or it will not be successful.

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CPS Asset Management Process
(continued from page 27)

Accuracy. A third issue encountered in the development of RMP specific to cultural assets was concern about the degree of accuracy of estimates and quality of recommended remedial action depending on the source of the recommendation. To resolve this issue, the project team developed three levels, or types of inspections. Each level includes a description of the type of inspection, (e.g. visual, non-destructive testing, special equipment), frequency of the inspection, and qualifications of the inspector for that type. All reports and forecasts include an indication of the level or type of inspection.

Cultural Asset Definition. The fourth issue presented here concerns the actual definition of cultural assets. RMP includes some of the pluses and minuses usually associated with a 'system'; accordingly there are no gray areas for designations. In the system itself an asset is either identified as a cultural asset or contemporary asset. The reality, however, is that within the CPS assets are designated in total by sites (e.g., Rideau Canal Heritage Waterway) or by asset type (e.g., Federal Heritage Buildings Review Office). The definition of cultural assets is not complete. Certainly all of the assets on the Rideau Canal are not cultural in nature, and on the other hand, cultural assets are present in national parks. Because of the application of RMP for resource allocation, the pressure to identify assets appropriately is necessary. To date, RMP includes only detailed descriptors for heritage buildings. CPS has struck a team to develop clear definitions of cultural assets later this year.

In summary, RMP will provide a tool for identifying and reporting capital requirements for asset management on a site, regional, and national level. It provides a consistent approach for a large organization to view immediate and long-term capital needs.

Through good team effort, we have succeeded in creating a tool that General Works, A&E, and CPS managers now recognize as an essential part of the management process for cultural and contemporary assets alike.

AMP/RMP Glossary of Terms

Asset Condition Rating

A rating assigned to the asset for each of the four main criteria of the condition rating matrix (e.g. Health & Safety, Risk to Asset, Level of Service, and Urgency).

Component

Components are portions of assets, usually grouped together because of function, construction method, or materials (e.g. Buildings - Foundation, Roads - Traveled Way).

Facility

A configuration or grouping of assets, usually collectively managed in accordance with the function or service they provide. For example, a campground facility is comprised of buildings, grounds, utilities and roads assets.

Fixed Asset

Fixed assets are non-moveable constructed physical objects such as a road or building, made up of components. For the purpose of the Asset Management Process fixed assets are divided into ten asset categories (e.g. buildings, roads).

Recapitalization

For contemporary assets, recapitalization is the replacement or reconstruction of an asset or component thereof, with a contemporary equivalent.

For cultural assets, recapitalization involves both stabilization and limited restoration of undeveloped assets and periodic renewal and reconstitution of components. Recapitalization measures are designed to ensure preservation of historic form, material and integrity of the asset as required by program policy.

Replacement Cost

Contemporary assets: The total cost to replace or reconstruct an existing component, asset or facility with a contemporary equivalent in compliance with applicable codes and standards. Includes all costs to complete work on site (e.g. mobilization, removals) including design and supervision costs. Does not include new initiatives or expansion.

Cultural assets: The total estimated cost to reconstruct or replace existing components, asset or facility with a replica of configuration, material and appearance of a specific period. Includes all costs to complete work including design and supervision costs. Does not include expansion.

John W. McBain is chief, Recapitalization Management, Public Works Canada—A&ES(EC).

Building Code Application to Existing Structures

Lyne Fontaine

The application of current building codes to existing structures can have a devastating effect on heritage buildings. This paper will look at the Canadian practice of the application of the structural code section to existing buildings.

Contemporary building code requirements were developed to ensure safety at a reasonable cost; however, when applied to existing structures the cost will likely be prohibitive, and worse for the historic building, it will destroy priceless fabric.

The Objectives, Not the Requirements

As indicated in Appendix A, Article 1.2.1 of the current Canadian National Building Code (NBC), the focus is now on meeting the objective of the code as opposed to meeting the requirements.

The paramount motivation for this new flexibility is the ratio of cost to safety. "In developing code requirements for new buildings, consideration has been given to the cost they impose on a design in relation to the perceived benefits in terms of safety.... the increased cost of implementing a design solution in an existing building that would normally be intended for a new building may be prohibitive."

This article indicates further the importance of understanding the objective and the intent of the code, and balancing this objective with the cost: "The successful application of the code requirements to existing construction becomes a matter of balancing the cost of implementing a requirement with the relative importance of that requirement to the overall objective."

The Lifecycle Field Test

Article 1.2.1 of the NBC further refers to the Canadian Building Digest No. 230, "Applying Building Code to Existing Buildings" for more information on the application of the Code requirements to existing buildings.

The structural section of this publication implies the use of structural performance in the evaluation process. This means that structural engineers do not need to condemn a structure only because structural calculations indicate under design results.

Cost is the prime motive: "...the cost of increasing the strength of an existing structure may exceed the potential benefits." Performance of structure during its lifetime has to be considered in the structural assessment and would overrule the theoretical assessment. "Where a building has been standing for many years, and its condition or its relationship to adjacent buildings has not changed significantly, one may consider the building to be field tested. If a roof has withstood the effect of snow and wind for 50 or 60 years and shows no sign of distress, one may reasonably assume that it will continue to provide adequate service." The same rationale can be applied for wind load. However, for earthquake loading it is different because of the irregular occurrence of earthquakes. "Nevertheless some assessment can be made in light of the recorded seismic activity of the area where the building is located."

NBC Concurring With Conservation Methodology

The NBC is now concurring with the international conservation engineering methodology or vice-versa. Indeed, the conservation engineering methodology has been advocating for years the use of *in-situ* performance to assess the structural condition of a building.

This methodology is a cyclical process: investigation, analysis, diagnosis. At the diagnosis stage, the theoretical results must be consistent with the observed performance *in-situ*. If they are not consistent, then assumptions must be revised and possibly, more investigation needs to be done. This iteration must be done as often as required to reconcile theory and *in-situ* performance.

The following questions may be posed in reviewing the evaluation assumptions: does the structural model need to be redefined, are the initial assumptions for the loading condition and the *in-situ* strengths too conservative, should safety factors be reconsidered?

Reconciling theory and performance is certainly the paramount element of the application of NBC to existing structures. It is a new challenge to the engineer as he must use considerable judgment to relax the particular requirements of the code without affecting the safety level. It is definitively more time consuming to assess an existing structure; however, optimizing the strength of structure usually saves in the end on the construction cost and most important in the conservation field, it minimizes the impact of contemporary intervention on historic fabric.

Lyne Fontaine is senior conservation engineer, Public Works Canada—A&ES(EC).

Protecting Buildings for Life
A Fire Safety Equivalency System

Thomas E. Solon

When historic structures are adapted to overnight lodging, such as a bed-and-breakfast, and made to comply with applicable codes, ordinary preservation issues become extraordinary. The difficulties associated with such conversions are numerous and not easily resolved. At times, the various building, life safety, and historic preservation standards appear to be at cross purposes. And these codes and standards vary by region, state and locality which further complicates their interpretation and application.

In the past, preservationists have blamed code compliance with destroying historic fabric, replacing perfectly good building materials and increasing the cost of rehabilitation. Over time though, model building codes and standards which previously favored new construction have been making allowances for existing buildings in the way of special provisions or tradeoffs. Thus, it is now possible to meet the spirit or intent of the code by compensating for deficiencies (rather than correcting them) with equivalent life safety measures.

The Codes and Fire Safety Equivalency

Canada and the United States have the two highest fire-related death rates per capita in the industrialized world. So it is hardly surprising to learn that fire safety concerns dominate most of our codes and that the primary objective of fire safety legislation is the preservation of the *occupants* of the building. From a code perspective, the preservation of *historic fabric* must therefore be achieved while posing no significant threat to life. When conforming to the codes, whether an existing building element such as a partition or room door, for example, can be saved or must be upgraded or even replaced will depend upon its fire rating versus the requirements or allowances of the model code that applies.

In the United States, almost all state and local building codes are derived from one of three regional models: the *Uniform Building Code* , the *BOCA National Building Code*, and the *Standard Building Code*. They are used respectively in the western, midwestern and northeastern, and southeastern states. In addition, there are national standards, referenced by the model codes, one of the most familiar being the National Fire Protection Association's NFPA 101 *Life Safety Code*. The National Park Service (NPS) has adopted the Life Safety Code as a servicewide standard. This code has broad national influence, prescribing requirements for various building occupancies, elements, design features, and fire safety equipment which affect safe egress from a building. Beyond being just a prescriptive code, the *Life Safety Code* allows flexibility in meeting these requirements through the recognition of equivalency concepts.

Equivalency concepts allow you to meet the code in any way you choose, provided that the alternative arrangement secures essentially equivalent safety to that which would be obtained by careful adherence to the requirements of the *Life Safety Code*. Today, all model codes have an equivalency section for alternative approaches to compliance. These are subject to the approval of the person or office enforcing the code, commonly referred to as the Authority Having Jurisdiction (AHJ). Usually a fire marshall or building official, the AHJ will base an approval for equivalent compliance on the adequacy of technical documentation submitted. A reasonable or equivalent level of life and property protection must be demonstrated before a system, method or device is approved for an intended purpose. But how best to prepare "adequate" technical documentation? One solution has been the adoption by some model codes of numerical evaluation systems which rate or score a building's various life safety features.

Alternative Approaches to Life Safety

The first such "quantitative" system—a Fire Safety Equivalency System (FSES) for Health Care Occupancies—was developed for the NFPA in 1979 by the National Bureau of Standard's Center for Fire Research. This was followed in 1983 by a FSES for National Park Service Overnight Accommodations, using the 1981 *Life Safety Code* as a baseline code. Equivalency is demonstrated by judging alternative approaches as being equivalent to, subtracting from, or adding to a building's inherent safety level. As explained by the *User's Guide for National Park Service Overnight Accommodations*, "The quantification of fire safety features in the FSES permits deficiencies (e.g., dead end corridors) which are given negative scores to be offset by safety improvements (e.g., sprinkler systems) which are given positive scores." The guide contains expanded explanations, illustrations and background information to assist with the uniform application of the evaluation system.

The scoring is done on worksheets which define 11 safety parameters. These parameters measure the extent to which various building features contribute to the protection of life and property. They range from construction and finish, through exit arrangements and distances to

Guest room protection using sidewall residential sprinkler supplied by plastic pipe concealed in a boxed-in cornice. Marameade Inn, Middletown, MD.

5. AUTOMATIC SPRINKLERS	NONE	BDRMS/SUITES ONLY	CORRS., COMMON SPACES	BDRMS/SUITES, CORRS., COMMON SPACES	TOTAL BUILDING	
					STANDARD	SPECIAL
	0	2(0)[c]	4(0)[c]	6	8	10

Excerpt from Table 1, Safety Parameter 5, Automatic Sprinklers, showing the points granted for partial to total sprinkler installations.

detection and extinguishing systems. Each parameter is rated for its contribution toward achieving fire control, safe egress, place of refuge, and general fire safety. Alternative compliance with the code is achieved using the tradeoff potential of these safety parameters to yield a score of zero or higher. In addition, a Facility Fire Safety Requirements Worksheet gives separate consideration to conformance of the following to the *Life Safety Code:* utilities, HVAC, elevator installations, rubbish or laundry chutes, and an in-house emergency organization.

The use of equivalency concepts requires an accurate evaluation of existing conditions. Historic structure reports, condition assessment reports, and original plans or even building codes when available are ideal. The building analysis may reveal hazardous construction features such as interior finishes with high flame spread values or inadequate fire stopping and compartmentation which allow smoke and fire to spread quickly and undetected. These and other deficiencies such as inadequate exits, stairs, and doors will impact heavily on the FSES safety parameter values.

Fire is no respector of historic buildings, nor do regulations and codes for fire protection respect the cultural and artistic values in a historic building. Their aim is to protect life. The conservationist's aim is to prevent fire and minimise damage caused by disasters and this in fact also protects life.

—Bernard M. Feilden, Fire and Historic Buildings

The *Uniform Building Code for Building Conservation* contains a guideline which lists fire resistance and separation ratings for out-of-date construction methods. This *Guideline on Fire Ratings of Archaic Materials and Assemblies* was prepared by the National Institute of Building Sciences in 1980 as part of HUD's *Rehabilitation Guidelines* series. The tables in this guideline can be used to establish values for the various safety parameters of the FSES, and they can be used to help justify the retention or determine the degree of upgrading required of existing materials. English Heritage (Historic Buildings & Monuments Commission for England) too, has been researching the fire-related performance of archaic materials and construction. And the Heritage Council of New South Wales has issued a technical information sheet for *Upgrading the Fire Resistance of Timber Panelled Doors.* Existing building elements may be upgraded using a variety of methods which range from the application of intumescent or fire retardant coatings to the selective replacement of individual materials.

Compensating for Deficiencies

Upgrading, even when hidden from view, can be costly in terms of disturbance to historic fabric. Interventions such as increasing fire resistance, enclosing open stairways, and adding exterior stairs can, however, be done with sensitivity and good taste. And this low-tech approach has the added advantage of being less prone to the human or mechanical failures so often associated with operational procedures or high-tech equipment. Nevertheless, the most effective means of compensating for code deficiencies is the installation of fire detection, alarm and suppression systems. No longer considered just an option, sprinkler systems have become a mandatory requirement for numerous occupancies. The 1991 edition of the *Life Safety Code,* for example, now requires sprinklers in most overnight accommodations with the only exception being existing small facilities or facilities where each guest room has a door opening directly to grade or to an outside stair. This is a response on the part of NFPA to the excessive number of fire-related deaths that occurred in large and small hotels during the 1980s. The January 1991 edition of the National Park Service *Loss Control Management Guideline,* NPS-50, goes even further by requiring "that all new...as well as existing and historic buildings be equipped with fire suppression and smoke detection systems."

Still, operational procedures such as risk management and fire safety planning are of the utmost importance and can go a long way toward preventing the irreplaceable loss of historic fabric. Recognizing this need, NPS-50 states that "Fire prevention is achieved when buildings are properly designed and inspected such that the relationship between heat, fuel and oxygen—the fire triangle—can be controlled. When this relationship is correctly managed, fires cannot start." Operational procedures can include such diverse measures as an emergency action plan, monthly drills, daily inspections, guest room information packs, and a lightning protection system. Nor should precautionary measures taken during the process of rehabilitation itself, probably the most hazardous period in the lifetime of any structure, be forgotten.

Besides being used to evaluate alternative solutions to fire safety equivalency for existing structures found to be deficient under the *Life Safety Code,* the FSES may be used to evaluate alternative design solutions when planning a rehabilitation project. Most importantly, the worksheets used to document these alternative solutions may be used to justify equivalency concepts when seeking approval from the authority having jurisdiction. As noted by NPS-50, the FSES should only be applied by persons who are knowledgeable of building construction as well as the *Life Safety Code* and such persons "will

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have been trained in applying FSES." As a form of code review, the FSES can also be used to help determine the least damaging use for a historic structure. And when compliance cannot be achieved "without significantly impairing a historic structure's integrity and character", Chapter 5 of *NPS Management Policies* suggests that the use rather than the structure itself be modified to minimize the potential hazards. Such an approach avoids subjecting either the historic structure or its occupants to unnecessary hazards. This policy has been included in the National Park Service *Structural Fire Guideline,* NPS-58. Since the development of FSES by the National Bureau of Standards, other numerical evaluation systems have been introduced.

A similar fire safety evaluation system, for example, can be found in the BOCA *National Building Code* under "Article 32—Repair, Alteration, Addition to and Change of Use of Existing Buildings." And the city of Boulder, Colorado, has created their own Measurement of Building Fire Safety equivalency system which has been in active use now for the past 12 years. Meanwhile, in 1988, the NFPA 101M *Manual on Alternative Approaches to Life Safety* was issued. It contains an updated FSES for health care occupancies as well as FSESs for detention and correction facilities, board and care facilities and business occupancies. Additional occupancies now under study (including hotels and apartment buildings) will be added in the future. The introduction of 101M is significant, for it recognizes the FSES as a time-tested concept which is capable of growth and change. The FSES *User's Guide for NPS Overnight Accommodations,* on the other hand, has fallen behind and is in dire need of revision. The *Life Safety Code* has been revised three times since the *User's Guide* was first introduced in 1983, and the guide is now outdated.

FACILITY NAME: _____

ALTERNATE TABLE 2 LARGE FACILITIES

SAFETY PARAMETERS	AS IS				ALT. 1				ALT. 2				ALT. 3			
	FIRE CONTROL (S_1)	EGRESS (S_2)	REFUGE (S_3)	GENERAL SAFETY (S_4)	FIRE CONTROL (S_1)	EGRESS (S_2)	REFUGE (S_3)	GENERAL SAFETY (S_4)	FIRE CONTROL (S_1)	EGRESS (S_2)	REFUGE (S_3)	GENERAL SAFETY (S_4)	FIRE CONTROL (S_1)	EGRESS (S_2)	REFUGE (S_3)	GENERAL SAFETY (S_4)
1. CONSTRUCTION		X				X				X				X		
2. HAZARDOUS AREAS		½				½				½				½		
3. MANUAL FIRE ALARM	½		X		½		X		½		X		½		X	
4. SMOKE DETECT AND ALARM	½		½		½		½		½		½		½		½	
5. AUTOMATIC SPRINKLERS		½	A½			½	A½			½	A½			½	A½	
6. SEPARATION OF BEDRMS/SUITES		½				½				½				½		
7. EXIT SYSTEM	X		½		X		½		X		½		X		½	
8. EXIT ACCESS	X		X		X		X		X		X		X		X	
9. INTERIOR FINISH	½		X		½		X		½		X		½		X	
10. VERTICAL OPENINGS	½				½				½				½			
11. SMOKE CONTROL	X				X				X				X			
A. TOTAL VALUE																
B. MANDATORY VALUES																
C. DIFFERENCE BETWEEN A AND B																

NOTE: A-Use full value if Safety Parameter 1 is based on Type V (000), Type III (200), or Type II (000) construction. Divided by 2 (÷ 2) in all other cases.

FSES Worksheet, Alternate Table 2, used for comparing existing safety parameter values with alternative approaches to compliance.

Conclusion

Each historic structure has its own unique requirements for the protection and preservation of historic fabric. Retaining significant historic features or elements while bringing an existing structure "up to code" requires ingenuity on the part of the project architect and flexibility on the part of the code enforcement official. If this official is involved early on in the decisionmaking process, code conflicts have a better chance of being resolved. However difficult concurrently addressing the various regulations for building, life safety, and preservation may be, successful compliance is an investment in the life of the building and its occupants as well.

Thus, **Protecting Buildings for Life,** denotes that the two very different aims of **protecting life** and **protecting property** are, after all, intimately related and interacting, as Mr. Feilden so adroitly infers. It would seem wise then, not to view them as being at cross purposes, but rather as sharing a common cause, one that will make possible an efficient contemporary use for existing structures that retains significant historic features, elements and spaces for the enjoyment of future generations of users.

This paper is based upon research prepared while participating in the Skills Development Plan for Historical Architects in the National Park Service. Assistance and guidance were generously provided by Skills Development Plan Coordinator, Emogene A. Bevitt.

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Park Roads and Highway Standards
Going-to-the-Sun Road

Rodd L. Wheaton

Prior to the establishment of the National Park Service (NPS) in 1916, the early parks typically came into the system with previously established road patterns. Some followed old trails and wagon roads such as at Yosemite. Other early parks, like Yellowstone, were so remote that there was little or no access into the interior and roadways were required in order to get the visitor into the park and interpret the parks' natural wonders. The Army Corps of Engineers continued to construct roads for the NPS, but it wasn't until the NPS teamed with the Bureau of Public Roads, in 1926, that major construction took place. Director Mather called it "...a splendid working agreement...." between the Service's landscape division and the Bureau of Road's civil engineers. It was envisioned as a joint effort "...where scenery must be conserved at all costs and left as little scarred as possible."[1]

Dudley C. Bayliss wrote in a 1957 article for the *Traffic Quarterly* that NPS roads were a "...specialized means of access and circulation...." and listed several points to illustrate that concept including:

1. Park roads are planned to reach principal features in a park and not necessarily by the most direct route;
2. Roads are located to fit the topography;
3. Roads are to be for low speed traffic;
4. Roads are to be designed to present the interpretative story in a chronological order;
5. Roads incorporate all worthy points of interest and include turnouts to view them;
6. All cuts and fills are revegetated to restore a natural appearance;
7. Selective cutting and thinning of vegetation is necessary to open vistas.[2]

Yellowstone's Grand Loop was essentially completed as well with amenities such as stone guard walls and bridges. Similar improvement work was carried out at Mount Rainier and at Sequoia-King Canyon's Generals Highway, initially constructed between 1920 and 1935. However, like many roads in the national parks, including Yellowstone, it was extensively reworked between 1933 and 1939 by the Civilian Conservation Corps (CCC). Typically, the CCC executed stone masonry work retaining walls, guard walls, ditches, culvert headwalls, and curbing.

The construction of the Going-to-the-Sun Road at Glacier National Park followed similar patterns. The park, established in 1910, was essentially inaccessible without an east-west route from which to interpret the natural scenic wonders of the park. Such a route was finally settled upon after a 1918 survey which took the proposed route over Logan Pass through the center of the park and along the shores of the west side's Lake McDonald and the east side's Lake St. Mary. The NPS

Triple Arches.

opened bids for constructing the first section to Lake McDonald Lodge, which is situated at the head of the lake, in September 1921. This section was completed in 1922 and the next section was completed in 1925. However, when the Park Service partnered with the Bureau of Public Roads in 1925, it was decided to concentrate on completing the west side which was accomplished by 1928. The east side was completed by 1932 when the first car crossed over the road. Going-to-the-Sun Road was officially opened July 15, 1933, and represented a major engineering feat which significantly changed travel patterns to and in the park. The road opened the way for automobile travel, camping, and auto courts which began to supplant the hotels and backcountry chalets operated by the Great Northern Railway in and adjacent to the park.

The road, which was listed on the National Register of Historic Places in 1983 in time for the 50th anniversary celebration, has continued to provide the transpark experience to an ever increasing number of park visitors and a growing variety of automobiles and recreation vehicles. Driving Going-to-the-Sun Road is the major park experience for most visitors where the dramatic scenery of Glacier unfolds along the shores of Lake McDonald, up around the Loop, onto the Garden Wall section which is the most significant segment, over the Continental Divide at Logan Pass, down the east side, and around Lake St. Mary. In all it is a spectacular piece of highway

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Park Roads and Highway Standards
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that along with the National Landmark hotels at Lake McDonald, East Glacier Park, and Many Glacier, and the busses plying between them creates an ambiance of the 1920s and 1930s that is unequaled in any other national park in the United States. It is this ambiance that the management of Glacier National Park, the regional office, and the Washington Office are determined to preserve in negotiations with the Federal Highway Administration which administers the Federal funding appropriated for Park Service highway construction and reconstruction.

The now historic road consists of a two-lane paved road extending nearly 50 miles from the T-intersection at Apgar on the west side to the park boundary at St. Mary on the east side. The primary section is the 12 miles along the Garden Wall which rises at a 6% grade to Logan Pass over 6,646′ above sea level. In addition to the road surface, there are two tunnels. The one on the west, built between 1926 and 1928 is 192′ long; the tunnel on the east side, built between 1931 and 1933, is 395′ long. There are seven historic bridges including the Triple Arches supporting the roadway along the Garden Wall and stone masonry guardwalls which were originally built out of the salvaged stone from the adjacent road cuts.

In 1989, the NPS became concerned about the deterioration of the road surface and the probable collapse of a section of guardwall and retaining wall located west of the Triple Arches. Because of the cost of major road rehabilitation, the Federal Highway Administration was requested to make recommendations for repairs and ultimately develop a long-term, phased project for reconstruction. The first phase involved the road along Lake McDonald. This project, like the current phase on the east side, involved resurfacing, shoulder reconstruction, and replacement of slumped areas. Prior to the start of the project, it was determined to keep the road width the same.

However, horizontal cracks in the section near Triple Arches presented more immediate problems that could be associated with the maintenance and preservation of the road's historic features. In that area the original road bed was carried on rubble fill contained by a battered stone masonry retaining wall rising up from a rock outcropping. The retaining wall was a typical crenelated stone masonry guardwall with 24″ and 18″ heights. The crenelation pattern generally runs for 12′ at the 18″ height and 4′-6″ at a 24″ height. At this section of road, however, the weight of the road and heaviness of traffic had caused the road surface to settle and the settlement had caused the exposed retaining wall to crack horizontally creating a potential safety hazard.

The situation approached an emergency and it was decided that the only expedient alternative was replacement of this section of the road with a concrete retaining wall which would be faced with stone masonry veneer. This project solved the structural problem of the road. However, the project opened up a whole new controversy as to guardwall height. Federal Highways said the 18″ and 24″ crenelated guardwall height was too low to meet safety standards. Their belief is that the low height would cause a vehicle, if it hit the wall, to flip over the wall rather than stop the vehicle. As a consequence, the concrete masonry wall was completed with a concrete core that extended above the road surface to form the basis for a 30″ high, uncrenelated, stone veneered guardwall. The controversy became immediately apparent. The height did not match the adjacent walls and visually the overall integrity of the road was compromised. Since 1989 the section has been left unfinished and even on the lower section stone veneer masonry has not been completed. That project reinforced the desire of the NPS to maintain our park roads as distinct from the roads leading into the park. Underlying this is also the desire to maintain and sustain the historicity of the road systems.

Initially, the Service was told that if the roadway was constructed to our specifications, i.e., low guardwalls, then it would be at our expense and the long commitment we have had since the old Bureau of Roads days would be terminated. Other major issues centered on scaling the cliffs above the road to eliminate overhead hazards and recutting some curves to provide better visibility by straightening certain sections. In short, the whole experience of driving Going-to-the-Sun Road was to be compromised.

All of these issues were predicated on standard speeds, the length of axle bases of vehicles, and presumed inability of the stone masonry guardwalls to not stand up to national crash testing requirements. Nevertheless, the Federal Highway Administration continued to insist that there was no point in crash testing the historic guardwall. For their predicted speeds on Going-to-the-Sun Road, the stone masonry guardwalls were too low, too rough in texture, and too easily breached in a collision. In order to demonstrate the potential adverse effects of raising the guardwalls to meet Federal Highways' expectations, the NPS developed a computer simulated video to illustrate the effect of cutting the visitor off from the view.

However, at a turning point meeting in Glacier in October of 1991, the representative from the Western Federal Lands Highway Division in Vancouver, WA, representing the Federal Highways Administration, agreed to consider a series of alternatives based on proposals that the NPS offered. The NPS offered to reduce the speed on the road and reduce the length of vehicles using the road. With that the Federal Highway Administration then agreed to develop a computer modeling program for crash testing the historic guardwall to see if the stone masonry work will contain a vehicle. This was a significant breakthrough, since all of Federal Highways predictive modeling to date had reflected a standard speed. If the computer modeling says that the historic guardwall is not safe, that is the end of the line for preserving the historic guardwall. If the computer modeling says yes or maybe, the Federal Highways will develop an actual crash test.

Second, Federal Highways agreed to determine through computer modeling the height of a new concrete reinforced guardwall that will be acceptable in resisting impact and breaching. If that modeling suggests that a lower height is acceptable, that type of reinforced wall will be crash tested. For both conditions the issues are

Typical masonry guardwall.

the expense of performing the actual test which is estimated to cost around $10,000 to $25,000 per test.

This summer, in order to accumulate data, it is proposed to locate observers at eight stations along the road to tally speeds and to document the size of vehicles. The latter is to determine how many and what type vehicles pass over the road. It is being considered that the vehicle lengths may be limited to 20′ which will rule out Class A and most Class C motor homes. It is also being considered to reduce the speed limit as originally proposed, but based on statistics of the survey. This, hopefully, will be a critical factor in providing a trade-off for guardwall height.

In addition, the design of the removable wooden guardrail in avalanche chutes and elsewhere is being analyzed by Federal Highways. This is a critical issue relating to safety as well as compatible design and location. Concerning location, it is proposed to eventually replace the wooden guardrail with a historic stone masonry guardwall outside the chute areas. Typically, it is proposed throughout the road that any new guardwall will have a concrete core. Elsewhere, it is proposed that the historic stone masonry guardwall will be left in place until such a time, due to deterioration, it will be replaced with concrete core wall. The intent would be to leave as much of the original wall in place as long as possible. All along the roadway, in areas more than one lane width away the travel lanes such as in turnouts for designated scenic overlooks, the historic wall will be maintained in its entirety and restored as necessary if it has sunken or tilted. Along the travel lanes it is more problematic to assure containment. It is also an issue as to the texture of the stone walling as it has been demonstrated that a rough textured wall can snag a vehicle and cause flipping over the guardwall or redirection into the opposing lane. All of the above issues can be at least partially alleviated by lowering the speed and reducing the size of vehicles on the road.

The Park Service desire at Glacier to save the special character of the road has had some spill-over effect. It has been particularly productive to work with the Vancouver office of the Federal Lands Highway Administration. They presented a proposal from their Washington Office that expressed an interest in reducing stringent speed mandates for testing. This had been a long-standing factor in resistance in saving the character of the road. The other spin-off has been that other national parks have been or will be the beneficiary of decisions made at Glacier National Park.

Toward meeting these new projects and in order to assure that the NPS develops a common policy in dealing with the three Federal Lands Highway Divisional offices it is the intent to identify all the significant NPS roads in each of the regions and to develop a broad context in which to evaluate them for the National Register of Historic Places. The task force working on this project includes key personnel from particularly the western regions of the Service. The intent is to assure that all roads are evaluated and documented similarly taking into account the recent Service studies of eastern parkways and the Yellowstone road system and the State of California's requirements for registration of road systems.

In conclusion, while Glacier National Park moves forward with its plans to maintain the ambiance while working in close partnership with the Federal Highways Administration through appropriate design of stone masonry guardwall and removable guard rail, limited scaling of the cliffs above, and restrictions on vehicles in terms of speed and length, it is interesting to reflect on recent developments in Austria as reported in the June 1992 issue of *Conde Naste Traveler* magazine. Where Glacier will continue to serve over two million visitors during a short four-month season, the Austrians are dealing with overuse and pollution of the Grossglockner Alpine highway near Salzburg by banning diesel buses, permitting only those with anti-pollution devices. In addition, private vehicles are subject to $30.00 and up in tolls for use. Ultimately, the road will be closed to through traffic and be limited to local use to provide access to the Grossglockner park.3 This is an interesting concept though it probably is not viable for Glacier National Park. Maybe that will be the next phase—how to deal with three to four million visitors per season.

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[1] Stephen T. Mather, "Engineering Applied to National Parks," *Proceedings of the American Society of Engineers*, Vol. 54, Dec. 1928, p. 2675.

[2] Dudley C. Bayliss, "Planning Our National Park Roads and Out National Parkways," *Traffic Quarterly*, July 1957, pp. 418-419.

[3] Hans Fantel, "In the Alps, A Scenic Road Aims to Stay That Way," *Conde Nast Traveler*, June 1992, p. 22.

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Constructing a Replacement Covered Bridge at Point Wolfe

Brian Gallant

For 81 years, the Point Wolfe bridge spanned a gorge at the mouth of a tidal river bearing the same name. Albert E. Smye of Alma, Albert County, New Brunswick, was an active contractor during the early part of this century. On February 1, 1910, he was awarded a contract to construct a covered bridge to the village of Point Wolfe for $1,456.00. This was the third bridge to be built at this precarious river crossing; the first being a suspension type, and the second an uncovered wooden bridge. The new bridge was built in response to demands from the local lumber company and the residents of the small village that had grown up around the mill. This was an important time for shipbuilding along the Bay of Fundy coast; river logging and saw mills were a part of this glorious era, and the bridge was a vital link to the area. In 1948, Point Wolfe was incorporated as part of Fundy National Park. The Point Wolfe bridge remained relatively unchanged until it was first painted in 1958. Operation of the bridge continued to be managed by the Canadian Parks Service (CPS) as it became New Brunswick's most photographed painted covered bridge, and popular tourist attraction.

Over the winter of 1990-91, a contract to stabilize one of the concrete bridge abutments included removal of an adjacent rock overhang very near the bridge. On December 29, 1990, while the contractor was using explosives to remove the rock, large fragments—propelled by the blast— struck one of the bridge trusses. The Point Wolfe bridge was destroyed in a matter of seconds and lay unceremoniously across the river below. There are now less than 70 covered bridges remaining in the province of New Brunswick, where once, over 300 crossed myriad rivers in the province. On the east side of Fundy National Park exists the Lower Forty-Five No.1 covered bridge (c. 1915). It is now the only original covered bridge remaining in our National Park System.

Cultural Resource Management Policy

In 1990, the CPS asked that an assessment of two covered bridges at Fundy be carried out by the Federal Heritage Building Review Office (FHBRO). This was in keeping with our Cultural Resource Management Policy requirements to review all buildings over 40 years of age, especially considering that the two Fundy covered bridges were cultural resources within a national park, and were proposed for major structural and architectural renovations in 1991. The FHBRO declined to evaluate these structures on the basis that, by definition, they were bridges and not buildings. Furthermore, the two bridges were never designated as being of national historic importance by the Historic Sites and Monuments of Canada. As our Cultural Resource Management Policy discourages the reconstruction of exact replicas, the decision was made that the replacement bridge for Point Wolfe would not be an accurate replica of the original, and as such would in no way violate this policy.

Nevertheless, immediately following the destruction of the Point Wolfe bridge, a strong public lobby quickly mobilized media and government to support the rebuilding of a new covered bridge in the park. Covered bridge enthusiasts would accept nothing short of a wooden covered bridge in likeness to the one destroyed at Point Wolfe. Possible alternative replacement types were considered on the basis of their timely replacement and economics. However, a traditional "Howe" truss wooden covered bridge proved to be very competitive to the cost of modern equivalents in steel or concrete. The CPS accepted the challenge and set to motion to construct a "1992" Howe truss wooden covered bridge. With official opening July 1, 1992, this was the first covered bridge constructed on a public road in New Brunswick since 1951.

Design Guidelines

Traditionally, covered bridges were constructed "high enough and wide enough to take a load of hay," and, "they had to be strong enough to bear the weight of local traffic." However, demands placed on facilities by users of the park had earlier forced the Canadian Parks Service to improve the campground, trails, and supporting services on the otherwise inaccessible north side of the Point Wolfe River. The replacement bridge was designed to meet greater load carrying requirements for a variety of public and park maintenance vehicles. The objective was to construct a wooden covered bridge at Point Wolfe which had an increased load carrying capacity, and a 35-year design life; was constructed of new materials wedded to a traditional Howe truss design; would comply with modern bridge code requirements and satisfy requirements of both the CPS and the public.

The CPS did not attempt an accurate reconstruction of the former Point Wolfe bridge. The new bridge is representative in style, and materials, while similar in design features to that of a turn-ofthe-century Howe truss covered bridge from New Brunswick. It be bears resemblance to the picturesque covered bridged built by Albert Smye, and respects the original 1840 and 1846 bridge patents of William Howe of Massachusetts. The decision was to build a contemporary Howe truss bridge with new applications. Equally important, the replacement bridge was to be visually acceptable in meeting the high expectations of the general public.

The bridge replacement project was a collaboration of engineering and architectural disciplines within Public Works Canada (PWC). This proved at times to generate lively debate if not disagreement on many details. The design consultant retained by PWC to satisfy applicable structural requirements referenced in the National Building Code of Canada. Unfortunately, there are no specific standards for building Howe truss wooden covered bridges. The Code is vague in some respects and subject to wide interpretation. PWC challenged the consultant to be innovative in resolving problems without promising important engineering or architectural design elements.

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Preserving Treatment Records

Thomas A. Vitanza

"... What's past is prologue; what to come, in yours and my discharge." These words from Shakespeare's The Tempest *have been preserved. Will the information collected during today's historic structure treatment projects be so lucky?*

The Record of Treatment is a component of the Historic Structure Report (HSR) whose time has come. The National Park Service (NPS) *Management Policies* and the *Cultural Resource Management Guideline (NPS-28)* both endorse the concept of post-construction documentation. The current draft release number 4 of NPS-28 has some solid language in this regard. But neither document gets down to specifics or suggests a framework to translate this to reality.

The goal of this paper is to present the Historic Structure Report: Record of Treatment as a useful document in the communication of information. It can be the method for recording the information obtained during crucial periods of treatment. This information needs to be preserved as well as the resource.

Treatment can be likened to an archeological excavation. Information concerning historic structures is often brought to light for the first time during a treatment project; the framing of a wall system is exposed, or an original detail is discovered. Valuable information is gathered, recorded, and put in a field notebook or folder. Later, when the project is completed, the information is filed away and forgotten, possibly even thrown out.

What happened to the structure during the period you were responsible for its well-being? The structure was in your hands; you assisted in its treatment. It is your responsibility to document that work; not only what you did, but how you did it, what you used, where you got it, and the actual changes that were made to the structure during your tenure as its steward.

There is no official definition for the HSR: Record of Treatment component. In the NPS, various terms have been used through the years—completion reports, project records, project histories. They all do the same thing. They gather in one place all the pertinent data regarding an intervention, or treatment, in the developmental history of a historic structure.

A more common term used in the construction industry is post-construction documentation. Any architect or contractor who has followed a project through to completion is familiar with this phase. It comes after the punch list items have been completed. Usually it lingers as the last part of the project closeout. Often it is not given the attention it deserves. Without the commitment of management to get this documentation completed valuable information regarding the project is lost forever.

Typically, the post-construction documentation package includes such things as the operations and maintenance manual, as-built drawings, and possibly the project files. These things and more are required to put together the package of information that is called the HSR: Record of Treatment.

Earlier it was mentioned that the idea of post construction documentation is endorsed by NPS Management Policies. Specifically, the NPS Management Policies say

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Constructing a Replacement Covered Bridge at Point Wolfe
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Features of the Point Wolfe Bridge

There are three fundamental parts that comprise a covered bridge: the structural truss assembly; the supporting road deck; and, the protective covering or "housing" surrounding the structure. Prominent features of the replacement covered bridge include: large timber chords and bracing the truss assembly; metal strain rods and connectors; painted weatherboards; gable roof with wood shingles; angled portal openings, and, weatherboard openings in the sidewalls.

The wooden truss is "Howe" with metal tension rods, which lends itself will to prefabrication. The Douglas Fir truss members are significantly larger, and the "Dywidag" steel rods are stronger than the original. New metal connectors were designed to ensure strength and performance; this was a critical area underdesigned in the original detailing. The sidewalls were constructed of 1" thick random weatherboards vertically applied in traditional New Brunswick style, and fastened to horizontal whalers on the truss. Sidewall openings are located on both sides of the bridge to improve visual access to motorists and pedestrians and to allow for a panoramic view of the river. In all, the 1992 Point Wolfe covered bridge is only significantly different to the original in detail, and is testimony to revival of otherwise vanishing bridge construction style typical of New Brunswick.

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Protecting Buildings for Life: A Fire Safety Equivalency System
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Preserving Treatment Records
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"The appearance and condition of the resource before treatment **and changes made during treatment** will be appropriately documented" (Pg. 5:5, 12/88, boldface added).

NPS-28 builds on this and offers more direction in terms of what "appropriate documentation" might be. In the release number 4 draft, Chapter 8 focuses on Management of Historic and Prehistoric Structures. Within this discussion there are several references to this idea.

"The information needed for planning and caring for historic structures is found in many sources, **including records of past treatment** (boldface added), ...To maximize the benefit of this work and minimize potential data loss, all research products containing information about historic structures should meet applicable standards for scholarship and archival preservation."

Documentation and Investigation (pg. 117).

"Treatment is documented to enhance the management database for historic structures. **This documentation is essential** in evaluating maintenance procedures, forecasting cyclic maintenance, and interpreting the integrity of each structure. **In addition to written reports, graphic documentation is particularly appropriate for any work that changes the form or substance of a historic structure** (boldface added). New materials and replacement features should be recorded in place with photographs or drawings that clearly show their extent. Physical evidence of the developmental history of a structure should also be recorded before being removed or covered during treatment.

"All field notes, negatives, and drawings produced during recordation are consider archival materials and should be managed according to current archival standards."

Recordation (pg. 120)

One of the six strategic objectives put forth in the *Report of National Parks for the 21st Century - The Vail Agenda* is Resource Stewardship and Protection. The objective states that, "The primary responsibility of the National Park Service must be protection of park resources."

Again, the release number 4 draft follows through stating that "stewardship is the bottom line" and that, "Stewardship requires interaction with both the resource and its environment. It seeks to limit the loss of historic materials and to maintain historic character." One response to the potential loss of materials and character is the mandate for "improved record keeping."

General standards are put forth that outline the basic ingredients of a good program but stop short of procedural detail. The following general standards apply to all treatments:

New materials or replacement features are identified, documented, or permanently marked in an unobtrusive manner to distinguish them from original materials. The manner and location of identification is recorded using the Inventory and Condition Assessment Program (ICAP).

All changes made during treatment are graphically documented with drawings and photographs. Records of treatment are managed as archival material.

Records of treatment are valuable, especially if they are mandated to be managed as archival material. The question remains then, what constitutes the record of treatment? Guidelines have not yet been developed that set up a framework of what needs to be included. But there is a general sense of what the contents should be.

Mumma Farm House, Antietam National Battlefield, MD. The braced frame of the structure was discovered while siding repairs were underway. Drawings and photographs were made to document the framing system before the siding was replaced.

Mumma Farm House, Antietam National Battlefield, MD. A former window location was discovered during the removal of interior plaster. This feature should be recorded prior to the replastering of the wall surface. Photos by Thomas Vitanza, Williamsport Preservation Training Center, National Park Service, 1992.

Some assistance can be taken from works that have been completed to date. Centers within the NPS that have completed the post construction project reports have developed a format. They provide a sense that all the loose ends have been tied up in one place.

The NPS Preservation Training Center at Williamsport, MD, implemented the Project Record as part of their routine in the mid 1980s. The practice of preparing this report as the administrative wrap-up to every treatment project is becoming institutionalized. The Project Record is included in each project task directive as a part of basic project documentation.

The report has evolved from containing only the project cost accounting data to now including color photographs, contractor produced samples and videotape of the project work in progress. Larger projects include submittal of various materials and approvals from project architects and park management. Project Records have ranged in scope and complexity from 1 binder to 12 binders with boxes of material submittals.

Currently the Project Record format has two parts. Part One, primarily cost accounting data, is officially known as the Completion Report. Part Two, including everything else, is officially known as the Project History. Together they form the Project Record.

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Upgrading HVAC Systems in Historic Buildings

Lauren Gruszecki

It is usually necessary to substantially upgrade the heating, ventilating, and air conditioning (HVAC) system of an historic building during its rehabilitation. The selection of a new system and its integration into the historic fabric requires careful consideration by both the designer and mechanical consultant in order to maintain the heritage character of the building as well as meeting today's standards of comfort, health and safety.

There are several architectural issues that the designer should consider when selecting and designing for a new HVAC system. The mechanical consultant should be available during the early design stages to provide technical advice regarding both the condition of the existing system and the appropriate application of contemporary systems.

An important first step is to identify those parts of an existing historic system which should be retained as heritage features such as decorative radiators or grilles, and those which may be reused or re-worked such as piping, ducts, shafts, and mechanical rooms. As-found drawings of an existing historic system are often prepared by the mechanical consultant, particularly if some parts of the system are to be retained.

At the same time, it is also important to identify the requirements of a new system. These requirements are influenced by the size of the building, type of occupancy, and occupancy load. For example, a small building with a low occupancy such as a large house converted to office use does not require a mechanical ventilation system providing the occupants have access to operable windows. The option to retain natural ventilation may influence a designer to consider a hydronic heating and cooling system with fan-coil units where chasing pipes through cavities in walls and floors require less space than ducts.

However, a similar building converted to a conference centre would probably require some additional ventilation to ensure occupant comfort during assembly occupancies. A forced air system including cooling, ventilation, and possibly heat would be a logical option also eliminating the noise of fan-coil units. An existing historic radiator system could be retained to supply the heat.

A design philosophy should be developed regarding the selection of a new HVAC system and various options explored. Standards and guidelines of accepted conservation practice produced by governmental departments and educational bodies can assist the designer in selecting a system which least compromises the historic fabric.

Whether the system should be entirely hidden from

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Preserving Treatment Records

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The Project History is usually the largest section of the report and includes all the administrative data that relates to the project. Major elements include the task directive (or contractual agreement), weekly field reports, copies of pertinent correspondence, a narrative description of the project, change order forms, copies of contracts and sub-contract agreements, vendor information, and material specifications and sources. This part of the report is most easily organized according to the 16-part Construction Specification Industry (CSI) format.

While the written data is crucial, the most important information in these Project Records are the visuals. This includes photographs, drawings and more recently videotapes and actual samples of material submittals. Photographs include any historic images that have turned up in the design stage of a project or during construction. Occasionally, unknown historic photographs will be discovered during the project. These are duplicated and added to the collective body of knowledge.

Construction photographs are also included. They document every stage of the project and relate important information about the structure that is lost or covered over during construction. Recording the project on videotape often adds another dimension to the documentation record that cannot be captured by photographs.

Other graphic documentation will include construction drawings, measured drawings, field sketches and as-built drawings. As-built drawings convey how the project was actually constructed. They include changes in construction different from the design drawings.

The scope and complexity of the Project Record is directly related to the complexity of the project. Records documenting the replacement of a deteriorated floor framing system or historic drainage system will be less complex than a Project Record documenting the interior adaptive use and exterior preservation of a historic house. Similar to Historic Structure Reports in this way, the Record is a task-driven document. Once the Project Record is completed it should be widely distributed and included in the agencies libraries and archives.

Future reports will most likely become coordinated with other mainstream efforts in the preservation and maintenance professions. Recording, storing, formatting and networking information may be possible using other data collection systems currently being brought on-line. Use of Geographic Information Systems, the Inventory and Condition Assessment Program, the Maintenance Management System, and video-documentation of historic structures will soon render the building file obsolete.

The development of standardized guidelines and implementation of the Historic Structure Report: Record of Treatment would greatly expand the distribution of information to the professional cultural resources community. Communication of important data can only enhance the understanding we all have of our historic structures. The results of better understanding can only lead to better protection and stewardship of the historic structures in our parks.

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view or an obviously contemporary intervention depends on the architectural quality of the building, the intended use, its structure, and cost constraints. A concealed or discrete system would be appropriate in a well-appointed Edwardian interior whereas an exposed system would reinforce the utilitarian character of an industrial building. Entirely concealing a new system often results in extensive removal of historic fabric while an exposed system, although not as aesthetically pleasing, is easily accessed and maintained. Since buildings outlive their services, other design considerations may include the "reversibility" of a system, its life span, and possibly future replacement needs.

Historic structural systems can also influence the selection process of an appropriate HVAC system. For example, the early use of structural steel with terra cotta infill including floor arches did not inherently make use of any interstitial spaces in the floors or walls. Cutting out sufficient spaces to conceal ducts would have costly structural implications.

One successful resolution for this type of steel and terra cotta structure (a five-story office building) uses a system of vertical surface-mounted air ducts which run down the inside face of the exterior walls and branches inward at various locations. These vertical ducts and branches have been articulated to mirror the existing structural pilasters and decorative plaster ceiling coffers respectively, and are visually unobtrusive. Additionally, the air-handling equipment was placed both on the roof-top to feed down three floors and in the basement to feed up two floors, thus reducing duct size and avoiding the principal rooms.

The building envelope is a separate aspect of climate control that should be examined simultaneously with HVAC upgrades. Assessing the building envelope could include determining the wall construction, identifying areas of air leakage or heat loss, and possibly plotting dewpoint locations.

Of particular concern is the addition of humidity, especially for uses such as museums, archives, and rare books libraries which often require higher RH levels. In most cases it is impossible to install a vapour barrier without extensive damage to historic finishes. Excessive moisture migration through the walls can cause severe structural damage during the winter months to masonry, wood and metal. Together with the conservator, the designer and mechanical consultant should examine alternatives such as providing climate controlled display cases or "black-boxing" designated areas, as well as finding the lowest acceptable RH value for the collection. Lowering the temperature in winter will also reduce the amount of water in the air.

Fire and building codes often require additional upgrades such as fire dampers or stops where distribution systems pass through fire separations and walls. Fire and life safety consultants as well as the mechanical consultant can assist in identifying these areas.

When a design philosophy has been formulated, there are three aspects of an HVAC system which require consideration during the architectural planning stages because of spatial or aesthetic implications. These include the plant size and location, the type of distribution system (ducts, piping and/or electrical wiring), and the aesthetics of the terminal, namely the radiator or grille. Operation of the system—the controls—should also be determined, whether by individual rooms, larger zones or a single control centre for the entire building.

Locating and sizing the plant is a planning issue which should be considered early. The general rule-of-thumb for plant sizing in new buildings is 5% to 10% of the total floor area. Air-handling and cooling equipment is noisy, occupying a significant amount of spaces and is often placed outside the building or on the roof.

Air-handling equipment can have a significant effect on the exterior elevations of a building with regard to vent sizes or the appearance of equipment in the adjacent landscape and/or on the roof. Furnaces and boilers are smaller and more efficient today, generally posing less of a problem. Residential-scale gas-fired pulse boilers are extremely small and efficient, requiring intake and exhaust ports of about 4" in diameter through the adjacent wall, thereby eliminating the requirement of a lined flue extending above the roofline.

Installing a new distribution system can be extremely disruptive to historic fabric. Original systems can occasionally be reused, particularly small-scale uses of two-pipe hot water radiator systems. Historic ductwork is seldom large enough to meet contemporary flow requirements and steam circulating systems usually have become corroded because of air which is inherent in the system. The use of T-bar ceilings to conceal distribution systems should be regarded as a last resort because of its negative impact on the heritage character of interior spaces. Better design alternatives should be investigated, including reusing or upgrading existing distribution systems. Other alternatives may include feeding out from adjacent secondary spaces, using partial bulkheads integrated into the overall design, or simply exposing systems if compatible with the architectural vocabulary of the building.

Forced-air systems require more space than hydronic distribution. Unitary systems such as electrical heating or through-the-wall heat pumps may eliminate the need for HVAC distribution altogether. Such systems which rely heavily on electrical consumption may offer the easiest and most cost-effective installation but the long-term operational costs may be prohibitive. Other space-reducing options should also be reviewed, such as plenum returns incorporated into existing ceiling spaces or induction systems—high velocity air distribution with mixing boxes at the room terminal—which reduce the cross-sectional area of distribution ducts.

New hydronic systems—usually a four pipe hot-cold return system plus a drainage pipe for condensation—can be routed within wall floor cavities of standard framing systems fairly successfully. However, a substantial amount of disruption to historic fabric is still involved. Air movement over the radiating coils can be supplied from a separate air ventilation system or by fan-coil units. Fan-coil units can be noisy and aesthetically detracting from the heritage character of a room but are easy to access for repairs.

HVAC terminals, namely radiators or grilles, strongly influence the heritage character of a room either by their presence or subtlety. Historic radiators and grilles often

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Preserving the Resource

Victoria T. Jacobsen

Bernard Fielden, in *Conservation of Historic Buildings*, refers to the conservation of historic buildings as "...primarily a process which leads to the prolongation of the life of cultural property for its utilization now and in the future" (Fielden 1982). If we believe that this is the goal of historic preservation, why are we repeatedly making and implementing design decisions which turn out to be detrimental to the very fabric of the buildings we are setting out to preserve? Historic-building-as-museum is the prime victim; the perpetrator of the destruction is the intrusion of the modern climate control system (and its associated insulations, sealants, and vapor barriers) introduced to accomplish the curatorial goals for the collection.

Psychometric Fundamentals

In order to understand how traditional (pre-"technology") buildings worked it is useful to be familiar with some of the basic concepts of the "thermodynamic properties of moist air." The temperature of air determines the amount of moisture that it *can* hold. Relative humidity describes the ratio of the amount of water the air *does* hold to the amount it *can* hold. The dew point is the temperature at which air releases its water content (changing from its gaseous state to a liquid state); cooler air holds less water than warmer air. And just as hotter air seeks equilibrium by moving toward cooler air, wetter air tends to disperse toward drier air because it contains greater amounts of water vapor and, therefore, has a higher vapor pressure (Fielden 1982; Hunderman & Rose 1988; Thomson 1986).

Building Fabric Dynamics

The materials of historic fabric—brick, stone, and mortar; wood, lath and plaster; paint and textiles—are all somewhat permeable materials capable of absorbing and passing moisture as well as heat. Before the advent of sophisticated mechanical systems, older buildings relied on their wall materials, siting, and the configuration of solid wall mass and openings to modify external conditions. An 'internal' environment was created within the historic building envelope: "...a complicated interacting system, comprising the movement and air and water vapor, and the transfer of heat" (Fielden 1982).

As long as the traditional building envelope is left undisturbed, in good repair, and the use remains constant, the system remains in balance. When any aspect of it is altered, the equilibrium is broken and rapid deterioration may begin. Adding more moisture to the system than it is used to can cause warping, swelling, movement of soluble salts, freeze thaw cycles, and invite a host of destructive molds, fungi and even insects. Create a situation where this excess water builds up within a cavity wall, and the deterioration is hidden from view and may go undetected until major damage has occurred. Seal sources of natural ventilation or paint the exterior of a building with non-permeable paint, and the moisture level is increased throughout the building envelope. Add a vapor barrier and a sophisticated climate control system (including heating, air conditioning, humidification, dehumidification, pollutant filtration, etc.) and dras-

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contribute significantly to the historic appearance of a room such that the new HVAC system is designed to retain these features. In one large-scale rehabilitation project it was not practical to retain the piping distribution so the decorative radiators were disconnected and essentially converted into individually operated electric baseboard heaters. This was accomplished by filling the radiators with glycol (for its heat retaining properties), inserting an electrical heating element, and sealing each unit.

In conclusion, there are many ways to upgrade an HVAC system in an historic building. Hybrid solutions integrating features of both the old and new are often well-suited for conservation projects. No system offers a perfect solution and it is essential that the designer make well-informed decisions to ensure the continued appreciation of an historic structure.

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Agenda (Continued)

2:30 p.m.	Session 19 Log Replacement Techniques	Larry Pearson Chief, Architectural Preservation Services Alberta Culture and Multiculturalism
3:15 p.m.	Discussion of Sessions 18 and 19	
3:45 p.m.	END OF SESSION	
4:00 p.m.	Leave Many Glacier Hotel	
5:00 p.m.	Arrive Prince of Wales Hotel	
7:00 p.m.	Optional Presentation on Waterton Lakes National Park, Interpretive Theater	Waterton Lakes National Park Staff
8:00 p.m.	Reception, Windsor Lounge, Prince of Wales Hotel	

Thursday, June 18

Bayshore Inn, Waterton Room 8:30 a.m.	Welcome	Duane Barrus Acting Superintendent Waterton Lakes National Park Canadian Parks Service

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New Orleans Charter

In 1991 the Association for Preservation Technology, International, the American Institute for Conservation, and the National Council of State Historic Preservation Officers endorsed the **APT/AIC New Orleans Charter for the Joint Preservation of Historic Structures and Artifacts.** The product of two multi-disciplinary symposia on museums in historic buildings, the charter defines a highly thoughtful, holistic approach to the process of conservation of cultural resources, and sets the tone for a new spirit of cooperation and professionalism. To paraphrase it would be to dilute its simple, concise statements of principle so it is quoted here in its entirety:

Arising from a concern for the coexistence of historic structures and the artifacts housed within them;

Recognizing our responsibility as stewards to provide the highest levels of care for the structures and other artifacts placed in our care;

Recognizing that many significant structures are used to house, display and interpret artifacts;

Recognizing that historic structures and the contents placed within them deserve equal consideration in planning for their care;

Recognizing that technologies and approaches will continue to change; and

Recognizing that those involved in preservation are part of a continuum, and are neither the first nor the last to affect the preservation of historic structures and artifacts:

We, therefore, adopt these principles as governing the preservation of historic structures and the artifacts housed in them:

1. Institutions' statements of mission should recognize the need to preserve the unique character of both the historic structure and artifacts.
2. The preservation needs of the historic structure and of the artifacts should be defined only after study adequate to serve as the foundation for the preservation of both.
3. Requisite levels of care should be established through the interdisciplinary collaboration of all qualified professionals with potential to contribute.
4. Appropriate preservation must reflect application of recognized preservation practices, including assessment of risk before and after intervention, and the expectation of future intervention.
5. Measures which promote the preservation of either the historic structure or the artifacts, at the expense of the other, should not be considered.
6. Regarding public use, the right of future generations to access and enjoyment must outweigh immediate needs.
7. Appropriate preservation strategies should be guided by the specific needs and characteristics of the historic structure and artifacts.
8. Appropriate documentation of all stages of a project is essential, and should be readily accessible and preserved for the future.
9. The most appropriate action in a particular case is one which attains the desired goal with the least intervention to the historic structure and the artifacts.
10. Proposed preservation strategies should be appropriate to the ability of the institution to implement and maintain them (APT/AIC 1991).

Preserving the Resource
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tic changes are imposed on the internal environment which may be highly destructive to the structure (Fielden 1982; HSR 1991; Hunderman & Rose 1988; Park 1991; Thomson 1986).

That the internal environmental balance is a delicate one should come as no surprise. We have long recognized this effect on museum collections. A steady state environment is usually specified for artifacts, with a set range for both temperature and relative humidity (as well as other factors which will not be dealt with here). It is ironic that this recognition and acceptance of rigid environmental controls to preserve museum collections has been a prime culprit in the damage caused to the very structures which house the collections. It has been accepted for several years (at least on paper) that the historic building which houses an historic collection should be regarded as highly as the collection itself when establishing the environmental parameters for conservation (Fielden 1982; Kay 1991; Park 1991).

Extra Documentation

While the documentation of existing physical conditions is typically accomplished via the Historic Structure Report, the monitoring of environmental conditions such as relative humidity and temperature (as well as the actual percentage of moisture in various materials) is often haphazard at best. The importance of a rigorous monitoring program should not be underestimated, and should be included in the investigations and assessment

portion of the planning process. The program should be based upon a one-year test in order to gather data from all four seasons. There should be schedules for frequency of data recordation, field checks of monitoring instruments, and data submission. A careful field assessment of the numbers and locations of monitoring points should be required (Fielden 1982; HSR 1991; Thomson 1986).

It is also possible to calculate the expected reactions of various building materials to new environmental stimuli; i.e., increased humidity, increased air movement and lower humidity (if forced air is being considered). Computer modeling should be available to analyze any combination of environmental influences on historic fabric and plot the expected reactions.

Asking the Right Questions

The NPS *Museum Handbook* suggests that the following questions be asked when determining the appropriate environmental design parameters for collections:

What is the appropriate environmental range for each collection?

What is the character and significance of the structure in which the collection is housed?

What is the environmental norm for the region of the country where the park is located?

What is the realistic target range that can be achieved for the structure and the museum collection?

What can and cannot be achieved? (NPS 1990)

These seem to be highly appropriate questions to ask. With a thorough knowledge and assessment of the physical and environmental constraints of the historic structure as well as the collection to be housed therein; and an understanding of the psychometric principles and how the historic building fabric reacts to them; these questions can be answered intelligently. And with answers to these questions in hand, the optimal choice for a climate control system can be made. This system should pose the least threat to the building fabric while achieving the most reasonable environment for the historic collection. Complete construction documents (including a carefully worded spec), careful installation of whatever system is chosen, and training in operation and maintenance complete the scenario. It is suggested that some sort of monitoring be continued to ensure that the system produces the expected environmental balance (CRM 1985; Fielden 1982; HSR 1991; NPS 1990; Park 1991).

Conclusion

The events of the past several years with regard to this issue have been rather exciting. The previously mentioned symposia sponsored by APT and AIC in 1990 and 1991, produced the **New Orleans Charter**, quoted herein. The Washington chapter of APT held a conference in 1991 in which one of the tracks was a two-day seminar on "Heating, Ventilation, Air Conditioning." This spring the American Association of Museums, at its annual meeting, offered a workshop on house museums and the "cost" (potential damage to the housing structure) of providing complete climate control for collections in such structures. It is my understanding that they even entertained the notion that there may be some instances where the "cost" is too high, and the collection should be preserved some other way (whether in individual climate controlled rooms/cases, or off-site where the climate controlling system will not destroy the historic fabric of the "museum." Finally, in 1991, Preservation Brief Number 24, "Heating, Ventilating, and Cooling Historic Buildings: Problems and Recommended Approaches," was published. Authored by Sharon Park, it addresses several of the planning and design issues associated with adding or retrofitting mechanical systems in historic structures (Hunderman & Rose 1988).

While moisture damage, caused by changes in climate control systems and the building envelope, has been documented in countless historic properties around the world and numerous nationally known museums (Hirschorn, the National Museum of American History, the Arts and Industries Museum of the Smithsonian Institution, and the Renwick), it is encouraging to know that the issue is finally getting the attention that it deserves.

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New Mechanical Systems for Historic Structures

Alan W. O'Bright

Installation of new mechanical systems in house museums can be very traumatic to historic fabric and objects during construction and over a long period of time. Issues such as the physical effect on building materials and objects must be weighed against historic integrity of the resource, visual effects, visitor load, interpretation, system maintenance, and energy consumption. Each site is unique and therefore demands individual attention in the determination of mechanical equipment needs.

The following three cases are similar in nature: the houses share temperate climate, construction techniques, and each was constructed prior to the general availability of forced air systems. Each is a nationally significant presidential site and therefore demands extra attention to the preservation of historic fabric and objects. However, they differ in percentage of intact historic material and artifacts, and visitation load.

Lincoln Home

The Illinois home of President Lincoln was constructed in several stages between 1840 and 1860, using braced and light wood frame construction. Finishes consisted of plaster over wood lath at the interior and walnut siding directly over studs. By the time the National Park Service (NPS) acquired the site in 1972 some of the historic integrity had been lost through many post-Lincoln era renovation and repair projects.

Historically, summer temperatures were controlled by opening windows, and adjusting shutters and drapes. The house was heated during Lincoln's time by chamber stoves in each of the primary rooms. By 1890 a central gravity air heating system was installed.[1] This was replaced by city supplied steam heat around 1902,[2] and the steam heat was replaced by a forced air system around 1954.

Until 1987 there were few Lincoln-associated objects among 1,000 objects on exhibit in the house. A few wooden objects cracked as a result of fluctuating temperature and humidity produced by up to 2,000 visitors per day and the lack of proper climate control. Acquisitions brought the total number of Lincoln-associated objects on display to about 50 during the 1980s. Historic building fabric integrity was relatively high and artifact integrity low.

During preliminary design for restoration work, the NPS established a goal of providing museum quality temperature and humidity control for the open display of Lincoln artifacts. Factors which made that goal difficult to attain included visitation load and the absence of perimeter thermal and vapor barrier systems.

Difficult design decisions required extensive modifications to historic fabric. Most of the siding was removed to install insulation and vapor barriers within all external wall and ceiling cavities. Where finishes could not be removed, vapor barrier paint was applied to interior surfaces. External access to wall cavities prompted a discontinuous vapor barrier, however. A sophisticated mechanical system featuring continuous humidity control was also installed.

These design requirements had effects on the preservation and maintenance of the structure which are still being realized today. In addition, some of the historic siding was damaged during removal, a portion of the basement was converted into a "ship's boiler room," and the back yard was extensively excavated to install a large remote condenser.

A past problem associated with the mechanical system has been the establishment of humidification limits. During a severely cold 1990-91 winter, water began dripping from beneath butt ends of siding. A physical investigation of wall cavities confirmed that moisture condensed on new sheathing, within studs, and at concealed siding surfaces (figure 1). Interior surfaces of poorly vented attic spaces were heavily coated with frost. It was discovered that humidification equipment malfunctioned during the holidays and allowed humidity to leap to 70% for a period of about two weeks. Two non-Lincoln artifacts were damaged and the building took several months to dry out.

A panel consisting of site staff, curators, mechanical engineers, and equipment manufacturers recommended that winter humidity levels be reduced to between 25%

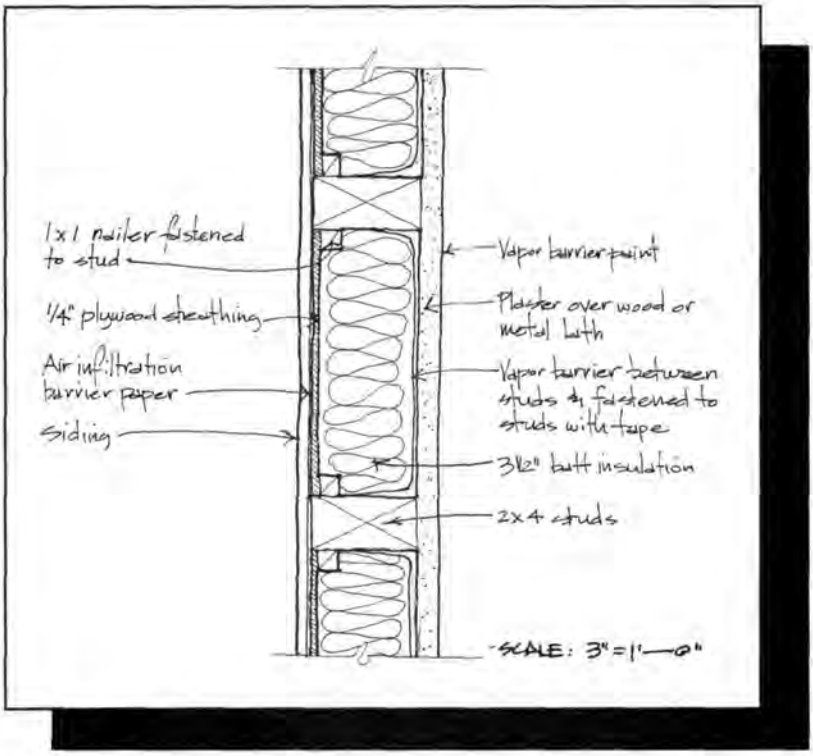

Figure 1. Typical perimeter wall plan section of the Lincoln Home after 1988 restoration work. Note that the vapor barrier is discontinuous at the studs. Field note drawing by the author.

Figure 2. Cavity wall brick infill or "nogging" on the Truman home. This unique element would be sacrificed if insulation were to be installed. Photo by the author.

and 30% from the previous set point of between 35% and 40%, and steps be taken to better monitor and control humidification.[3] Although this incident was deemed unique, the panel was uncertain if whether the vapor barrier system would continue to contribute to wall cavity condensation. Extensive monitoring during the mild 1991-92 winter has shown that internal cavities and structural members exhibit acceptable moisture levels. A hard winter will truly test the changes and recommendations.

Truman Home

The Missouri home of President Truman had very high building and artifact historic integrity when acquired by the NPS in 1982. The balloon frame residence features brick nogging in most wall cavities (figure 2). Early heating was supplied by fireplaces and natural convection coal fired furnace until the Trumans installed a gas forced air furnace during the 1950s.[4] Heating was also supplemented by electric resistant heaters in some rooms. A huge whole-house fan supplied ventilation since the early 1940s.[5] Interior cooling was also supplemented by pulling shades and curtains, and two window air conditioners installed in 1954.[6]

After opening the home to the public in 1984, attention turned toward exterior preservation and mechanical system work. The gas furnace was at the end of its approximate 30-year life; there was no active air cooling system; and windows could not be used for ventilation for security reasons. During the first summer of operation several visitors suffered heat exhaustion and original portrait paintings began to swag noticeably. Alternative systems were developed based upon the impact of new mechanical equipment and distribution systems on historic fabric, and the anticipated temperature and humidity levels that could be maintained with a peak of 256 daily visitors.

After much debate between the mechanical engineer, park curator, managers, and preservationists, it was believed that too much historic fabric would be lost through the installation of an advanced mechanical system. New insulation and vapor barrier systems would require removal of either siding or interior finishes, and removal of brick nogging. The Service decided to use the existing adequately-sized ducts and registers but install new commercially available air conditioning and heating equipment and monitor the long term effects of temperature and humidity change on the structure and artifacts. Objects in rooms with no climate control were given top priority for removal and storage within a controlled environment.

Temperatures have been found to be stable in rooms serviced by the new system. The target relative humidity range of between 40% and 55% has rarely been exceeded while maintaining a year-round temperature of 72°. Humidity has fluctuated by as much as 10% within a 24-hour period, however. Unconditioned spaces are subject to wildly fluctuating temperature and humidity levels. Alternatives are now being explored to condition these spaces without intruding on the external visual qualities of the house.

The wide temperature differential between attic and second floor spaces may be affecting the performance of second floor ceiling plasters although vibrations caused during removal of attic artifacts may be the reason. A study will be initiated to identify the causes for plaster deterioration. The good news is that there has been no noticeable deterioration of household objects.

White Haven

An early St. Louis home of Ulysses S. Grant, White Haven was acquired by the NPS in 1990. The house was constructed around 1814 of heavy timber and later additions of vertical log and light wood framing. Most external wall and ceiling cavities were insulated during 1940 renovation work.

The house was heated with six fireplaces until a hot water central system was installed around 1915. That system was replaced by forced air heating and cooling in 1940. During the historic period, summer heat was controlled by the shade of porches and through adjustment of shutters and drapes.

Fabric integrity is good, although two room wings and much of the interior plaster finishes were removed during 1940 renovation work. The park has no Grant objects, although there is some chance that a few will be acquired.

Since the integrity of objects associated with Grant is extremely low, preliminary planning goals provide for long term preservation of the building. To accomplish this goal, windows and shutters will be used to control ventilation on a daily basis. It is believed that natural ventilation at the first, second, and attic floors will provide a stabile environment for wood members. The

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enclosed basement area will require mechanical ventilation to control moisture, however. Portable electric resistance heaters will be located in each major space during the heating season. Minimal curatorial temperatures will be maintained with no addition of humidity. The location and capacity of these conceptual heaters have yet to be explored.

If this proposal is accepted, the existing central mechanical system will be removed and inappropriate alterations repaired. This will eliminate all ducts and registers from view. Insulation will be removed where accessible during construction work to promote cavity ventilation.

After restoration is completed, daily operations must be programmed for the adjustment of windows and shutters. However, it is felt that this will give the visitor an understanding of 19th-century ventilation control rather than treating windows and shutters as static elements. Windows and shutters will also be subjected to daily condition inspection through daily use. Some visitors may find the unconditioned interior too stifling, although we have not found the interior to be too unpleasant during summer work.

Conclusion

Artifacts, building, and site are increasingly being treated as separate entities with different, sometimes conflicting, needs. In fact, all of these interact and are important to the interpretation of historic sites. Favoring one over the others may have undesirable consequences in terms of long-term preservation or historic appearance. In the process of protecting the structure and furnishings we have in many cases eliminated site qualities such as window breezes, sounds of birds, and the fragrance of flowers. Perhaps we should treat historic structures, objects, and their surroundings as a whole rather than striding into the installation of complex mechanical systems. We must carefully evaluate the short- and long-term consequences of design decisions. We must listen to what the resource is telling us before we install contemporary mechanical systems.

Acknowledgements

The author extends his gratitude to Lincoln Home NHS Curator Linda Suits and Truman Home NHS Curator Carol Dage for their technical assistance on this paper.

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Effects of Extreme Snowfall on Historic Buildings at High Elevations

Laurin C. Huffman, II

Heavy snow accumulations can impose substantial loads on historic buildings. The characteristic snowfall that predominates in an area and the patterns of its accumulation have great effect upon the shape and form of properly designed structures in these environments; over time this has led to the development of distinctive regional styles. This presentation concentrates upon the ways in which snow interacts with the form of a building.

The design solutions used in areas of heavy snowfall employ different strategies, but all strive to achieve the same objective—to get the weight of the snow to the ground. To comprehend the different means that have been used historically to accomplish this goal, and their strengths and weaknesses, we must first understand some of the characteristics of falling snow. A popular myth holds that the English language has only a single term, "snow," while the Inuit people of the north have dozens of descriptive terms for the substance.[1] In actuality, there are many terms in use to describe the properties of snow; terms such as "powder," "corn," "champagne," and "sleet" are just a few of those that are widely recognized.

The varied types of snow have strikingly different weights and behavioral properties; consequently their interaction with snow-country structures differs markedly. When cataloging the impact of falling snow upon a building, we generally classify snows as either "wet" or "dry," though one must recognize that there is a continuum between the two extremes.

The Effects of Wind

Prevailing winds sculpt the falling and drifting snow and cause recurring patterns of accumulation. Where the snowfall is usually dry and light and where the winds are strong, wind can become an important tool for avoiding the accumulation of heavy snow weight upon the structure. Park structures situated on precipices with commanding views and ones that are above the timberline often exploit this clearing action effectively. An exposed location and a simple and unobstructed nearly-flat roof line will often perform quite effectively in these conditions.

The snow clearing action being exploited on these broad, low-pitch, dry snow country roofs is an illustration of a standard principle of fluid dynamics described in Bernoulli's Law. The roof is acting as a crude wing, and the vacuum created as the air rushes over the ridge helps to sweep the roof almost clean and limit the depth of snow accumulation.

Though obviously cold, light snows trap a lot of air and do have a measurable insulating effect. Engineering texts list the k factor for snow and ice as ranging from 0.34 to 1.3.[2] I believe that the ability of snow to seal cracks and retard air exchange is of even greater importance in conserving heat in these exposed locations.

Because it has an insulating effect, some snow accumulation may be desirable. This accumulation can be encouraged by placing barriers perpendicular to the wind flow much as sand is influenced to accumulate along a shoreline by the use of groins, jetties, and other projecting structures. These impediments to the wind flow "spoil" small segments of the roof "wing" by creating turbulence and eddy currents as the air flows over them; this causes snow to drop from the windstream and deposit behind them. The visitors' center situated near the continental divide in Rocky Mountain National Park employs a type of snow guard to encourage a controlled amount of snow to collect on its roof. On this structure, logs have been laid upon the roof and the applied snow loads are balanced across the ridgeline by interconnecting timbers running parallel to the roof rafters. Because the snow loads are about the same on both sides of the ridge, this design avoids the introduction of uneven stresses into the roof structural system and does not require the trouble-prone roof penetrations required by more typical snow guards (figure 1).

The Force of Gravity

Where the average snowfall is wetter, the snow is heavier and more cohesive; these properties leave the wind unable to transport the snow as far and roof clearing is

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Agenda (Continued)

8:45 a.m.	Session 20 Intervention Guidelines for the Conservation of Historic Concrete Structures	Eric Jokinen Consulting Engineer Halsall & Associates, Ltd.
10:00 a.m.	BREAK	
USE		
10:15 a.m.	Session 21 PWC:Over Utilization of Historic Buildings	Gilles Fortin Coordinator, Architecture Studies A&ES (EC) Quebec Region Public Works Canada
PRESERVATION PARTNERSHIPS		
11:00 a.m.	Session 22 CPS:Private Heritage Buildings in CPS Park Townsites	Ted Mills Architectural Historian Architectural History Branch Canadian Parks Service Jim Taylor Staff Historian Western Regional Office Canadian Parks Service
11:45 a.m.	LUNCH	

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Figure 1 The log snow guards on the Rocky Mountain National Park visitors' center allow snow to accumulate without introducing further stresses to the roof system.

Effects of Extreme Snowfall on Historic Buildings at High Elevations

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not as effective. When such snowfall predominates, roof slopes are traditionally steeper and gravity becomes the principal mechanism for reducing the snow load. On steep roofs, Bernoulli's Law is also in effect, but these roofs begin to act less like wings and more like barrier walls. The wind impacts the steep roof rather than flowing smoothly over it; behind the ridge, the sudden relief of pressure develops a slight vacuum causing eddy currents to form. On the leeward side in the "shadow" of the peak, the snow is pulled from the wind stream and a greater accumulation of snow results. This uneven snow loading was not factored into the design of many of our historic structures and has caused many unanticipated problems for their structural systems.

We have briefly explored the use of wind in controlling the load that snow places upon a structure and have begun to discuss additional non-structural methods that can be effective with wetter snows and in areas where deep accumulations occur. Snowfall that accumulates over the winter season also has characteristic properties. The layers of snow that collect during different snowfall events can be quite distinct in the snow stack and may contain marked differences in the amount of moisture present. As a general rule, however, the snow pack is in many ways similar to the atmosphere surrounding the earth. The higher up in the stack we go, normally the less dense we find the snow. The lower layers have become more compressed as they have been pressed down by the overburden of later snows. Intervening warm weather and heat from the ground or other warm surfaces and melt water working its way downward along these surfaces leads to further densification of the lowest layers. As the season progresses, the bottom of the pack is transformed into hard slush or ice.

Where a steep roof is situated with an eave line higher than the surrounding snow pack, the roof will frequently clear itself. Gravity is assisted in these situations by a smooth slick roofing material such as metal or large slates. The absence of complicated protrusions and other obstructions that catch the dense ice at the bottom of the pack and stop the slide is also an important performance consideration. Even where these impediments occur, snow buildup that exceeds the height of the obstructions will tend to slide, particularly where a shear plane exists between two layers in the pack. The upper portion of the snowpack slips easily over a layer containing freezing rain or one on which an icy glaze formed on a warm sunny day.

As the snow accumulation moves down the roof, additional forces are exerted upon the structure. Chimneys, vent pipes, and other obstructions to the downward progress of the snowpack are subjected to large uneven lateral loads. The sidewalls of dormers and abutting wings are ground down by the abrasive action of the ice in this moving glacier. At wings and dormers where gable roofs intersect the roof slope, the resulting valleys become pinch points in the downward progress of the ice and snow. Localized snow loads increase here and additional lateral forces are exerted on the protrusions. Massive almost unimaginable forces are found in such spots when heavy wet snows remain for long periods of time.

Where two or more gable-roofed wings or dormers project from the main roofline, the funnelling effect becomes even more extreme. In these situations hanging glaciers often form that will avalanche downward at some unpredictable moment. At porches and other additions where a roof abuts the wall below, large dynamic impacts with great destructive power occur. These crushing forces are experienced when a section of the snow pack above finally breaks free. Historic structures, and particularly their later accretions were frequently not designed to withstand these impacts.

Early park visitor facilities were often located parallel to the brow of a dramatic hill or precipice in order to take advantage of an impressive view and to offer this inspiration to the greatest number of guests. Where this orientation is perpendicular to the wind direction, a drop-off of the land on the leeward side will greatly increase the wind deposition of snow there. And if the hillside or mountain slope continues upward on the opposite building elevation, the structure is also broadside to the action of hillside snow creep. The movement of snow down the hill is blocked by the building walls and great lateral loads must be resisted at the building face if the building is not to be stove-in or dislodged from its foundation.[3]

Snow creeping down a hillside will also flow around and past the structure; in its passing, the grinding action of the moving mass will shave away the materials at its base. In addition to the abrasive action of snow on buried buildings, wet rain and snows work into cracks and crevices and saturate porous finish materials. Where the building is unoccupied and unheated, this moisture melts, penetrates, and refreezes, expanding in the process as well as effectively bonding itself to the exterior building elements. Consolidated with a large mass of snow and ice, a component of the building is likely to be pulled along when the mass moves or breaks

loose. Intermittent sunshine or building heat can cause cedar shingles to become saturated with frozen water creating an ice/wood composite that is capable of pulling away layers of wood as the ice drops off the building during the spring melt.

With snow periodically and unpredictably breaking loose and falling from the building roof and walls, pedestrians entering and leaving the facility may be in some peril. Standard gutters, snow-guards, and diverters that offer effective protection on the low-sloped roofs of the dry snow regions are unable to withstand the force of the heavy wet snow accumulation on the steeper roofs; furthermore, these details can also contribute to unwelcome ice damming problems during the spring thaw. In deep-snow areas, moving the building entrances to the gable ends is an adaptation that addresses these hazards. Icicle formation and snow cornicing are two additional problems that are commonly encountered. Where 24-hour period snowfalls are high or drifting snows are the norm, outward-opening doors are impractical, even on public buildings (figure 2).

Figure 2 In the North Cascades, a distinct style of cabin has evolved that allows both light and people to enter a snow bound building.

The Action of Heat

Actively melting snow from the roof is a strategy that has been attempted on some contemporary structures. Such solutions are a conscious attempt to improve on the melting that is frequently observed on uninsulated older structures that have some heat during the colder months. For such systems to be practical and effective in areas of extremely high snow accumulation, snow build-up on the roof cannot be allowed. Extremely high calorie inputs are required to melt the denser snow and ice at the bottom of a typical snow pack and in these situations, the lag in melting the accumulation from the roof could leave it overloaded after an unanticipated blizzard. Another complication is that if the roof surface is not heated perfectly evenly, the denser ice at the bottom of the stack will bridge over the heated spot, creating an air gap and greatly increasing the time required to reduce the snow load on the roof structure. In areas of high snow accumulation, the energy costs of operating melt systems are unacceptably high in today's energy market.[4]

Figure 3. Wind tunnel testing can be useful in predicting the behavior of snow around a building.

Predictive Modeling Techniques

This brief presentation has hopefully imparted some empirical understanding of how different types of snows interact with the exteriors of snow country structures. Modeling techniques can be used to study the interaction of snow and wind and land and building forms in greater detail. In an open-channel water flume, sand is sprinkled into a tank of flowing water to predict the deposition patterns of falling and drifting snow.[5] Wind tunnels are another tool that can be used for these studies. In wind tunnels, it is a common practice to use glass micro-balloons to simulate snow; other substances such as crushed walnut shells can more accurately duplicate the almost vertical edges and clinging properties that wetter snows exhibit.[6] By selecting appropriate techniques and materials, accurate predictive studies of building and detail performance are possible. Where exterior alterations to existing historic structures are being contemplated, such studies can be particularly rewarding; in these instances the tests can be calibrated by correlating the results with actual snow observations (figure 3).

When the first structures were built in the national parks of the Pacific Northwest, the tremendous winter snow loads to which these structures would be subjected were unseen and unanticipated. The early designers had little perception of the forces these facilities would have to endure over the winter. Many of the snow country structures in the National Park Service's Pacific Northwest Region are of timber frame construction. These structural systems are quite compliant and flexible. They frequently wrack and bend when they are overloaded; occasionally one or more members will fail. When a member is overloaded, by moving and bending it will redistribute its overload to nearby members,

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thereby avoiding failure. Because the greatest overloads are likely to occur in the wintertime when the building is vacant, we consider the hazard to the public to be low and do not automatically make major alterations to the historic structural system in order to bring these systems "up to code." Mathematical analysis of these structures is often complicated because the design and condition of the connections is unknown or the structure is otherwise indeterminate. The structural properties of the clear old-growth timbers in some of these buildings exceed the strengths listed in the strength tables. On-site non-destructive load testing of the structural system should be considered before the conclusions of engineering calculations are accepted as accurate. These tests can also be used to determine the actual snow loads being resisted. Limited reinforcement of existing components, design and installation of temporary winter bracing systems, and even annual programmed replacement of failed structural elements and building components should be considered as effective preservation techniques where more extreme solutions would impact historic fabric and spaces.

Further Challenges

The difficulties encountered in introducing systems of plumbing and sprinkler pipes and heavy and brittle fire separation materials into flexible historic structures offer the designer interesting challenges. Many additional details such as hot and cold roofing systems, the prevention of ice dams and icicle damage, and the design, mounting, and storage of snow shutters, snow tunnels, snow grates, and exterior railings must be properly executed for successful operation and maintenance in areas of extreme snowfall. It is my hope that this discussion has given you some insight into the problems and challenges of properly preserving this fascinating genre of historic structures. With their continuing record of serving the public, though we may sometimes find them buried in the snow, these cultural resources are not archeological sites.

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[1] see "Name That Snow," *Snow Country*, December 1991: The New York Times Company, New York, New York, p. 32.
see also:
Pullum, Geoffrey, "The Great Eskimo Vocabulary Hoax."
[2] *1989 ASHRAE Handbook: FUNDAMENTALS*, 1989: American Society of Heating, Refrigerating and Air Conditioning Engineers, Inc., Atlanta, Georgia, pp. 37.3 - 37.4.
Baumeister, Theodore, *Marks' Standard Handbook for Mechanical Engineers*, Eighth Edition: McGraw-Hill Book Company, New York, New York, p.4-63.
[3] see "Paradise Inn Fire Suppression System, Structural Analysis, and Electrical Wiring Analysis," by John Morse & Associates, May 28, 1976: National Park Service, particularly the "Bibliography of Lateral Snow Load Literature," Appendix p. II - X-1..
[4] see "Repair & Improvements Study, Paradise Day Use Facility," by John Morse & Associates, December 1979: National Park Service.
[5] see Theakston, Franklin H. (of Morrison, Hershfield, Theakston, & Rowan Limited, Guelph, Ontario), "Snow Loads on Low-rise Buildings," The Canadian Architect, September 1974.
[6] see Crater Lake snow modeling studies performed by Cermak Peterka Petersen, Inc., Wind Engineering Consultants, Fort Collins, Colorado.

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Agenda (Continued)

1:15 p.m.	Session 23 NPS:Management of Mixed Ownerships in a Historic District	Steve Peterson Regional Historical Architect Alaska Region U.S. National Park Service
2:00 p.m.	Session 24 NPS:Partnerships—Leasing at Lowell	Bill Barlow Regional Historical Architect North Atlantic Region U.S. National Park Service
2:45 p.m.	BREAK	
3:00 p.m.	Discussion of Sessions 22, 23, and 24	

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Seismic Retrofit of Historic Buildings

Terry L. Wong

Architects and engineers have known for centuries how to design buildings for gravity (vertical) loads, but it has only been within the past few decades that the engineering of buildings for lateral (wind and earthquake) loads has been understood and practiced. Consequently, there exists a plethora of historic buildings constructed prior to the second quarter of this century that have not been properly designed to withstand these lateral forces. Structural deficiencies in building systems have become most obvious during hurricanes and earthquakes, such as the recent Loma Prieta earthquake near San Francisco (the epicenter of the earthquake was approximately 65 miles southeast of San Francisco) in October 1989.

Because of the extensive damage suffered by principally older and historic buildings (residences, and low- and mid-rise buildings) in a widespread area during the Loma Prieta earthquake, the life safety hazards of these structures has been extensively debated. (It should be noted that the Loma Prieta earthquake had a magnitude of 7.1 on the Richter scale and had a duration of only 10 seconds; thus, it was considered only a moderate earthquake.) While unreinforced masonry and wood-framed buildings suffered most of the serious structural problems, concrete and steel framed buildings suffered from extensive cladding failures. The typical structural deficiencies in historic buildings which became apparent after the earthquake are as follows:

- lack of parapet bracing;
- lack or insufficient ties from floors and roof to walls;
- lack or insufficient lateral bracing in cripple walls;
- lack or insufficient connections of walls to foundations;
- insufficient bracing or support of chimneys;
- "pounding" action of closely built adjacent buildings;
- "soft" stories (stories with extensive openings);
- lack of capacity of the basic structural elements or system, such as diaphragms or shear walls.

The amplification of ground acceleration and liquefaction of soils in the Marina District of San Francisco also caused many building failures. This area had been filled with bay mud and debris from the 1906 earthquake.

As evaluations of the earthquake and subsequent damage continue to be conducted in many municipalities in the Greater San Francisco Bay area, this information is becoming available and is being used by the National Park Service (NPS) as this agency prepares to accept the transfer of the Presidio of San Francisco—designated a National Historic Landmark in 1960, and containing hundreds of historically significant buildings—as a unit of Golden Gate National Recreation Area.

The challenge before the NPS is balancing the needs between historic preservation (maintaining historic character and preserving historic fabric) and seismic safety as well as considering economic factors for adaptively reusing many of the buildings. This paper will give an overview of the process NPS is using, specifically evaluation methodology and possible upgrading and strengthening techniques.

Evaluation Methodology

There are various methods for evaluating the seismic resistance of existing buildings and identifying structural deficiencies. Traditionally, engineers have relied on current building code requirements for new buildings, which have been found to be inappropriate and consequently "unfriendly" to historic buildings especially in the hands of untrained users. The building officials which publish the Uniform Building Code have improved this situation somewhat by publishing the Uniform Code for Building Conservation (UCBC), which has been adopted by many jurisdictions, however not in San Francisco. The most significant aspect of this code for structural engineers is the analysis of unreinforced masonry buildings in Chapter 1 of the Appendix. However, even the UCBC can adversely impact historic buildings.

In an effort to preserve the integrity of historic buildings, the state of California issued the State Historical Building Code (SHBC) in the late 1970s. This code provides the opportunity for engineers to devise alternative solutions (performance oriented) versus meeting the prescriptive requirements of the current building code. Consequently, the experience and judgment of the structural engineer are vital in determining appropriate retrofit techniques. A decisionmaking flow chart for the traditional way to seismically retrofit historic buildings in California is shown in the illustration.

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Agenda (Continued)

TRAINING

3:30 p.m.	Session 25 Career Development and Staff Enhancement	Ghassan Attar Chief, Period Engineering A&ES (EC) Public Works Canada Susan Hum-Hartley Randy Biallas Tom McGrath Chief, Williamsport Preservation Training Center U.S. National Park Service Andy Piebalgs Director of Operations Organization Metrics
4:30 p.m.	Workshop Evaluation	Chuck Anibal
5:00 p.m.	END OF SESSION	
7:00 p.m.	The Last Supper, Windsor Lounge, Prince of Wales Hotel	

SAFE TRIP HOME

Seismic Retrofit of Historic Buildings
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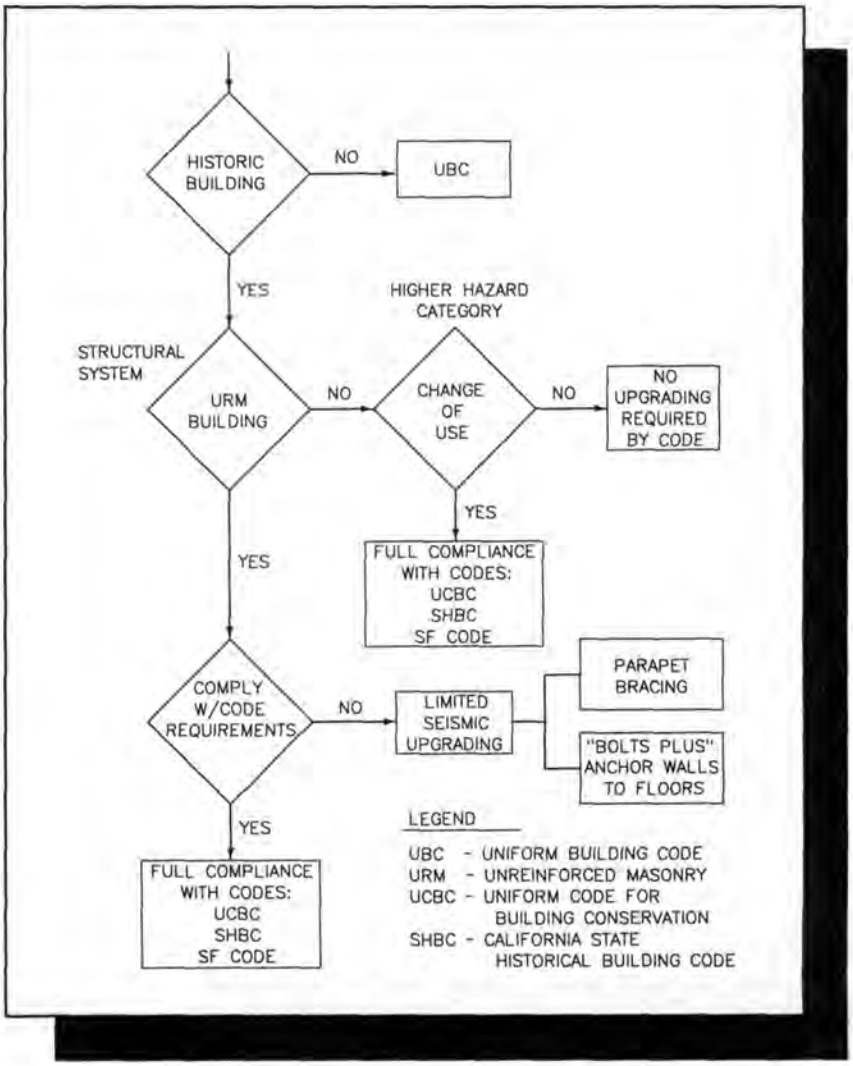
Alternative approaches have been developed for evaluating existing buildings, apart from building code requirements. One such method is described in a document prepared by the Applied Technology Council (ATC) in 1987 and is titled, *Evaluating the Seismic Resistance of Existing Buildings* (ATC-14). In the early 1980s, the Federal Emergency Management Agency (FEMA) instituted the National Earthquake Hazards Reduction Program (NEHRP) and published recommended provisions for the development of seismic regulations, in 1988. Earlier this year, the Building Seismic Safety Council (BSSC) of the National Institute of Building Sciences under contract with FEMA produced the NEHRP Handbook for the *Seismic Evaluation of Existing Buildings* and a companion document, *NEHRP Handbook of Techniques for the Seismic Rehabilitation of Existing Buildings*. The "Evaluation Handbook" is drawn from earlier work at ATC, especially report ATC-14, but significant differences exist. One of the more significant differences is that ATC-14 is based upon an earlier generation of seismic design provisions, such as those in the 1985 UBC (allowable stress design), while the NEHRP provisions and handbook are based on strength design.



While the NEHRP handbook is certainly appropriate for the evaluation of both existing and historic buildings, the NEHRP Rehabilitation Techniques were not necessarily devised with preservation of historic buildings in mind. Therefore, care needs to be taken in applying their use.

The NEHRP handbook procedure for evaluating the seismic performance of existing/historic buildings consists of the following steps.

1. **Site Visit and Data Collection.** This initial evaluation of the building consists of becoming familiar with the structure and assembling pertinent building design and construction data.
2. **Selection and Review of Evaluation Statements.** This can be done using a general procedure or evaluation lists (which require simple true or false responses) for 15 common building types. The general procedure consists of evaluating the basic building system, vertical systems resisting lateral loads, diaphragm or horizontal bracing system, structural connections, foundation and geologic site hazards, and nonstructural elements.
3. **Follow-up Field Investigation.** The first assessment of the evaluation statements may indicate a need for more information about the building. This investigation should also take into consideration the condition of structural elements. Nondestructive and destructive tests may be necessary to complete the evaluation statements to the greatest extent possible.
4. **Structural Analysis.** From the evaluation statements, analyses can be performed for the building system and individual elements as required. The basic acceptance criteria is that the total demand must be less than or equal to the capacity. If elements do not meet the specified acceptance criteria, then the relative hazard or seriousness of the deficiencies should be assessed.
5. **Final Evaluation.** The results are asse bled and presented in a report.

After the final evaluation is completed, alternatives can be generated and recommendations made to correct structural deficiencies. Criteria and guidelines should be developed to aid the structural engineer in the development of the alternative concepts.

At the Presidio, the NPS will begin using this procedure this summer to evaluate five building prototypes of different structural systems and materials. The evaluation statements in step 2 will be input into the Inventory and Condition Assessment Program (ICAP) database for documentation. The success of this evaluation will then be determined, with the goal of identifying other prototypical buildings for future evaluation.

Upgrading and Strengthening Techniques

Upgrading and strengthening techniques to improve the seismic resistance of historic buildings are largely based on the goal(s) of such a program. This goal results

in levels which can range from minimal techniques such as hazard reduction and protecting life safety to more extensive solutions that may minimize damage to the structure. When dealing with a large inventory of buildings, such as the Presidio, guidelines, such as the Secretary of Interior's *Standards for Rehabilitation and the Architectural Design Guide for Exterior Treatments of Unreinforced Masonry Buildings during Seismic Retrofit* prepared by the Preservation Committee, American Institute of Architects, San Francisco Chapter, are essential for providing engineers with information relative to appropriate treatments.

Many factors affect the extent of retrofitting, such as functional considerations, impact on historic fabric, cost, relative merits of alternative techniques, and mandatory ordinances. These factors need to be determined on a case-by-case basis, as most buildings are different in size, construction, and/or condition. A brief overview of seismic retrofit techniques is listed below divided into the following categories: wood-framed, unreinforced masonry, and mid-rise buildings.

Wood-framed Buildings. The anchorage of walls to foundations and lateral bracing of cripple walls are the most essential needs. Upgrading of diaphragms, shear walls, and connections may also be necessary. Further, bracing of masonry chimneys or alternatively reinforcement of flues is common in historic residences.

Unreinforced Masonry Buildings (UMBs). Six areas of strengthening can typically be required in low-rise buildings of this type. The following list is in priority order:

- parapet bracing
- wall to roof diaphragm anchorage
- wall to floor diaphragm anchorage
- out-of-plane wall bracing
- shear wall strengthening (in-plane)
- diaphragm strengthening.

If out-of-plane wall bracing is unacceptable, then a technique called "centercore" can be used. This technique involves coring vertical holes in masonry walls at specified intervals, installing reinforcement and filling the void with grout.

Mid-rise Buildings. These tend to be early steel (with masonry infill panels) or concrete framed buildings. Because of the scale of these structures (and therefore higher forces), more extensive retrofitting is normally necessary if the building requires upgrading. To increase lateral resistance of stories, steel bracing can be used, usually on the interior of the walls. Another technique is reinforced concrete (gunite or shotcrete) on the interior or exterior of walls. If the above adversely affect the historic fabric, then base isolation can be implemented. This technique was applied in the mid-1980s to the Salt Lake City/County Building and is being considered for Civic Center buildings in San Francisco and Oakland. In many instances, base isolation is used in combination with other lateral bracing techniques.

These techniques described are just a few examples of many which exist. Readers are referred to references at the end of this paper for further techniques. Architects and structural engineers need to work together to evolve proper retrofit techniques in order to minimize disruption to historic materials and maintain historic character, while reducing seismic hazards.

Conclusion

Because of the geologic conditions at the Presidio site, only minor damage occurred during the Loma Prieta earthquake. However, because of the active faults in the area, the possibility obviously exists for larger and closer seismic events, which could cause more extensive damage. Therefore, the seismic retrofit implications at the Presidio are significant given the number of buildings and aggregate construction costs for upgrading historic buildings. Seismic retrofit costs vary widely depending on the condition and size of the building and retrofit technique, and has been estimated from $5.00 per square foot for simple residences to $100.00 per square foot for large complex ornamental landmarks. Clearly, the NPS will be challenged at the Presidio, as this agency attempts to balance the needs of life safety and historic preservation during rehabilitation of historic buildings in the 1990s.

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Accessibility and Preservation Conflicts

Robert L. Carper

Cultural resource and accessibility specialists often do not find mutually acceptable design solutions for historic buildings. Historic preservation standards—with the objective of preserving character-defining features and historic fabric—are not always compatible with accessibility standards—with the objective of providing equal and unassisted access. Historic fabric and character can be adversely effected by requirements for routes of egress, number of accessible exits, elevators, door widths, door hardware, thresholds, stairs, railings, and hallway widths.

The Secretary of the Interior's Standards for Historic Preservation Projects, established under the National Historic Preservation Act, guide the preservation of the integrity of historic buildings. The Architectural Barriers Act of 1968 and the Americans with Disabilities Act of 1990 specify the legal requirement, and the Uniform Federal Accessibility Standards outline the procedures for accessibility.

Interpretation of these legal requirements, standards, and procedures is sometimes inconsistent or one set of objectives is favored over another. To meet the intent of both objectives— preservation of historic character and fabric and providing equal accessibility is difficult. This paper provides a brief overview of some common types of conditions and example design solutions or concepts.

There are four design or planning approaches that range from that which would best provide for meeting accessibility requirements, but which is the least desirable from the preservation standpoint, to solutions that preserve historic fabric and character, but do not achieve accessibility.

The four approaches are:

1. *Fabric removal, alteration, or replacement solutions.* These solutions can provide accessibility, but also can destroy or drastically alter significant historic character-defining features and fabric.
2. *Technical solutions.* The addition of a non-historic feature or equipment provides accessibility, but may have adverse character and fabric effects.
3. *Use solutions.* Changing the use of a building may be inappropriate for the building's spaces and still may not provide equal accessibility.
4. *Program solutions.* Providing alternative opportunities can preserve historic fabric and character, but does not necessarily provide equal accessibility.

Typical Accessibility Issues

The following describes typical conditions and design approaches.

1

Entry Steps

The entry steps of many historic buildings are a major character defining feature. Ramps to overcome these steps might not only be an unacceptable visual impact on the street scene and building, but can also adversely restrict the public sidewalks. Alternate entrances might be used. However, they can have a negative psychological effect (Example 1).

In historic towns boardwalks were often a part of the historic scene. It is possible to modify the slopes and elevations of boardwalks and even to add boardwalks to areas between and behind buildings. However, railings that may have to be provided along the edges of ramps or boardwalks can be intrusions.

Door Thresholds

High doorway thresholds or sills in some structures, especially in prehistoric structures, are features that had a purpose and are part of the character of the structure. Removal of such obstructions obviously would be an adverse effect. Several simple solutions are available. The visitor route could be defined to avoid such openings or dirt fill could be used to raise the path of travel, leaving other openings unaltered. This would preserve the feature, and would be visually acceptable (Example 2).

More difficult situations are thresholds in historic buildings that might be unusually high and are likely to be an important character-defining feature that to remove them would be an adverse effect. Ramps or elevated walkways would probably also adversely effect the character of the building. In such cases, direct assistance or alternative interpretive programs seem to be the best acceptable solution.

Door Widths

Doors and their surrounds are one of the most prominent character-defining features of historic buildings. Very frequently, however, their unobstructed opening width is less than that required to meet the accessibility standard. To widen the opening usually results in fabric alteration and loss: (a) at a minimum—replacement of at least the head frame and trim and alteration of the door, or (b) in the worst condition—replacement of the entire system with a reproduction. In the latter case, while not

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only creating the potential loss of the original fabric (if it is not placed in a collection), the change of scale can misrepresent the original character of the feature or building.

Single doorways, and sometimes double doors, that need only minor widening might be modified. The minimum original fabric replaced would be head framing and trim, and one or both door stiles.

Another possible solution would be electrically operated hardware with interior and exterior pushbutton activation to open and close both door leaves of double doors. Historic hardware would remain, but would be inactivated.

Door Hardware

Thumb latch and knob operated hardware are the most common in historic buildings (Example 3). Usually historic door hardware does not provide the operating functions necessary for accessibility compliance. In historic house museums, guided tours and leaving most interior room doors open would be appropriate to solve this problem. In adaptive use buildings, replacement of knobs with lever handles might be considered.

Stairs and Railings

Stair railings in historic buildings are often important decorative features, but usually do not meet the accessibility requirements because of the handrail shape and size, the railing height, or strength. Stair riser and tread dimensions also are usually not in compliance. Obviously rebuilding such stairs or adding code complying handrails have major adverse effects. When other routes of access/ egress are available, they should be used instead.

3

Hallway Widths

Depending on building use, hallway widths may be only a few inches narrower than required by accessibility standards. To relocate or replace an entire wall to gain several inches is a drastic intervention. An exception to the requirement is preferable, because alteration can cause excessive loss of historic fabric or decorative finishes or require major changes in other building features—a historic floor plan or the building structural system. Widening a hallway a few inches also could require relocating other openings and walls. Planning an alternative use scheme may be more appropriate.

Routes of Egress and Accessible Exits

If major interior changes are planned in adaptively used buildings, routes of egress and the needed number of accessible exits are easier to achieve than in historic house museums. Again, in the house museum, guided tours and emergency evacuation procedures are appropriate.

Elevators

In multi-story adaptive use buildings, consider installation of an elevator to provide accessibility in spaces that are not historically important.

Conclusion

These example conditions demonstrate that it will not be possible to equally satisfy preservation and accessibility objectives in all cases. Therefore, an improved methodology is needed for weighing the aspects of each case and providing resolution. Both the historic preservation standards and accessibility procedures provide the means for negotiation and variance. More understanding and application of these means are needed. Also, the impact of accessibility legislation on the private sector will expand the demand for new products, such as door hardware that will assist designers in solving some of the conflicts. Even with an improved methodology to provide balancing of requirements, and with new products, the need for creative design solutions will still provide us with many challenges.

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Log Replacement Techniques

Larry Pearson

The following paper is based on a series of reports prepared by Peter Caron, former senior trades foreman, Historic Sites and Archives Service, Alberta Culture and Multiculturalism. In particular reference has been made to the article, "Jacking Techniques for Log Buildings," which appeared in the APT Bulletin, Vol. XX, No. 4, 1988.

Over the course of the last 15 years, the Historic Sites and Archives Service of Alberta Culture and Multiculturalism has been involved in the restoration of over 20 log structures. These have ranged from the 1860s clerk's quarters at Fort Victoria Hudson's Bay Post to the many early-20th-century farmstead dwellings and outbuildings preserved at the Ukrainian Cultural Heritage Village near Edmonton.

In undertaking the restoration work on these buildings, the Service developed a number of different approaches to the problem of replacement of deteriorated logs. This paper will discuss and illustrate the different jacking techniques which were employed in the replacement of logs on these structures and will provide some guidance for the selection of a particular system for a given situation. While there is no routine technique which can be applied in every case, an assessment of the particular building undergoing restoration with respect to the style of construction, structural condition, extent of deterioration and deformation will provide a guide to the most appropriate techniques for log removal.

Complete Dismantling

No doubt the most radical approach to the replacement of deteriorated logs, the complete dismantling of a structure may be required where the majority of the logs need repair or replacement. This was the case at the Slemko House, a single-room dwelling typical of the first permanent homes built by the Ukrainian pioneers in east central Alberta.

Prior to being dismantled, the building was recorded with drawings and detailed photographs. The mud plaster material which covered the exterior and interior of the structure was removed and retained, and ultimately reconstituted and reused in the restoration. Each element of the building was tagged with its location and the structure carefully taken apart it reverse order to its construction. Each element was laid out on the site adjacent to the building and blocked off the ground. Each element was then inspected and a decision made with respect to replacement or retention. Where deterioration was only partial, only this portion was removed, and a sound piece spliced to the remainder of the log.

Through a process which employed both the original pieces as templates and by scribing against the log below, the replacement pieces were fitted together with the original retained elements and the structure reassembled. The walls were fitted together as far as the top plate, and then disassembled again and the new logs treated with preservative (OPP in Methyl Hydrate). The building was then reassembled. This approach had the advantage of allowing the preservative to be applied after all cutting and fitting had been completed so that the entire surface of each log would receive treatment with the preservative.

Jacking Techniques

Where deterioration is limited to a smaller number of logs it is usually possible to employ one of a number of techniques which employ jacks to split the building in a manner which isolates the deteriorated log allowing removal and replacement. The first principle in any jacking operation is that the load from the member being removed must be transferred to another member of sufficient strength. The building may also require stiffening to avoid wall failure or deflection while lifting or while separating the building for replacement of deteriorated members.

The Internal Frame

Based on a system developed by the Canadian Parks Service (CPS) and used in Dawson City, an internal frame was used in the restoration of the Pylypow House, again at the Ukrainian Village. Here, deterioration was limited to the lower courses of logs of this two-story structure, and to the area beneath the second floor windows. The structure was finished on the interior with mud plaster which was subsequently covered with vertical "V" groove paneling. The building's original siding, evident from nail holes in the logs and visible in early photos had been removed prior to the buildings acquisition by the Province.

The use of an internal frame allowed the upper portion of the building to be raised, leaving the bottom deteriorated course of logs behind for restoration. The remnants of the original plaster in the sound logs was left undisturbed with this method.

An internal frame is created by building a three-dimensional framework within the structure tight to the walls and ceiling supported on timber cribs bearing on grade. Timbers are bolted on the exterior (for rigidity) through the walls onto the frame. After jacking, the building is suspended from the interior framing. With such a frame, the roof structure can be left intact and the walls (or portions of them) can be dismantled.

The frames are constructed of 6"x6" timbers throughout (vertical and horizontal) with 3/4" plywood gussets attached with 3" double-headed nails (for ease of dismantling). Care is taken to ensure that the size of the framing timbers will be strong enough to perform the job.

This system has several advantages. Its openness permits freedom of circulation for inspection, research, recording and monitoring the bracing system. Deformations of the building are obvious before construction. Spacers can be applied between the frame and the wall and can be pushed out. Alternately, drawing in the exterior timbers can eliminate outward deflection of the walls.

The internal frame itself is built to the desired interior dimensions of the building. Vertical members of the frame must be plumb and horizontal members level. A 1/2" threaded rod is used to bolt the internal frame through to the exterior timbers. As often as possible, the through bolts are placed between logs, thus keeping damage to the walls to a minimum. This also allows the building to be split at any point of the upper sections of the walls.

Bipods

Use of a bipod is an option when dealing with small log structures where weight is not a problem. (A bipod is a two-legged support.) Bipods are used for buildings where the roof has been left in place. The system is not ideal for lifting entire structures, but is well suited to buildings where only one or two walls need work. Bipods are easy to erect, but wind can make this system unstable if precautions are not taken.

The first step is to reinforce the building with 3xl0s. These are placed vertically along the walls, inside and outside, at all corners, and at door openings. Blocks (3"x10") 1' long are bolted to the top of these vertical members to act as stops for the bipod legs. The verticals extend down the wall to just above the lowest log to be replaced. If more logs need to be replaced, the verticals are cut back as needed from the bottom up. A 3"x10" base with stops supports the bipod legs. To insert the diagonals the building must be jacked up slightly. The result is that the building is suspended from the two legs of the bipod. If the building has splayed out, the diagonals can be cut longer or shorter to push the building back into place. When workers finish for the day, or in extremely windy conditions, the space between the bipod base and the bottom log must be firmly blocked, or a gust of wind could knock out one of the bipod legs.

Tripods

The tripod is a good way of splitting a building when the roof has been removed or when it has collapsed. Erecting a tripod is relatively easy, and it is low-cost in manpower and materials. Because the system makes it easy to raise and lower parts of the building, small crews have found this system especially useful for adjusting and fitting notches.

To construct a tripod, three shallow holes are dug at each corner of the building: one inside the wall and two outside. A large flat rock is dropped inside these holes to act as a base for the tripod legs. Three poles about 8" in diameter form the tripod over the corner of the building. A 1/4" chain is wrapped around the intersection of the poles above the wall about 2' above the top leg. The tripod legs ideally are not less than 60° from horizontal. A 1-ton come-along is hung from the intersecting poles to act as the lifting device.

To prevent damage to the logs, it is best to use strapping to lift the building. If a log in the middle of the wall is to be replaced, straps are inserted under the log just above it. The log to be replaced can be slipped out and a new log inserted and adjusted until the notch fit is perfect.

Though tripods are more stable than bipods, precautions should be observed. Tripods have a limited lifting capacity and are unstable in wind. Raise one side of the structure at a time. If the tripods were not placed precisely and all four corners were lifted at once, the structure itself might shift so that it would not hang plumb under the tripods. Pushing it back over to lower it down to its original position would create a problem.

Jack and Plate

Probably the most common way of splitting log structures is to do log replacement using jacks and plates. Railway jacks (5 or 10 ton) work best, but hydraulic jacks can also be used. This system involves heavy, labour-intensive work because of the cribbing needed at every jacking station. On the other hand, all the cribbing is reusable unlike some of the other systems that require wood members to be drilled or cut to length.

The principal of this system is to insert a jacking plate between the logs. Where logs fit tightly, a wooden wedge can be driven between the logs to create a space for the steel jacking plate to pass through.

A special jacking plate must be created for each jacking station. The jacking plate is made up of two 1/2"x6"x12" plates welded together with a 4" lap. The weld is placed as close as possible to the centre of the wall.

To minimize stress on the jacking plates, jacks are placed as close to the wall as possible. On the lower portions of the wall, cribbing must be installed under the jacks. On the upper wall vertical 6x6s bolted through the wall can be used as jacking bases. These must also sit on cribbing.

Silver System

Ideal for replacing wall logs, this system is preferred for buildings with good foundations. Jacking splits the wall, freeing the deteriorated log which is pulled out endwise until one end can swing freely and be removed from the side of the building.

A number of slotted 1/2" steel plates are bolted together to form the base for the jack. The same configuration of plates forms the area to be jacked against. The jacks are placed between the plates. The system has long legs which travel up and down the building. The system uses the building for stability and requires no blocking.

Top Plate Removal

The top plate of a log building can be removed and replaced by one of two methods. With either method a system of braces must be built from the underside of the ceiling either to grade or to the underside of the basement floor.

A method of lifting only one side of the roof is achieved by bolting a 4x4 onto the underside of the rafters. Seats must be cut into the 4x4 so the seats are horizontal. These are the jacking points. Pole jacks (also called jack posts or post jacks) work well to lift the rafters off the plates. If there are no collar ties, temporary collar ties must be installed. The 4x4 jacking beam is placed below the collar tie/rafter joint.

To lift the entire roof off a building a larger system is necessary, but the same principles are followed. Both plates can then be removed simultaneously.

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Log Replacement Techniques
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General Guidelines

At no time is jacking a building of any size or shape not dangerous. There is always the possibility of falling debris, slippage, jack failure, or failure of a building member. Care must be taken not to cause undue stress on existing building materials; stress can damage them. While jacking it is important to lift only the minimal amount needed. Too much height and the structure or jacking system can be thrown off balance.

Wind is also a powerful force when funneled into a building through a space left by a log that has been removed. Braces must be installed for safety, especially when work is left overnight or over a weekend.

Shim stock and wedges must be plentiful when splitting or jacking a wall. The building or frame should never have the potential for dropping more than 1/2". When jacking at the corner of a building, spaces will be created in the walls perpendicular to the wall being jacked. Wedges should be inserted into these spaces at 2' intervals to help support the logs above them. The wedges are removed as the building is lowered.

Jacking points should always be as close to the corners of the building as possible. On long walls intermediate jacking points may be necessary in order to lift the entire wall. At jacking points the building should be protected with padding and cloth strapping.

The choice of systems entails assessment of the building and its foundation. Manpower cost of materials, and interior and exterior finishes are also important considerations. For example, a decision about which jacking system to use may be contingent on whether interior and exterior finishes are to be conserved. In some of the systems, particularly the systems that require wooden frames, the cost may be higher because the material may not be able to be recycled. The trade-offs are higher labour costs and backbreaking work.

It must be obvious by now that this type of work is usually hard, heavy work; caution is the key word. When a building is being moved about in what it considers an unnatural way, it definitely has something to say about it. Listen to it. It is talking to you.

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Workshop in Historic Structures: CPS/PWC/NPS
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Les Consequences de la Surutilisation de Structures Historiques

Gilles Fortin

Le Service Canadien des Parcs, Région du Québec, dont on fête ce mois-ci le 20ième anniversaire, a à son actif un bon nombre de réalisations de projets de conservation qui dans l'ensemble, au même titre que ceux des autres régions, font l'orgueil du réseau national. Plusierus d'entres eux sont récipiendaires de prix d'architecture provinciaux et même nationaux. Nous avons tous à en être fier mais soyons réalistes, rien n'est parfait.

Avec le temps et à l'usage, nous vivons et subissons leurs petits travers, ou défauts majeurs. Nous, comme les autres, avons à faire face à différents problèmes. Certains sont reliés au confort des usagers, certains à la détérioration des artefacts et d'autres au manque de flexibilité ou de polyvalence dans nos installations et même parfois à un vieillissement prématuré de l'enveloppe.

Dans le processus de conservation et de mise en valeur de structures historiques, l'intervenant (architecte, ingénieur ou autre), fait face à une problématique importante. Il est confronté à un dilemne qui peut parfois la déchirer, à savoir: maximiser la conservation et optimiser l'utilisation. Dichotomique, la réussite d'un tel objectif dépend de l'importance relative que l'on attache à la valeur de chacun. L'équilibre demeure toujours le meilleur choix. Mais qu'est ce que l'équilibre? Chaque compromis devra être éclairé et bien mesuré.

Nous tenterons à l'aide d'exemples de démontrer notre propos et de tirer quelques recommandations qui nous osons l'espérer, éclairerons nos démarches futures.

Il ne s'agit pas de savoir ce qui est bon ou maluvais, ou encore de porter des jugements de valeur mais bien de se questionner et de treouver la façon d'éviter ces erreurs.

Au préalable, il serait approprié de bien définir ce que loin entend par surutilisation.

Un peu d'étymologie; surutilisation est un mot compseé du morphème ou préfixe "sur" et du radical "utilisation".

Le préfixe renforce le mot et ici, marque l'excès.

La définition du dictionnaire pour utilisation se lit comme suit: "rendre utile, faire servir à une fin précise, ce qui n'y était pas nécessairement ou spécialement destiné".

Dans le contexte de conservation et mise en valeur, je crois approprié de parler de surutilisation, car par exemple, lorsqu'un bâtiment conçu comme une résidence devient un centre d'accueil et d'interprétation, il y a changement de fonction. On peut dire qu'elle n'y était pas spécialement destinée. Par surutilisation on peut aussi sous-entendre perte, désordre, modification et usure prématurée.

En d'autres mots, la surutilisation est la résultante du choix de la nouvelle fonction.

A l'aide de nos exemples, nous toucherons 3 aspects où la surutilisation est présente ou possible.

- Structural (capacité de support).
- Accessibilité et confort (circulation et climatisation).
- Conformité aux normes (issues, accessibilité universelle).

Structure

Le 1er exemple de l'aspect structure est la résidence de Sir GeorgesEtienne Cartier. Les 2 maisons d'un étage et demie construites de pierre sont séparées par un passage cocher mitoyen et datent de 1837. A part l'installation d'un système de chauffage et d'éclairage au gaz, aucune modification majeure n'est faite avant 1870. En 1871, elle devient le Grand Pacifique Hotel et en 1881 jusqu'à 1884, elle héberge le département de la Milice. En 1893, suite à la construction du tunnel de la rue Berri, on ampute la maison Est de 3 mètres. Cela implique des travaux d'envergure et on en profite pour construire un toit mansardé tel qu'il nous apparait aujourd'hui.

Compte tenu de la nouvelle vocation impliquant (admission du public à tous les étages) on devait augmenter la capacité portante des planchers.

La structure en place, modifiée en 1893, ne pouvait être renforcie sans l'ajout de murs secondaires ou de colonnes, éléments non souhaitrés dans le concept retenu d'utilisation.

Le résultat est qu'il n'y a plus de structures d'origines.

Le 2e exemple est La Caserne Carillon. Bâtiment érigé en 1836 pour l'intendance Britannique à des fins de résidence militaire, très rapidement il devient un hôtel et depuis 1938, lors de son acquisition par le Service canadien des parcs, il abrite la Société historique d'Argenteuil. En 1984, le ministère a débuté un processus de récapitalisation du bien, qui n'est pas une véritable mise en valeur. Des interventions telles que la réfection de la couverture en bardeaux des cèdre, le rejointoiement de sa maçonnerie ainsi que le remplacement des systèmes électromécaniques furent effectués afin de conserver l'intégrité de l'ouvrage.

Cependant, pour rencontrer les exigences du code, un renforcement du plancher du rez-de-chaussé était nécessaire.

Ce travail fut élaboré avec les principes de réversibilité que l'on ne retrouve pas à l'exemple précédent.

Accessibilité

La propriété St-Laurent peut être divisée en deux zones, il y a le secteur domestique et privé et le secteur commercial et public.

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In the process of conserving an asset, we must be able to balance conservation and user requirements. At the planning phase, decisions concerning utilization should be compatible with the period of restoration. To save an important historic element we may have to compromise comfort, for example, or specify the type of use for the asset ...a good conservation choice may not be a good choice for purposes of using the asset.

Les Consequences de la Surutilisation de Structures Historiques
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La résidence St-Laurent est une structure en bois comptant 1 étage et demi dont le carré original date de la 1ère moitié du XIXe siècle. A la fin de ce siècle deux sections furent ajoutées en 2 étapes.

Le magasin général fut construit vers 1866 et l'entrepôt attenant entre 1903 et 1908.

L'étage de la résidence fut condamné pour des raisons de capacité portante et aussi dû au fait qu'il n'y a pas d'issue.

La maison rècele une multitude d'artefacts et d'exhibits. Lors de la mise en valeur du projet, il fut décidé de ne pas installer de système de climatisation et aujourd'hui, à l'usage, dû à la présence des nombreux projecteurs, les pièces sont surchauffées. Pas question d'ouvrir les fenêtres, la poussière de la rue ainsi que ses bruits causent un préjudice.

Aussi, l'exposition multimédia de l'entrepôt ne peut pas souffir d'éclairage externe.

N'aurait-il pas été plus facile ou profitable d'installer un tel système dès le départ.

Les choix faits autant au niveau de l'aménagement que de l'utilisation ou que le choix des périodes d'utilisation, doivent être compatibles. On est souvent porté à se rendre aux extrêmes. Il se doit d'y avoir un équilibre. Pour sauver un élément jugé important parfois on va se limiter dans l'incorporation d'équipement qui permettrait une utilisation plus conforme aux exigences de la fonction. Il ne faut pas ménager la chèvre et le choux. Il faut toujours essayer de bien doser.

A priori, un choix de conservation peut nous sembler approprié mais à l'usage peut devenir une source de problèmes ou de contraintes qui amène des détériorations importantes ou majeures sur d'autres éléments ou sur l'enveloppe elle-même.

Recommandation

Etre conscient du choix de vocation fait pour le monument et connaître toutes ses implications.

La meilleure façon d'y arriver est, en plus de suivre le processus de planification, d'élaborer ou produire une étude d'encadrement de projet qui contiendrait une évaluation du potentiel et des contraintes d'utilitsation.

Cette étude doit clairement faire ressortir les caractéristiques physiques de façon à bien connaître toutes les composantes avec leurs valeurs relatives ainsi que ses limites.

Elle doit aussi faire ressortir le potentiel d'adaptation aux normes et codes.

Ceci devait permettre de faire des choicx judicieux et conforme aux objectifs de conservation tout en alliant la mise en valeur.

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Processus de Restauration d'un Edifice Declare Historique

1. **Les Recherches et Etudes Documentaires**
   - La recherche historique.
   - La recherche archéologique complémentaire à la recherche historique.
   - Le potentiel archéologique.
   - Le relevé architectural.
2. **Les Etudes Techniques Preparatoires**
   - La dépose sélective de matériaux.
   - Les relevés complémentaires arch. et structuraux.
   - Le relevé d'état et du degré de détérioration de l'ensemble des composantes architecturales et structurales (évaluation).
   - Les études géotechniques et de génie structural:
     - Sondage de sol,
     - relevé des systémes structuraux et leur évaluation (condition),
     - carottage et sondages non destructifs aux endroits pertinents,
     - évaluation des capacités portantes des pla chars et toiture,
     - évaluation des déformations.
3. **Evaluation des Contraintes** reliées a la mise aux normes de confort, d'occupatin et de sécurité
4. **L'Analyse des Besoins d'Occupation par Rapport aux Contraintes de Conservation**
5. **Le Concept de Restauration**
   - Le parti optimal de restauration (conservation, mise en valeur).
   - Le parti optimal d'occupation.
6. **Les Travaux de Restauration**
7. **Les Travaux d'Amenagements Contemporains (Rehabilitation) et de Mise aux Normes**
8. **La Strategie de Mise en Oeuvre**

The Reconstruction of Engine House No. 6

David E. Snow
Kenneth W. Bennett

The historic site of the Allegheny Portage Engine House is visible from old highway 22, some 90 miles east of Pittsburgh. From a vantage point just below the summit level, one can catch a brief glimpse of the incline used by the Portage Railroad 161 years ago. Though it only functioned for a scant 24 years, it provided a vital link between the eastern and western watersheds of the Susquehanna and Ohio Rivers. Canal boats were hauled from the banks of the Pennsylvania Main Line Canal System, then loaded on specially designed carriages equipped with railroad wheels.

The entire trip was an arduous 36-mile portage over the Allegheny Mountains, rising from an elevation of 946' above sea level at the eastern front, to 2,340' at the summit. It was at this crest that Engine House No. 6 provided the motive force to tug the canal boats up the last incline. Linked together like traditional rail cars, they rode a single track on a double track alignment up the incline and through the large doors of the Engine House. The other track provided an avenue where the same machinery simultaneously let down trains of cars traveling in the opposite direction as a counterweight. This was the final gradient, in a series of 5, that scaled the eastern front. There were 5 other inclines on the western linkage, contributing to a total of 10. Engine House No. 6, a large barn-like structure, contained a pair of two-piston, 35 h.p. steam engines similar in design to what was commonly used on stern-wheelers of the era. The engines functioned alternately with one lying in reserve of the other in a disconnect mode, clutched to gears and sheaves the size of a man.

For its day, the construction and operation of the Allegheny Portage Railroad was a considerable feat of engineering. The ruins and traces remaining are a testament to the scale and complexity of this remarkable endeavor. The entire passage is now preserved by an act of Congress as a national historic site.

As the planning process evolved, it became apparent that the ruins of Engine House No. 6 demanded a unique preservation approach. No structure directly related to the technical operation of the Portage Railroad existed. This created an interpretive void, making the historic scene appear incomplete. The site's primary focus, the ruins of Engine House No. 6, consisted of only an exposed archeological excavation. This presented a frustrating dilemma for the designers. Management had a strong desire to reconstruct Engine House No. 6 over its historic foundation. This was a problem. First, the ruins are designated as an archeological resource. Second, historic data pertaining to Engine House No. 6 is extremely scarce, consisting of several vague photos and artists' renderings. To make matters worse, the ruins had been tampered with over time, for interim stabilization purposes. Any serious attempt at reconstruction would be highly conjectural—any construction on the site might damage what remains of the ruins.

Despite these formidable challenges, the need for interpretation and protection of the ruins remained a high priority with park management. There would be no way to avoid the philosophical mine field. As all historical architects in the National Park Service (NPS) are only too aware, the policy is: "Thou shalt not reconstruct." Fraught with these contradictory messages, the genesis of the current design came to be.

In one afternoon, an abstract notion was translated into a single sheet of architectural schematics. That basic design changed little during the design development. This concept would sit on the vulnerable knife edge of the dreaded "R" word.

The solution was to create a modern structure that primarily borrowed massing and proportion from the sparse data available on historic Engine House No. 6.

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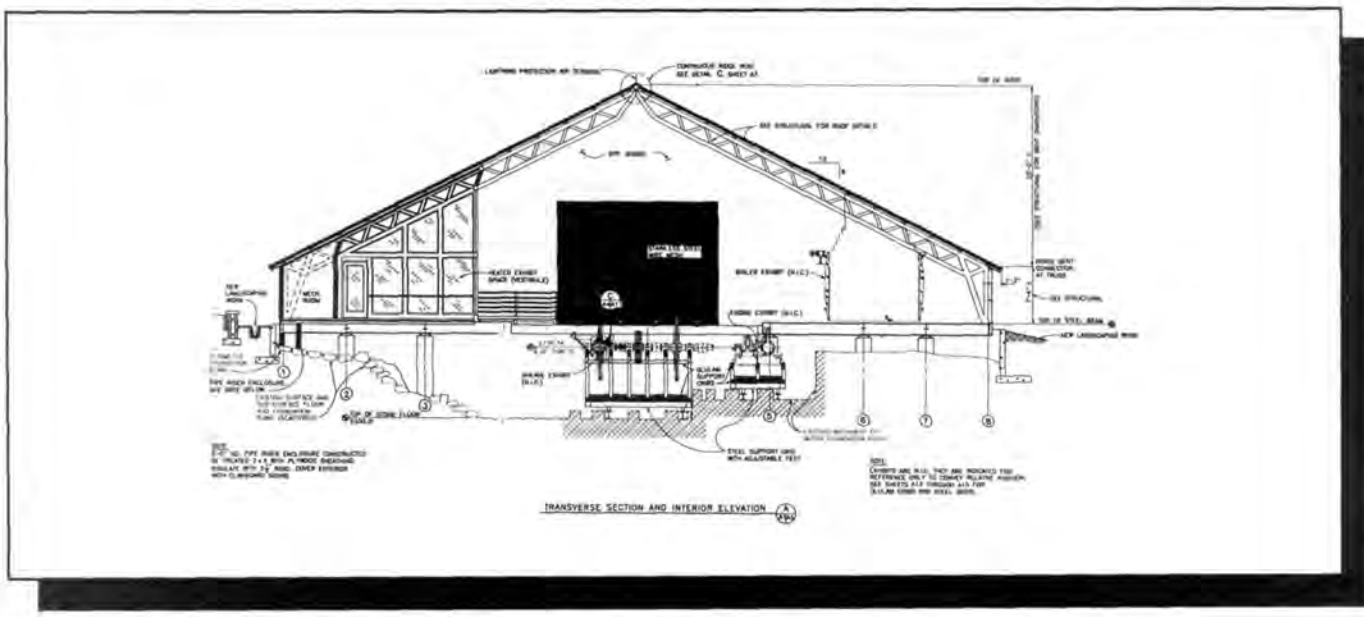


The Reconstruction of Engine House No. 6
(continued from page 61)

The resulting shelter design would transversely span some 50′ in the middle to a double row of piers and cantilever an additional 10′ to the outer side walls, thereby missing the most significant archeological ruins. Volumetrically, it was to reestablish the historic scene by recounting enough of the engine house to be recognizable, yet remain clearly distinguishable upon closer scrutiny.

By employing the design intent of lifting and spanning the resource, the structure would appear to float over the ruins. A mere 24 foundation piers supported the 70′x 90′ structure, thus avoiding contact with the historic foundations. To further emphasize that the shelter was not a historic structure, no roof support columns were used. Instead, tube steel lattice trusses, responsive to the industrial character of the site, span the full 90′ width of the building.

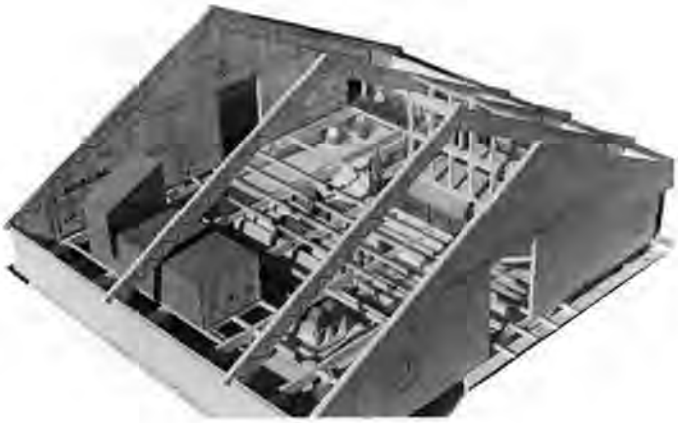
Included in the overall design was a very important element for interpretation—a full-scale mockup of a single steam engine linked to gears, sheaves, and the facsimile of a boiler. The comprehensive exhibit would be laced between the open steel floor grid.

The coordination between the full-scale exhibits and the structural design of the building was exacting. Tolerances between the ruins, the exhibit, and the structure were down to less than 1/16″. Engineers closely calculated the deflection of the steel beams to prevent the structural system from crushing the static engine display. Additionally, there was a programmatic need for an air-conditioned vestibule to house small hands-on exhibits. The exhibit room was located where the second steam engine historically had been mounted.

Working closely with archeologists, the designers carefully selected zones of the ruin that would be the most acceptable for positioning the 2′ diameter concrete piers. To further complicate the process, soil borings indicated the presence of old mine shafts beneath the site. Each pier would now have to be drilled more than 40′ deep to reach sound bedrock.

Meanwhile, the details of what would ultimately be called the exhibit shelter were refined and simplified. On the exterior, there would be no characteristic chimneys, no wood shingles, only a monochromatic paint scheme. The interior would be an even greater departure from the conventional, bordering on the surreal. The structure was to have no floor, only an exposed steel skeleton with the single steam engine and boiler unit entwined above and below in context with the masonry machinery pit floor pad. Visitors would be restricted to a catwalk, accessed via short bridges at the entry doors. Just inside, they would encounter the climatically controlled vestibule housed unobtrusively behind glazed steel bents and latticed trusses. The primary purpose of the shelter would become obvious once inside the exhibit shelter.

As the design progressed, a scale model of the entire shelter was necessary to help clarify the sheer complexity of the project. Once the shelter model was complete, a replica of the steam engine exhibit was placed inside so its impact could be better evaluated. This three-dimensional representation proved essential in communicating



the construction restraints of all the varying components with regard to the ruin.

The design of the shelter was not without its detractors. Near the end of the design process, some said the project could not be built. The aesthetic appeal, the functionality, and the suitability of the shelter were questioned. In fact, it eventually became quite clear that, philosophically, the shelter was not actually a building in the conventional sense at all, but could better be described as an exhibit itself—a contextually sensitive design that pragmatically addressed the historic scene, historic fabric, and overall interpretation of the site. Three resource-related concerns melded together in this approach. The exhibit shelter became such an integral part of this preservation triad that it ceased to exist as a separate entity.

We may never know exactly how close the shelter's proportions, gleaned from such meager data, might match the actual Engine House No. 6. However, from a distance as one faces it from the summit level to the west, or from old highway 22 at the base of incline 6, it will fill an obvious void in the historic scene.

Under the shelter's expansive gable roof, the full scale mock-ups of the steam engine, with its compliment of gears, sheaves and ropes, will be perceived by visitors as very close to their historic juxtaposition with the stone ruins. When viewed within the context of the historic setting, interpretation of the archeological site will take on new meaning.

As easy as it is to label the exhibit shelter a reconstruction, it is just as easy to see and experience the reasons why it is not. The design accomplishes what it set out to do—solve a difficult, multilevel preservation problem in a unique and creative manner. The proof will lie with public acceptance and visitation over a period of time.

David E. Snow and Kenneth W. Bennett are historical architects with the Western Team, Denver Service Center, U.S. National Park Service.

Reconstruction of Fort Union
A Multi-disciplinary Approach

Richard J. Cronenberger

Mention the word **reconstruction** around National Park Service cultural resources professionals, and more likely than not, you will hear, "It doesn't work!" And while these specialists disagree on the desirability, aesthetics, and ethics of the Service undertaking such projects, park visitors love them. Rarely does the public question the accuracy of these reconstructed buildings and sites.

While reconstructions are not inappropriate for interpreting history, the inherent nature of an incomplete historical record inevitably results in inaccuracies and compromises to the original structures or sites. The National Park Service (NPS), unfortunately, has more than its share of such problems—problems further compounded by maintenance nightmares.

Inaccurate reconstructions partly result from the way the NPS conducts business—funding and planning. More often than not, these span several years during which minimum coordination takes place between archeologists, historians, historical architects, planners, architects, and engineers. However, the Fort Union reconstruction benefitted from a compressed research, design, and construction timetable, a phenomenon that resulted in an accurate reconstruction with minimal conflicts between the historical record and contemporary design requirements.

Fort Union was the American Fur Company's principle trading post on the upper Missouri River. An active trading center from 1829 to 1865, the elaborate installation (at least, by 19th century frontier standards) sheltered and entertained many important people of the day. The measure of the fort's importance to the region is embodied in the extensive historical record—diaries, sketches, paintings, articles, letters, and the like. The fort was even photographed two years before being torn down.

Extensive historical research, including a Historic Structure Report, had been done prior to its becoming part of the national park system in 1966. The Historic Structure Report, however, was primarily a history overview and did not include archeological or architectural data.

Then in 1979, the Rocky Mountain Region produced "The Fort Union Reconstruction Analysis," a report to Congress recommending a partial reconstruction for those fort structures that were adequately documented by archeological excavations, written records, photographs, drawings and sketches. The report recommended additional historical research and archeological excavations to complete a comprehensive database in support of the Service's reconstruction design effort.

Fort Union Trading Post. Photo by Orville C. Loomer, Aerial Photography, Williston, ND.

In 1985, reconstruction of Fort Union became reality. An election year Congress appropriated the first of four years of funding, thus requiring the politically-driven project to be completed as quickly as possible. This meant that additional historical research and archeological excavations necessary to the project would have to be done during the design phase; and while the reconstruction analysis and associated research provided a good database, there were many assumptions and decisions that needed further study.

Although the resulting compressed research phase created many challenges, it turned out to be a blessing in disguise. All the research specialists involved in the project had the rare opportunity to work closely with each other, in contrast to the usual scenario in which historical research is completed several years in advance of project design. Because the Fort Union project was fortunate to have most of the original reconstruction analysis team available for participation in the final design process, "institutional memory" ensured that initial thinking, assumptions, and ideas were addressed during design and that misinterpretation of the historical research was minimized.

The author, though not part of the original 1979 reconstruction analysis team, served as primary designer for

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Reconstruction of Fort Union: A Multi-disciplinary Approach
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the reconstruction project and brought to it a technical perspective involving long-term maintenance design criteria that did not jeopardize the fort's historic appearance. Interaction with the original team worked well in verifying or questioning many aspects of the original research.

It was important to involve as many interested and supporting parties as possible in order to keep the project within budget and on schedule while reducing long-term maintenance but still avoiding any compromises in historic accuracy. During the design phase, everyone who had an interest in the project, from the archeologist to the contractor and sub-contractors, was involved. By closely coordinating with historians, archeologists, curators, interpreters, park staff, and the contractor, important and critical historical information was addressed in a timely manner while not delaying the project.

When the 1986 archeological phase began, it soon became evident that previous excavations had not been comprehensive. Since these earlier excavations had not included the entire fort nor had they reached down to sterile soil, it was uncertain as to what would be found and to what extent this new information would affect the fort's reconstruction design. The situation offered a unique opportunity for the historical architect to work closely with the historical archeologist during excavation work.

Since only watercolors, sketches, and photographs were available for recreating the fort's design, it was important to get as much information as possible to verify type, locations, and size of buildings. Therefore, the historical archeologist was given three objectives by the historical architect: 1) verifying the locations of those structures shown on the many historic drawings and sketches of the fort; 2) verifying assumptions made about various aspects of the fort's original construction, but which had no clear supporting documentation; and 3) locating as much historical fabric as possible since as-built drawings did not exist.

While designing the buildings, the author noted questionable reconstruction analysis design decisions that possibly could be verified through ongoing archeological excavations. These questions were posed to the historical archeologist who then would alter the work plan in order to deal with the issue. Such interaction worked extremely well in resolving several important issues and in averting potential conflicts with the historical record. This daily interaction helped the field archeologist focus on research aspects of the excavations and concentrate excavations in those areas that would yield the most information in support of the design.

For example, the only known historical reference to the size of the palisade pickets indicated that they "were about 1 foot square." While numerous drawings and sketches were descriptive, none included dimensions. A scale model of the palisade cross-bracing was constructed using 12"square timbers. However, the model didn't look proportionally correct. Then during excavations of the north palisade, the original palisade sills, measuring approximately 9" in width, were found intact on the foundation stones. Allowing for minor shrinkage, this suggested about a 10"-wide timber that appears to be about "one-foot wide." Besides a more accurate design, this finding resulted in substantial savings in material costs.

While undertaking research related to Fort Union, the project historian found an 1843 watercolor folded in a book. No one had seen it before. It verified colors of the fort's building materials, general appearance of the buildings, and modifications to the buildings described in numerous diaries and journals. The watercolor was the key piece of evidence that tied most of the historic records together, and would not have been found if the original research historian had not been involved with the reconstruction project.

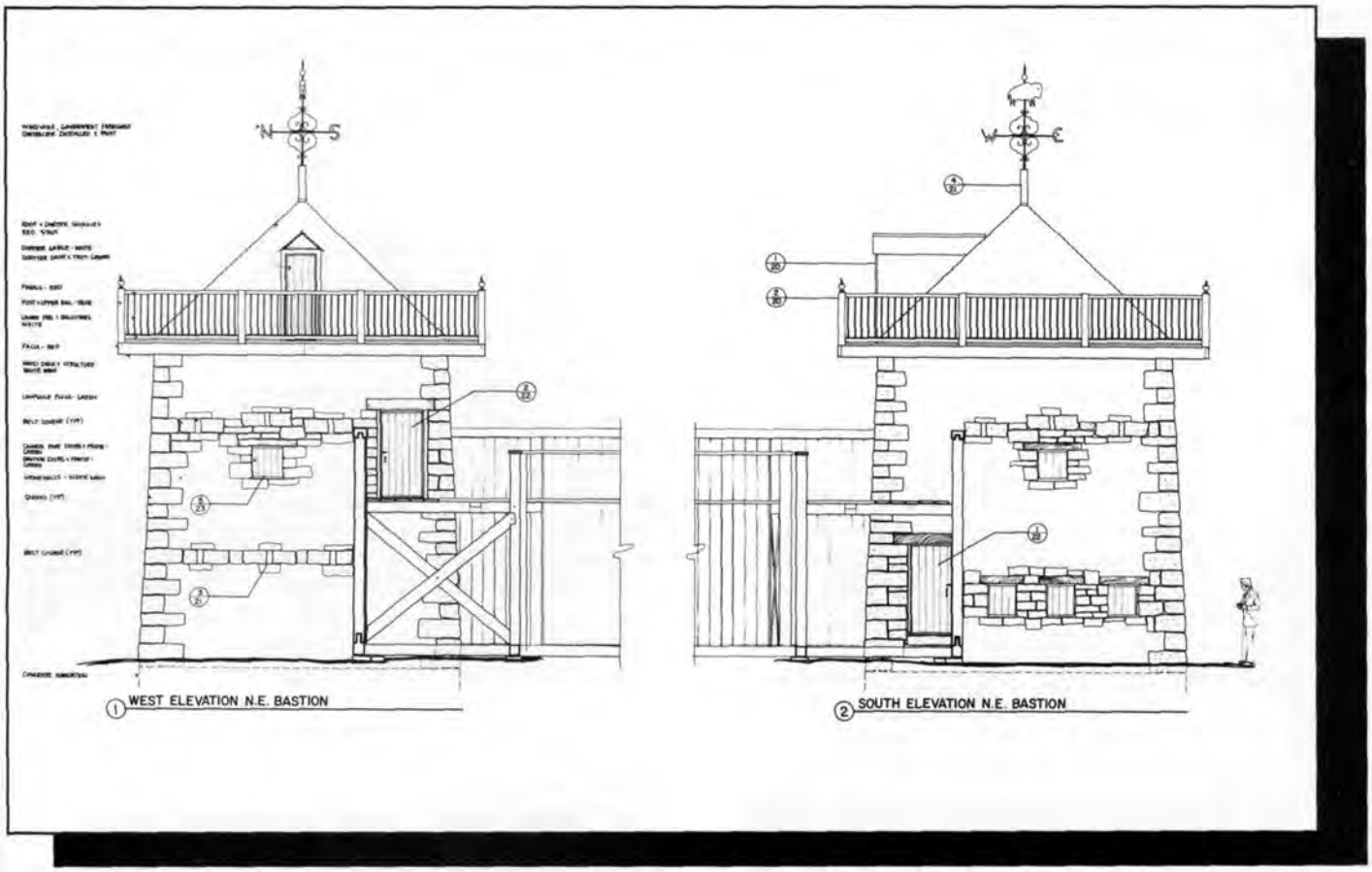
The park staff provided valuable assistance throughout the design process. Several were members of the Muzzelloaders Association, a group of historic re-enactors, familiar with the history and lifestyles of the fort's inhabitants. Well acquainted with historic documents, books, and journals about the fort, their participation and enthusiasm provided valuable interpretive and factual input into the design. Park employees reviewed plans throughout the design process, and also were involved during the construction phase, providing invaluable historical interpretation to the contractor.

It is one thing to produce accurate reconstruction documents, and another to get the project built to reflect the aesthetic intent of those drawings. It is the contractor who provides one of the most important roles in executing this aspect of a project. If the structures cannot be built the way the drawings intended them to be built, the final result will be less than desired. The contractor's input is critical to controlling costs, and to building an efficient and accurate structure. Working closely on-site with stone masons, timber experts, foresters, plasterers, and blacksmiths on construction details, techniques, and hardware, resulted in the production of a design characterized by efficient fabrication methods that did not compromise the historical character of the site.

It is important to be open to fabrication and construction suggestions made by the contractor. A give-and-take relationship encourages that individual to offer valuable suggestions for fulfilling project requirements. Fabrication can be altered during construction to address long-term maintenance considerations while producing better detailing that doesn't compromise final appearance.

Historic fabrication methods can cause problems and confusion with modern contractors. This was overcome at Fort Union by providing training to the contractor on historic construction methods—historic hardware fabrication and installation, log hewing and fabrication, and plaster and stone work. The contractor was encouraged to read historical accounts about the fort and to understand the historical significance of the project. In making this effort, the contractor realized that this project was not just another building. He appreciated the intent of the reconstruction and developed a greater appreciation for the construction skills of the original builders. He became emotionally involved with the project.

Unusual and challenging projects such as the reconstruction of Fort Union can be highly successful. However, no single person or organization has all the skills or knowledge needed to make it a success. The his-



Northeast Bastion, west and south elevations. Drawing by Richard Cronenberger, Rocky Mountain Region, National Park Service.

torical architect understands the overall intent of the project through research and preparation of the construction documents. He or she is probably the only person who is involved with and understands the total relationship and integration of the wealth of historic, archeological, and fabric information that contributes to the implementation of the final design.

It is critical that all potential contributing resources be involved during the design and construction phases. Coordinating all this can be difficult at times, but the final results speak for themselves. The Fort Union project provides an excellent example of how direct interaction between the historical architect, historian, historical archeologist, park staff and contractor can produce a more accurate reconstruction.

Richard J. Cronenberger is the regional historical architect, Rocky Mountain Region, U.S. National Park Service. He was project designer, supervisor and manager for the Fort Union reconstruction.

Rehabilitating Jacob Riis Park

Andrew Barton

Jacob Riis Park is part of the Gateway National Recreation Area. The 220-acre park is located at the western end of the Rockaways Peninsula, on the Atlantic Ocean, just south of Brooklyn, NY.

When Gateway was established as a national park in 1972, it was considered to be a "unique opportunity" because it had the potential to offer to millions of Americans "the only real hope that they might ever have to visit a unit of the National Park System." It was one of the few natural areas of outstanding quality that was still available adjacent to one of the most heavily populated urban centers in the entire country (see CRM, *Vol. 15, No. 4). Named after Jacob Riis, a journalist and champion for social reform for the urban poor, Riis Park was established to provide beach-related recreational opportunities for the residents of Manhattan, Brooklyn and Queens.*

Park visitation has been decreasing due to the dilapidated condition of the park facilities. The park is presently being rehabilitated to serve the needs of the park users better and to stop the deterioration of its historic improvements.

Part of Riis Park was added to the National Register of Historic Places in 1981. This 88-acre historic district includes three historically significant structures—the Bathhouse and the West and East Mall Buildings. The parking lot, which was at that time the largest in the world—capable of accommodating 14,000 automobiles, and seven smaller structures considered to be contributing elements were subsequently nominated to the National Register.

Riis Park is historically significant because it is a relatively unaltered example of a publicly planned and designed municipal bathing beach of the 1930s. The period of significance has been established as being from 1932 to 1941. The treatment is rehabilitation.

In addition to being an example of 1930s municipal park design, the park is significant for its association with the following themes: Moderne and Art Deco design; Works Progress Administration; Great Depression and the New Deal; Poverty Relief and Urban Social Reform-Jacob Riis; and Robert Moses era.

Buildings

The Bathhouse is the most important structure in the park and is an excellent example of early- 20th-century beach-front recreational architecture. A massive structure 600′ long by 200′ wide, it consists of four separate buildings: the Entry Pavilion, the Beach Pavilion, and the West and East Wings. These four components are connected with masonry walls which form the courtyards. The Bathhouse was constructed between 1931 and 1933. It was modified in 1934. Robert Moses, the influential commissioner of parks for New York City, made major changes to the structure during 1936-37.

The Entry Pavilion is a single story symmetrical structure with an arcade designed in the Moorish/Byzantine style, and was the point of access to the Bathhouse courtyard changing facilities. The Entry Pavilion and the two Beach Pavilion towers contain the greatest amount of decorative detail in the Bathhouse complex.

The East and West Wings are long single-story structures with gable roofs. The two structures enclose the ends of the courtyard spaces.

The Beach Pavilion is a long two-story structure fronting the beach. It was constructed in 1931-32 and contained a cafeteria, a storage area and kitchen on the first floor, and a restaurant and an eating/sunning terrace on the second floor. Robert Moses removed the roof terrace and the floor area below in 1937 to provide for better circulation up and down the promenade and to provide more separation between the front of the building and the beach. A new Art Moderne facade was constructed at the middle section, the two towers were raised 15′ and connecting walkways were constructed between the courtyards and promenade. A large two-story service structure was built in the courtyard behind the center portion of the structure.

A Historic Structure Report (HSR) and a Cultural Landscape Report (CLR) were prepared to document the history and morphology of the Riis Park site and improvements, to define the significant elements and to offer rehabilitation recommendations.

Program Needs

A design program was prepared to help guide the rehabilitation process at the park. The purpose of this document is to identify the program needs and the requirements to be met in offering a

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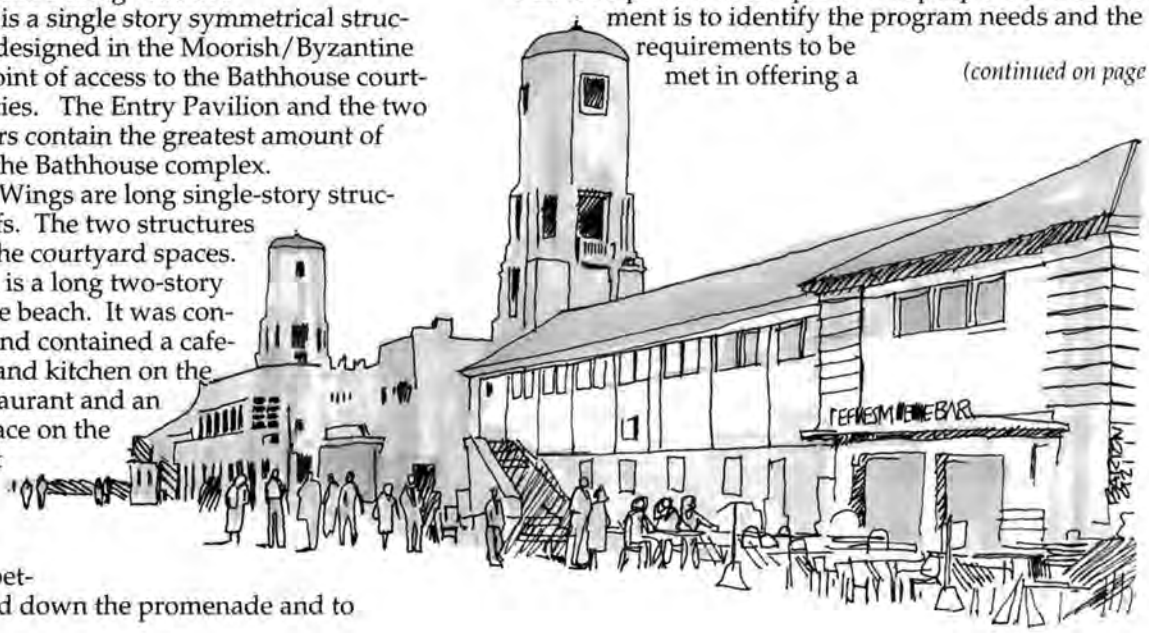

Rehabilitating Crater Lake Lodge

C. Craig Frazier

Congress created Crater Lake National Park in 1902 to protect and celebrate the deep clear lake formed in southern Oregon when Mount Mazama erupted and collapsed approximately 4860 BC. After several years of temporary campgrounds, a private company was formed to build permanent visitor facilities. Construction of Crater Lake Lodge began in 1909, but was troubled by cost overruns and repeatedly extended construction schedules. Difficulties were due to the shortness of the construction season—three to five months depending on how early the fall snows close the roads, and due to the isolated location of the site—at 7100 feet up winding roads of the southern Cascade Mountains.

Perhaps the most important historic character-defining feature of the lodge is its peculiar personality, an eclectic quality formed by the differences in what was envisioned initially and the reality of what was built over an extended period. Just when it was almost complete, there followed a struggle to make life-safety improvements and repairs merely to keep it from falling down. Although the lodge opened in 1915, construction continued through most of its life: fire escape ladders were added in 1919; electric lighting replaced kerosene lamps after 1920; plumbing for lavatories, a gift store, and a registration desk were added in 1921, the same year that upper level exterior walls were shingled, and the roof was stained green. In 1922 construction started on an 80-room addition. By 1929 the Lodge boasted 105 guest rooms, but only 20 had private baths. Between 1929 and 1932 an 80'-long veranda and an entry porch were built, and new water supply and new electrical power were installed. During the 1930s, the site was landscaped, more rooms were finished, some rooms were wallpapered, 15 more rooms were fitted with bathrooms, and a laundry was built in the basement.

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Crater Lake Lodge, kitchen wing.

Rehabilitating Jacob Riis Park
(continued from page 66)

rehabilitation solution.

The end product of the programming effort is a statement of the problems to be solved during the design process.

Identification of Conflicts

A number of conflicts between preservation requirements and program needs became apparent as the HSR, CLR, and Design Program were being prepared.

The HSR and CLR are driven by preservation values while the Design Program is driven by functional needs and requirements.

Conflicts were also discovered among NPS planning documents and between the proposals in the documents and preservation policies and requirements. For example, the Development Concept Plan-1986 proposed modifying a historic ball field to accommodate picnicking needs without acknowledging that the field was historic.

Conclusion

Users and user needs have changed between the 1930s and 1940s and today. Riis Park must adapt to meet the needs of today. Riis Park is not a museum piece. It is a part of the real world and, if it is to survive, it must adapt to be able to accommodate the park users' needs.

The park is also a historic resource. Its significant character-defining elements must be preserved. The resource should be interpreted so that the park users can understand and appreciate it.

It is inevitable that conflicts between preservation and program needs exist. It is important that these conflicts be resolved in a way that doesn't adversely impact the historic resource and allows the resource to function in today's world.

The first step in successfully rehabilitating a historic property is to prepare a Historic Structure Report and/or Cultural Landscape Report. These documents must clearly define and prioritize the historical significance of the resource.

It is equally important to define and prioritize the program (functional) requirements in a design program document.

Conflicts between the two must be clearly identified. And finally, an open and honest dialogue must be held between the parties representing preservation values and rehabilitation needs to negotiate a mutually satisfactory middle ground. Conflicts and inconsistencies among NPS documents must be identified and resolved.

The rehabilitation process should be one of collaboration, not confrontation.

Andrew Barton is a historical architect with the Eastern Team, Denver Service Center, U.S. National Park Service.

Rehabilitating Crater Lake Lodge
(continued from page 67)

During the 1940s, life safety deficiencies, material deterioration, and structural dilapidation began to outpace the building operator's improvements. In the 1950s supplemental columns were placed under exposed ceiling beams because of excessive sagging, and a system of cables with steel beam strong-backs were installed to keep the walls from spreading further. By the 1960s, due to fire safety deficiencies and structural concerns, the National Park Service (NPS) recommended many more improvements or the option of removing the upper floor levels. But there were cost-benefit compromises. NPS finally bought the building from the concession operator, installed a sprinkler system (1967-68) and restricted guest use to lower floors. However, by the early 1970s, because of progressive deterioration and the history of modifications, Crater Lake Lodge had become a clearly sub-standard hotel.

NPS was entertaining options to tear down the lodge in 1976, but the Oregon historic preservation community nominated it to the National Register of Historic Places and requested it be retained. Public hearings and a planning process ensued. While awaiting the outcome, NPS implemented stop-gap repairs (adding external fire escape stairs, fire-rated stair enclosures and doors, smoke detectors and alarm system). Historic interest in the lodge, a honeymoon destination for 70 years, prompted the decision for preservation. The plan for improvements to the park's Rim Village was approved in the spring of 1988: the lodge was eventually to receive full rehabilitation. The schedule to carry out the rehabilitation was accelerated dramatically when, on the advice of consultant structural engineers in spring 1989, the lodge was closed. The risk of operating it without substantial structural reinforcement was not warranted. Park improvement emphasis shifted to the lodge and its early re-opening.

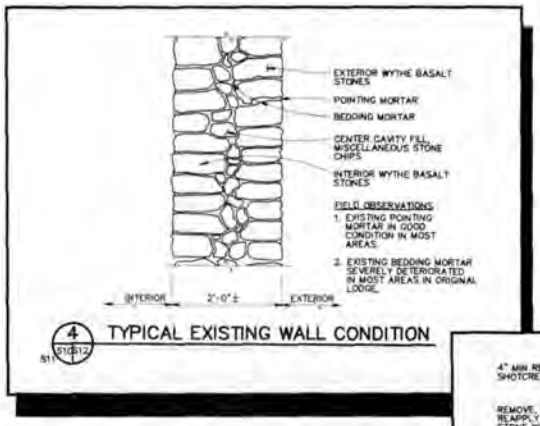
The NPS Denver Service Center undertook several studies to clarify character-defining features, inventory salvageable fabric, and to update the historic structure report. Structural, mechanical and electrical systems were assessed, and a design program for the rehabilitation was developed and based on the Secretary of the Interior's Rehabilitation Standards. A consultant team, Fletcher Farr Ayotte, was procured, and quickly prepared schematic and preliminary designs by summer of 1990. The work was phased, requiring construction documents to begin on the first phase while the design development was still under way for the second. The first phase contract was awarded in April 1991. The second phase construction contract was awarded in May 1992. For the two rehabilitation phases, 302 construction drawing sheets were required. Completion is expected by summer 1994.

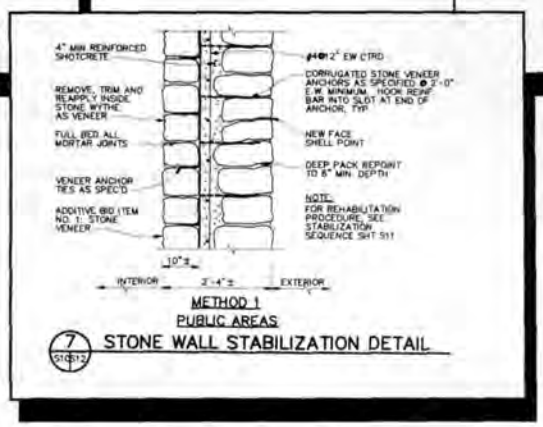
A radical intervention strategy was undertaken due to the substandard life-safety conditions, deteriorated historic fabric, and indeterminacy and distress of the structural systems. Extensive intervention was also required to fulfill the rehabilitation program necessary to return the lodge to serviceability under contemporary standards.

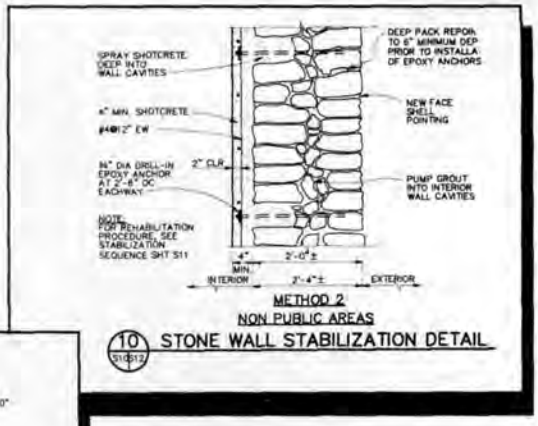
Original construction simply underestimated the design snow loads—which can amount to 350 pounds per square foot (up to 60′ of snow can be encountered per season)—and used techniques and materials common at much lower elevations. Weather conditions at the altitude of the lodge are brutal. The lime based mortar employed 80 years ago did not stand up well and had become friable and was falling out of the walls. The double hung sash could not keep out blowing snow. Floors sagged. Gaps had grown to nearly 3″ between partition walls at upper floors where they intersected deformed exterior walls. Some rafters, and dormer headers, were cracked and, even with subsequent shoring, were bowed under snow loads.

The great hall wing, at the center of the older portion of the building had to be entirely rebuilt. Structurally, it was most deteriorated being held together by 1950s cables and shoring. It was also very crucial to the lateral stability of adjacent wings. A full basement was constructed before the wing was rebuilt to provide a connection between the dining wing and annex basements. The wing was originally under designed. Therefore, 24″ steel beams replaced 14″ wooden first floor beams, 18″ steel replaced 10″ second floor joists, and 7 x 9 glulams replaced 2 x 6 rafters. In addition, the stone walls of the lower floor became stone veneered cast-in-place reinforced concrete walls. The external appearance, however, duplicated the original great hall wing.

Crater Lake Lodge, built beginning in 1909, seen from the southwest in 1990.







Technical details showing two methods for stabilizing unreinforced stone masonry bearing walls.

The lobby wing also had only a crawl space. Installing a basement under it required shoring the entire wing to excavate and pour new concrete walls. This was partially facilitated while the adjacent Great Hall wing was removed and its basement built concurrently. The new basements and the deepening of existing basements to create additional head room provided space for service and utility equipment and plumbing and mechanical runs where none had existed.

Two techniques were employed for stabilizing un-reinforced stone masonry walls of the lodge (see details). The stone appearance was sacrificed where the interior would not be seen by visitors. A 4" reinforced application of shotcrete anchored to the interior side of the repointed stone wall provided the necessary reinforcement. Where both interior and the exterior stone surfaces of walls would be seen, the exterior was thoroughly repointed, then the inner wythe was dismantled. A reinforced shotcrete core was built and the inner wythe, after stone trimming, was then relayed. All 700 perimeter feet of the building's stone walls were underpinned with a 5' spread footing, after initial masonry stabilization. This was done in nominal 6'increments involving excavation, compacting soils, forming and pouring reinforced concrete, waterproofing, and backfilling. Throughout the building undersized floor members were replaced with larger ones or 'sisters' installed to enhance the strength of the floor diaphragms.

The design significantly alters the interior room configuration to increase guest room size from an average of 150 square feet to 280 square feet. This reduced the overall room count from 105 to 72, but the new room size approaches contemporary visitor needs, permits the desired range of room sizes, accommodates historic window locations, and eases the proper introduction of shear walls. The increased room size was also necessary to permit the installation of bathrooms where most rooms had none.

Two new stairs and two elevators were installed, cutting into available guest room floor area. However, the rehabilitation includes creative use of the dormered attic spaces to help increase the floor area for guest room use by approximately 20%. The attics above three of the wings were large enough to accommodate guest rooms.

However, introducing two means of code egress from the attic level of the great hall wing was so convoluted, it was decided, initially, to abandon that attic. Then it was decided to place the designated larger guest rooms on the floor below the attic and allow them, room-by-room, to enter the attic as a second level. Thus, several of the (programmed 15%) larger guest rooms became interesting 2-level suites. The attics of the two Annex wings were also physically constrained by the roof configuration, dormers, and width of the wing, but two stairs and the elevators could be squeezed in. Thus, the annex and annex wing will contain 10 rather small rooms, but with the most interesting shapes and character.

The design required retrofitting heating and cooling systems, plumbing, fire sprinkler, smoke detection and alarm systems, and electrical service that the original building was not designed to carry. Every rehabilitation designer knows the extent of gymnastics required to squeeze these modern systems into historic buildings while trying to maintain original ceiling heights. In the kitchen wing, with all of its new equipment, it was necessary to completely gut the three level wing and deepen its basement 3' to install a fully modern kitchen. This was done, forming a two-level kitchen connected by new stairs and dumbwaiter. Chimneys here (and elsewhere in the lodge) were converted to carry both exhaust gases and to provide make-up air.

The result is not "pure restoration" by any means, nor could this extensive rehabilitation achieve such a goal; however, from the outside, Crater Lake Lodge will completely resemble its historic appearance. The interior will be a modern hotel while maintaining important aspects of the historic character of a 1920s eclectic rustic style including the historic appearance of the main public spaces, the great hall and dining room. The 55,326 square feet rehabilitation cost $11.8 million net or $213/square foot, not including site work and furnishings.

C. Craig Frazier is a historical architect with the Western Team, Denver Service Center, U.S. National Park Service.

Private Heritage Buildings in CPS Park Townsites

Edward Mills
C.J. Taylor

Current national parks policy in Canada stipulates that all cultural resources in national parks, including those on alienated land, be surveyed and evaluated, and that "cultural resources will be safeguarded and presented for public benefit." To meet this objective, efforts have been made to map, record and evaluate cultural resources within the parks.

To date, this process has been heavily weighed in the area of archaeological investigation. During the past several years, the Archaeological Services Section in the Canadian Parks Service's Western Region Office has implemented a program of systematically recording and evaluating archaeological sites in the parks. The Archaeological Resource Description and Analysis (ARDA) has had considerable success in packaging archaeological resource data for use in management decisionmaking. The development of a parallel program for built heritage resources (i.e. buildings) has proceeded at a slower pace. This is due to a long-standing predisposition within the national park system to perceive cultural resources in pre-historical or pre-park terms. Buildings associated with park development are frequently regarded as non-historical, the implication being that the historical processes stopped at the time the individual parks were created.

The evaluation and conservation of heritage structures has been largely confined to park-owned buildings covered under the mandate of the Federal Heritage Buildings Review Office (FHBRO). The FHBRO program's involvement is in turn confined to federally-owned structures that are 40 years of age or older.

Excluded from the FHBRO review are privately-owned buildings on leasehold properties in the parks. These fall into two primary groups: those located in the backcountry, and those located in the seven townsites within national parks in western Canada. Buildings in the latter group account for the largest single category within the national park system, and present a special set of problems from the standpoint of heritage conservation. It should be added that the group encompasses a broad range of building types, from private dwellings to dancehalls, cinemas, shops and tourist accommodations of all sizes and descriptions. Among the group are many buildings of architectural merit that define the visual character of their respective communities.

At present no clear mechanisms exist for the protection and conservation of privately-owned buildings, despite the fact that many constitute major cultural resources for their respective parks and for the park system as a whole. One has only to consider the obvious impact of the Banff Springs Hotel, Jasper Park Lodge, or the Prince of Wales Hotel, to be aware of the importance of such buildings to Canada's national parks.

The issue is given urgency by accelerating development pressures within the townsites which, with the possible exception of Banff, lack the protective mechanisms normally provided by elected municipal governments. In the absence of municipal governments, park superintendents have been called upon to exert regulatory authority, but without the benefit of clearly-defined policies or directives. Section 14 of the National Parks General Regulations stipulates that "no person shall wilfully remove, deface, damage or destroy any prehistoric or historic artifacts or structures in a park." This regulation theoretically empowers superintendents to block alterations or demolition of buildings that have been identified as having heritage significance, but they are justifiably reluctant to do so on this basis since the wording of the relevant clause in the regulations is not precise enough to avoid possible court challenges. Furthermore, superintendents run the risk of public censure should their actions to protect private buildings appear to be unilateral or arbitrary.

The national parks system thus finds itself in the peculiar and potentially embarrassing situation of being a primary exponent of cultural resource management, while at the same time having no mechanisms in place to manage a rather conspicuous body of early buildings located on leasehold properties under its jurisdiction.

During the past year the Western Regional Office and Architectural History Branch of the Canadian Parks Service have undertaken a number of pilot projects in an effort to address the issue of private heritage buildings in the park townsites. The first of these projects was conducted for the Waterton Lakes townsite, and resulted in a document

The Prince of Wales Hotel, built in 1926 as part of the Great Northern Railroad's chain of resort hotels. Photo: E. Mills

known as the "Waterton Townsite Built Heritage Resource Description and Analysis." The fact that the Waterton townsite was then involved in a community plan review made it a suitable location in which to attempt a project of this nature, since it offered an opportunity to introduce the issue of built heritage management into the park planning process.

Following preliminary discussion with the park superintendent at Waterton, the project team determined that the best approach to long-term heritage resource management within the townsite lay in the formation of a citizens' advisory committee, in partnership with Canadian Parks Service. The immediate goal, however, was to create a preliminary inventory and evaluative model with which this committee could begin to function.

As a first step the team undertook a survey of the buildings within the townsite and assessed them according to predetermined criteria based on the FHBRO model: historical importance, design, and environmental context. The purpose of this exercise was to determine the most important buildings from architectural and historical standpoints and to identify a larger group deemed to be of secondary importance. The survey is intended to function as a model for a community-based assessment as well as a guide for future discussions on how to conserve and interpret Waterton's historic buildings.

The Waterton BHRDA Model

The Waterton townsite buildings were sorted into three categories: an 'A' list comprised of buildings deemed of outstanding heritage value to the community; a 'B' list consisting of buildings that illustrate key building phases or technologies, or form parts of distinctive streetscapes or precincts within the community; and a 'C' list consisting of buildings that were deemed to not contribute positively to the community's heritage character on the basis of available information. Individual reports were prepared on each building in the A and B groups. Each entry was accompanied by a heritage character statement aimed at explaining the building's assigned rating and encouraging sensitive interventions when alterations are deemed necessary.

While the evaluation relied heavily on the site survey, it was also based on a careful examination of historical records. In this way, the team attempted to avoid an impressionistic approach that might overlook key aspects of the historical building processes at Waterton Lakes. The historical component entailed a review of Parks Branch policies and records of the former internal architectural division, as well as property files on the individual buildings. This exercise was especially useful in identifying key historical processes that influenced building practices in this particular townsite. It revealed, for example, that W.D. Cromarty, the Parks Branch's first chief architect, spent successive summers as acting park superintendent at Waterton during the mid-1920s, where he provided a free design service for many lease holders. Many early buildings, from cottages to shops and cinema, bear evidence of Cromarty's personal notions of appropriate design for the townsite.

There are various implications inherent in a document such as the "Waterton Lakes Built Heritage Resource Description and Analysis." The report supplies a modest list of "A" and "B" buildings. In so doing it runs the risk of being identified as a definitive document, rather than part of the ongoing process of identifying and managing the community's built heritage resources. In an attempt to overcome this risk, the report is prefaced by a recommendation that its contents be scrutinized by members of the local community with a view to improving its accuracy.

The Royal Canadian Mounted Police headquarters in Waterton Lakes, designed by chief national park architect W.D. Cromarty and built in 1927-28. This was one of several public buildings that anchored the "Tudor Rustic" architectural theme in the townsite.

Creating a list and soliciting community involvement in the process carries with it the implication that the Canadian Parks Service is prepared to establish and enforce regulations that protect the identified buildings. This takes us back to the essence of the problem. Once groups of heritage buildings are formally identified for protection, the onus for enforcement falls to the park superintendents. Yet existing legislation and leasing policies offer little backing for effective action in this regard. Changes at those levels, possibly in concert with financial incentives for building owners and the involvement of existing provincial heritage programs, are essential steps that must be taken before effective built heritage resource management can occur at the park level. In the meantime, the prospects for protection of privately-owned heritage buildings in the parks remain highly uncertain.

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[1] The park townsites are: Banff (Banff National Park), Lake Louise (Banff National Park), Field (Yoho National Park), Jasper (Jasper National Park), Waterton Lakes (Waterton Lakes National Park), Waskesiu (Prince Albert National Park), Wasagaming (Riding Mountain National Park).

[2] The Banff townsite became a municipality in 1990. A civic heritage advisory committee has subsequently been established there.

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Partnerships—Leasing at Lowell

W. Lewis Barlow, IV

In 1978, Congress authorized the Lowell National Historical Park in Massachusetts. The authorization envisioned an array of partnerships among Federal, state, and local governments and the private sector as the primary means of providing for the preservation and interpretation of Lowell's cultural resources. This approach was conceived to minimize Federal ownership of cultural resources while maximizing involvement in their treatment and use.

On a November day in 1821, a small group of Boston merchants made a visit to the hamlet of East Chelmsford, nestled along the banks of the Merrimack River. They were discussing not the scenic beauties of the river, but the river as a reliable source of power—power for a new industrial enterprise. In 1815, these men had established the Boston Manufacturing Company, based on Francis Cabot Lowell's ideas of a fully integrated cotton mill within one building, and the use of his improvements on the English power loom. The men, later known as the "Boston Associates"—the merchant elite of Boston, closely related by marriage and business partnerships and armed with extensive capital from settlements derived from the Treaty of Ghent—were ready to not only expand their textile enterprises, but to start the first planned industrial city which led the United States into the Industrial Revolution.

The transformation of the hamlet of East Chelmsford into the industrial city of Lowell was astonishingly quick. In 1820, the area was an agrarian district with a population of about 200 living on scattered farms along the crossing of early Colonial roads. By 1830, the industrial town of Lowell had sprung up in the former farm fields with nearly 6,500 citizens and four larger textile manufacturing corporations. Ten years later the population of the city of Lowell was nearly 21,000 and miles of canals powered dozens of textile manufacturing corporations. Through the 19th century and into the early 20th century, Lowell continued to grow. Population peaked at 120,000 by 1920; however, by the 1930s, many of the mills had moved out or failed, starting Lowell on its long and slow decline.

After many years of debate, the town of Lowell voted in 1829 to erect a Town House on a corner lot on Merrimack Street. At that time the town began to purchase building materials and engaged Isaiah Rogers to develop plans for the fee of $12. Rogers became one of America's most prominent architects. By the spring of 1831, the Town House was completed and in use by the town.

As constructed "... the Town House, an overall simple rectangular mass with a gabled roof supported by engaged corner Doric pilasters, was the first structure in Lowell to show, however simply, the growing influence of the Greek Revival style of architecture. The mass of the building was treated classically with facades symmetrically organized with clean-lined recessed openings in the smooth red brick walls"[1] (figure 1).

The Town House was constructed to provide commercial space in the basement and on the first floor with the second floor housing a two-story meeting hall and two offices for town functions. During the ensuing years, with the tremendous growth of Lowell and the evolution to city government, many minor changes were made to accommodate demands for additional space requirements and civic pride. In 1893, the then City Hall was replaced by a monumental Richardsonian Romanesque Revival structure "... both to accommodate the growing municipal government and to provide an appropriate symbol of the prosperous industrial city that Lowell had become."[2]

After construction of the new City Hall, it was deemed advisable to sell the old structure at public auction. The successful bidder was a real estate developer from Lexington named Warren Serburne who had by 1896 converted the structure into a commercial building that received an extensive "Colonial Revival" face lift and was renamed as "Old City Hall" (figure 2). Old City Hall during the 20th century changed hands many times and was subjected to numerous insensitive remodelings until by 1980 the building was suffering from neglect and had become representative of Lowell as a tired and worn out industrial city.

As part of the legislation creating the Lowell National Historical Park, the Old City Hall was identified as one of the key buildings to be acquired by the National Park Service to serve as an anchor to the interpretive and preservation programs. The General Management Plan

Figure 1. Conjecture drawing (1894) of the original Town House as constructed in 1830. Drawing by F.W. Stickney, architect.

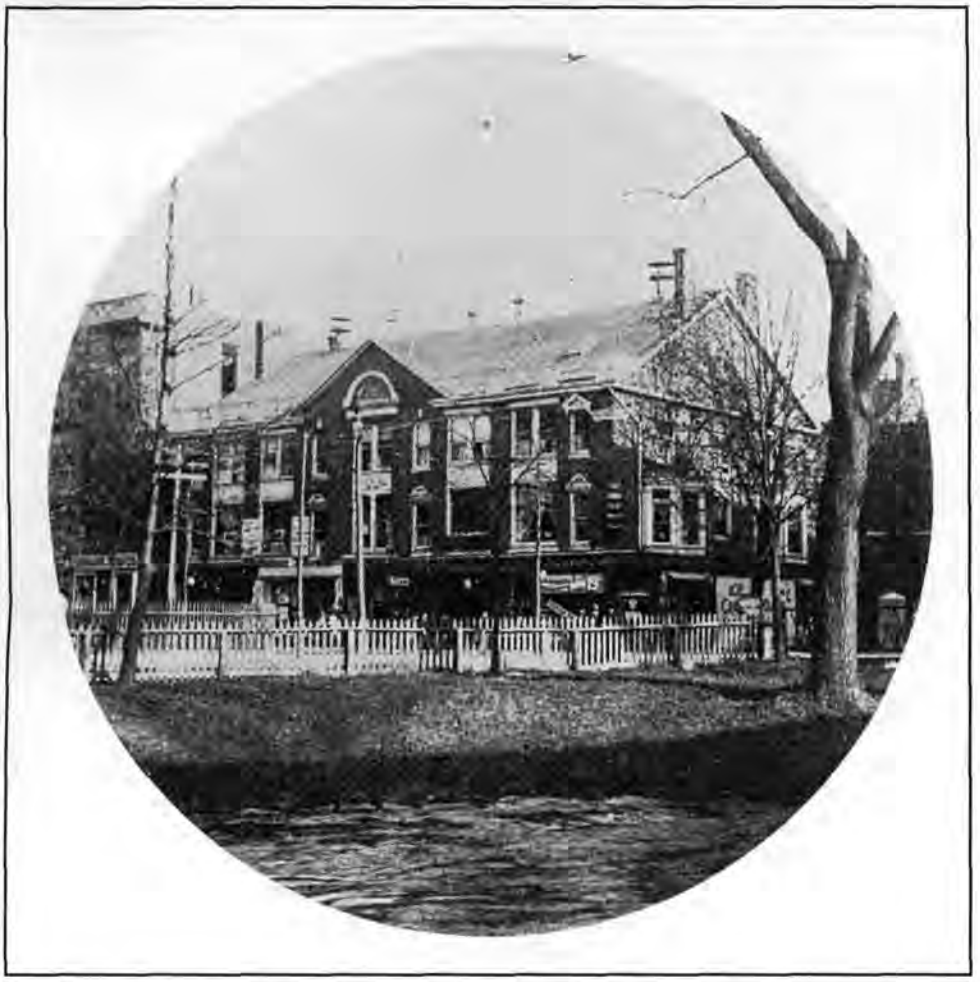

Figure 2. Ca. 1896-1900 photo showing the Old City Hall after the 1896 remodeling.

(GMP) recommended that the building be rehabilitated and adaptively used as park headquarters and the adjacent modern one-story buildings be removed for a landscape area.

Old City Hall, from the time of its construction, had always been one of the major structures on Merrimack Street, Lowell's main business thoroughfare. Since the mid-1970s, the city using various Federal grant programs began to revitalize the many deteriorated commercial structures along Merrimack Street. With the advent of National Park Service (NPS) technical assistance, the preservation grant program, and the use of Federal historic preservation tax credits, Merrimack Street went through a remarkable revitalization. However, Old City Hall, now under NPS ownership, remained untouched and substantially vacant (figure 3).

While the NPS was committed to the ultimate rehabilitation of Old City Hall, all available developmental funds for the foreseeable future were committed to the redevelopment of Boott Mills. It became obvious that the NPS needed to seek other alternatives. The NPS Historic Property Leasing Program provided an excellent means of achieving redevelopment by the private sector while the NPS retained ownership.

The leasing program was authorized by the 1980 amendments to the National Historic Preservation Act of 1966. The primary intent of the program is to provide care for historic structures for which the NPS does not have a use and/or funding by the private sector. With the decision to lease Old City Hall, several difficulties were identified with regard to finding funds and individuals to perform the required appraisal and the development of the request for proposals (RFP). The legislation that created the park envisioned the use of cooperative agreements with various private and public organizations as a prime tool to foster park developmental and interpretive goals. To assist the public sector, city officials and civic leaders created the Lowell Plan. This organization was to provide guidance and funds to undertake projects or programs designed to complement the efforts of the public sector. This organization working with Federal, state, and local government officials became the hallmark of Lowell's revitalization.

It was the Lowell Plan that the NPS turned to for funds to underwrite this first major historic property leasing effort in the national park system. The plan provided $15,000 to underwrite the cost of an appraisal to determine the fair market value and for retaining a real estate development firm for advice.

This expertise helped park management to decide that the best market for the building was commercial, with retail on the first floor and with upscale offices on the upper floors versus using the structure for housing. It was also decided that the adjacent site occupied by two intrusive one-story contemporary buildings would be included in the project and would be offered for new infill construction that would provide additional rental square footage and stitch the historic streetscape back together.

In addition, the park was fortunate in that excellent historical and architectural research had been completed that gave clear direction for the level of treatment required to preserve Old City Hall. With this research, the park staff was able to develop the RFP that clearly stated the requirements of the historic property leasing program, the criteria for evaluation and selection, detail requirements for the exterior rehabilitation of Old City Hall and design standards for the new infill construction. The RFP was written to make the leasing and redevelopment of Old City Hall compatible with the private sector development and financial practices and requirements prevailing at that time.

There was strong interest expressed in the opportunity to redevelop a historic structure in Lowell and especially in a unit of the national park system. Five proposals were received with several of them from local developers

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who were extensively involved in Lowell's revitalization. The proposals in general were very similar in the treatment of Old City Hall, causing the selecting committee to focus on the designs for the new infill construction and the soundness of the financial packages as the primary evaluation factors. In the end, it was the financial dynamics that determined the successful proposal. First Development, Inc., a local development company, was selected for its high quality design, the financial depth of the partners, and the ultimate dollar return to the NPS.

Even though the development climate was strong in Lowell and the New England area during the early 1980s, the rehabilitation of historic structures required innovative financial approaches that took advantage of both governmental and private programs. The financially successful package relied heavily on the then available certified historic preservation tax credits, industrial revenue bonds, and low interest second mortgage funds made available by the Lowell Development Financial Corporation, a nonprofit consortium formed by local banks to assist in local redevelopment. Without this use of creative financing, the successful leasing and rehabilitation of Old City Hall would not have happened.

Once the challenge of formulating the developmental concept and putting financing in place was accomplished, the actual rehabilitation was straightforward and typical of most certifiable tax act projects. The project was subject to review by the NPS both as a tax act project and as a governmental development project requiring historic preservation compliance.

Even though the structure was owned by the NPS, the project was subjected to additional review for the demolition of noncontributing structures and for the design of the new construction by the local Lowell Historic Board since the project was being undertaken by a private-sector developer.

Construction started in late 1986 and was completed by the end of 1987, with tenants fully occupying the structure by the end of 1988. Because of the quality of the development and compliance with the *Secretary of the Interior's Standards for Rehabilitation,* the developers were able to receive top rents and to date have one of the few fully rented commercial buildings in Lowell.

Figure 3. Old City Hall prior to rehabilitation. Photo by Harlan D. Unrau, National Park Service, 1979.

While the preservation of Old City Hall is a highly successful example of the potential of the Historic Property Leasing Program, this project would never have been undertaken with the currently available reduced historic preservation tax credits. The Historic Property Leasing Program can be an effective tool in preserving historic buildings that make economical sense in the private market.

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[1] John Coolidge, *Mill and Mansion: A Study of Architecture and Society in Lowell, Massachusetts, 1820-1865*, p. 61.
[2] Harlan D. Unrau, HSR, Historical Data Section, *Old City Hall, Lowell National Historical Park, Massachusetts 1982*, p. 129.

A Preservation Skills Training Program for the NPS

H. Thomas McGrath, Jr.

In 1991, Jerry Rogers, the Associate Director for Cultural Resources of the U.S. National Park Service (NPS), challenged a small group of Service professionals to develop a comprehensive training program that would enable park maintenance employees to gain the appropriate preservation maintenance skills to ensure the preservation of park historic structures. Further emphasis on mission-driven Service employee training was recommended in the 75th Anniversary Symposium Vail Agenda report to the NPS Director released this past spring. The Vail Agenda report specifically identified the need for the Service to enhance skills in cultural resource stewardship and establish or raise educational requirements for Service employees.

Following an initial planning meeting, the group gathered training data that confirmed that the area of greatest need for cultural resource stewardship training was indeed in park maintenance. Thereafter, the group proceeded with the goal of developing a wide-reaching program that would enhance preservation maintenance skills, impart confidence in using those skills, provide a basic knowledge of preservation philosophy and requirements, and upon completion of the training assure the application of the skills of the graduates on the historic structures in their parks.

It has been widely acknowledged by park management that deterioration of park historic structures is largely the result of deferred maintenance due to inadequate funding and staff poorly prepared to deal with the problems inherent in maintaining historic structures. Although the maintenance workers of the Service are extremely dedicated, most of these workers have little background in detecting incipient problems in historic structures and almost no training in carrying out maintenance in the particular crafts unique to historic structures. The maintenance workers in the parks are the front line forces of care for the collection of historic structures in parks and make up 72% of the permanent labor force of the Service. These maintenance employees carry out the majority of preservation-related work. Ironically, the task force discovered that these workers, usually those most familiar with the cultural resources of each park, are in turn the least likely Service employees to be trained to preserve and maintain historic structures. In fact, in 1990 park maintenance workers received less than 8% of the total available training funds for all Service employees. Any proposal to redress this conspicuous lack of training for maintenance workers would first have to overcome the challenge of securing an adequate funding source. This obstacle was cleared this past July when the NPS directorate agreed to initial program funding in fiscal year 1993.

The criteria for assessing alternatives to meet the challenge of preservation skills training for maintenance workers were developed by the group and the Associate Director. The ideal program was one that reached the greatest number of participants at the least cost. Currently, the Service offers an intensive preservation craft training program at the Williamsport Preservation Training Center that is patterned after a more traditional apprenticeship-type vocational education. The Williamsport program requires a three-year commitment from the participant that often results in expensive employee relocation costs and requires a willingness on the part of the trainees to travel extensively. While the NPS need for the relatively small number of highly skilled craftspeople that the Williamsport program graduates is expected to continue to grow in the 1990s, the group found that the appropriate maintenance skills required to properly maintain the majority of the Service's historic structures requires a far less intensive training level for a greater group of workers.

A long-term program of adult education and skills training that would allow maintenance employees to remain in their home parks would not only be less costly, but was determined to hold a greater appeal to those workers less willing to relocate from their homes or undertake frequent travel. Therefore, the preferred program needed to be compatible with a long-term training process that promoted learner commitment, provided qualified instructor demonstration and guidance, allowed for skill practice and mastery by the learner with tools and materials on historic structures in a supervised context in a local environment, and offered certification for competency after a successful demonstration of the skills acquired and understanding of the principals behind the correct application of preservation treatments.

The preservation and skills training program developed by the group that was successfully presented in concept by Mr. Rogers to the directorate is based in part upon other Service training initiatives such as the Intake Program, Natural Resources Training Program, and the North Atlantic Regional Historic Preservation Maintenance Skills Certification Program. A key concept of the proposal incorporates mentor training techniques that have proven successful on a small scale in the North Atlantic Region. This program has resulted in improved maintenance of historic structures, elevated worker morale, and enhanced career potential. It has been received enthusiastically by the regional office staff, superintendents, chiefs of maintenance, mentors, and participants. Mentors are assigned to each trainee and their role includes: orientation to program objectives, introduction to the established national network of preservation education, organizations, resources, and material suppliers, career development guidance, and individual assistance and training at the park concerning applicable maintenance duties.

Those who are tasked to maintain become the target group of program participants. In the NPS these are the maintenance workers in the WG 5-9 range, and it is they

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who should receive sustained training and developmental work experiences. The initial targeted maintenance activities would be limited to the craft areas of masonry, carpentry, or painting as they relate to historic structures. The entire program will be coordinated out of the Williamsport Preservation Training Center in cooperation with each regional employee development office, the Washington Employee Development Division, and the Washington Engineering and Safety Services Division. The regional training offices would monitor the competitive application process. Trainees would be required to successfully complete a series of at least four preservation training courses and/or four developmental work experiences in their own or a nearby park (one to two weeks each) in a particular skill. Training courses would be offered at approximately six-month intervals and the entire program would require approximately a two-year commitment. During the interim between courses, a trained and certified mentor would visit the trainee at his or her park to monitor, demonstrate, and critique the skills being learned. The training would emphasize basic skills and would not necessarily demand journey level expertise to achieve certification. In many cases locally available vocational training, supplemental educational instruction, or correspondence courses will be used.

Many challenges and issues remain to be addressed as the program becomes operational: uniform standards need to be established, procedures for incorporating the program within the established lines of supervision in parks must be developed, pilot parks selected, mentors selected and trained, issues of career enhancement studied, certification testing procedures developed, and budgets formulated and approved. The overall objective is to create a program that at full capacity will enroll 60 maintenance workers a year. It will take three years to become fully operational. In the first year mentors would be selected and trained and the first group of 30 trainees selected. In the second year the first group of 30 workers would commence their training and a second group would be selected. The third year would see graduation of the first class of 30, first year level training of the second class, and selection of the third class.

As each class graduates the pool of potential mentors will grow. If in 1993 the program is successful in enrolling a class of 30 and the preservation skills training is continued for 10 years, the national park system will have at least one certified graduate for every park containing a historic structure by the year 2003.

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