

A New Documentation Methodology : Videographic Architectural Analysis

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Abstract

The primary objective of this research effort was to develop a new method for documenting architectural resources by using contemporary videographic and computer processing technology to enhance traditional recording procedures. Techniques for the architectural analysis of video images have been developed by merging computer hardware and software systems with principles of photographic and photogrammetric interpretation. By applying these technologies to the survey process, a multifaceted document can be created that comprehensively describes the built environment. The survey process is facilitated by the ability to extract dimensionable images of buildings from a video recording without resorting to costly and time consuming hand-measuring techniques. National Park Service properties and other cultural resources of national significance have served as test sites for the development of this methodology.

The key component of the documentation system is VCAD, the Videographic Computer Assisted Designer software package developed by VideoCad, Inc. as an interactive videographic data base manager. This software enables the user to combine and manipulate data of different types from a variety of visual and verbal media sources. As a consequence, it serves the user as four fundamental data management tools:

1... an audio-visual archival document that combines dimensionable video images, environmental sounds, and verbal commentary.

2... an analytical device for extracting quantifiable data from the multifaceted context of the built environment.

3... an interactive simulation program that depicts historical change, demonstrating the contextual evolution of a site and visually promoting an understanding of the essential character and integrity of cultural resources.

4... a planning device that prescribes appropriate material treatments, maintenance routines, development schemes, or monitoring activities.

Videographic architectural analysis provides a framework for developing and studying conservation and revitalization strategies. It gives regulatory bodies, design and planning professionals, developers, and the public a means of better understanding the increasingly complex issues embodied in an architectural heritage. These interactive design tools provide a foundation for making informed decisions that will shape the future of this cultural heritage.

Background

In building anew or adapting the old, architects, planners, and builders have struggled to decipher the enigmatic architectural and cultural attributes embodied in extant structures. In the United States, the legislative commitment to the study and documentation of the existing built environment began in earnest with the Historic Sites Act of 1935 (P.L. 74-292), which acknowledged the need for records of historic American architecture. This Act authorized the National Park Service to conduct historic resource surveys, and to both secure and preserve drawings, plans, photographs, and other data relating to historic buildings. Among the recent legislative landmarks in the shaping of a Federal mandate for the conservation of architectural resources is the National Historic Preservation Act of 1966 (P.L. 89-665). Under "Section 106" of this act, Federal agencies are required to examine the effects of proposed undertakings on properties either listed on or eligible for the National Register of Historic Places prior to approving the expenditure of Federal funds in support of such projects. In addition to numerous other Federal, state, and local legislative efforts that have reinforced this mandate for conserving the cultural heritage of the United States, significant economic incentives, culminating in those embodied in the Economic Recovery Tax Act of 1981, have been legislated to encompass a broad range of preservation strategies. In recognition of the cultural significance of preservation and the implications that legislative incentives hold for the active conservation of historic resources, the Tax Reform Act of 1986 has retained substantial benefits for preservation efforts. The cumulative effect of these acts represents a fundamental acknowledgement of the economic and cultural value of this nation's historic architectural resources.

The building industry is a major component of the economy of the United States, and the existing building stock represents both a significant capital investment and a fundamental measure of the nation's wealth. It has been estimated by the American Institute of Architects that as many as 90 to 95 percent of the buildings that will exist in the year 2000 have already been built. According to statistics assembled by the A.I.A., rehabilitation and preservation projects represent more than 50 percent of the construction expenditures in this country, and the number is continuing to grow. While the current utilization of existing buildings may not adequately meet contemporary or future socio-economic needs, the prohibitive cultural and economic cost of wholesale demolition and renewal suggests that the architecture profession must devise coherent strategies for efficiently documenting, analyzing, adapting, and managing existing architectural resources. The tools employed in these strategies will have a significant effect on the design, planning, and development professions' ability to assess the functional and economic viability of existing resources.

One of the most challenging problems facing architects, developers, and public agencies is the administration of this nation's wealth of historic architectural resources. The accurate and comprehensive documentation of these resources is a fundamental prerequisite for the effective and sensible management of this significant cultural heritage. Traditional methods of recording such as those employed by the Historic American Building Survey (HABS) and Historic American Engineering Record (HAER) have been highly successful over the past fifty years in documenting historic structures. These techniques typically include the use of archival research, oral histories, photography, hand measurements and descriptive field notes. More sophisticated and technologically complex methods entail the use of scaled rectified photography and terrestrial stereo-photogrammetry, techniques that have been employed more widely in Europe than the United States.

Though these tools of architectural survey are capable of yielding high quality results, the complexity of the documentation task often produces a disjointed array of written

and photographic material. This plethora of material ultimately encumbers not only the field surveyor, but also the editing professional who must assemble and interpret this diverse collection, and the curator who must facilitate accessibility while ensuring archival preservation. Time and budgetary constraints exacerbate these shortcomings of traditional recording techniques, as the process can be both costly and slow. Particularly in the face of catastrophic hazards, such as flood, seismic, or fire damage, that imminently jeopardize the structural integrity of a building, a cumbersome methodology can hinder field recording efforts and result in the loss of significant resources without benefit of adequate documentation. Additionally, the quickened pace of socio-economic change can adversely affect preservation efforts by forcing planning and design decisions without an adequate understanding of the cultural and environmental context of which an individual historic structure may be but one small part. Informed decisions concerning the management of a complex cultural heritage, i.e. the "tout ensemble" rather than isolated parts, also depend on the ability to accurately visualize the impact that contemporary decisions have on these cultural resources.

These circumstances require a fresh perspective on the recording of historic architectural resources. The traditional elements of cultural resource survey can provide the foundation for the application of appropriate contemporary technologies that will enhance the accuracy, depth, replicability, execution, accessibility, and economy of documentation projects. Micro-computers, video imaging equipment, and computer-aided design systems, when endowed with the principles of photogrammetric interpretation, dramatically expand the capacity of contemporary survey strategies. The result is a new methodology that can expeditiously and comprehensively respond to the task of architectural resource survey, analysis, and interpretation that is confronting the preservation community.

Methods

The application of videographic and computer processing technology to the documentation of historic sites facilitates the whole process of architectural survey. The videographic method is well suited to the description of historic resources, as it can capture the multifaceted context and inherent "sense of place" through real-time video and audio recordings supplemented with verbal commentary. This imagery, sound, and commentary is immediately accessible in the field, providing an instant confirmation of quality and content. The subsequent manipulation of the recorded information is possible through a unique configuration of computer hardware and software systems.

The process of documentation begins with a television camera and video recorder which are used to document an individual building, group of buildings, or landscape. Included in the image field are a reference stadia and survey targets, which provide three dimensional control points. Appropriate elevations, floor plans, details, and environmental data are recorded on video tape. These images are then transferred to the computer environment by a process called "frame grabbing." This entails converting the video signal (which is in line or raster form) to digital (dot or pixel) form. The resultant digital image is henceforth in a format which can be manipulated by the computer. The computer image, which duplicates the video image, is stored in a permanent memory medium (disk) for future reference and dimensional analysis. This digital image can be further supplemented by other kinds of tabular and contextual information such as construction date, architect, historic relevance, structural condition, construction techniques, materials, and field interviews. Much of the technology that supports this system has been developed for the information needs of various disciplines. However, neither the configuration of this system, nor the performance parameters have been previously articulated for applications relevant to historic preservation.

The unique videographic software package that drives the system is called VCAD, the Videographic Computer Assisted Designer. It consists of two and three dimensional graphic programs which have the capacity to construct the necessary geometry for quantifying dimensions, correcting perspective distortions, and remapping the size, shape, and position of the object image. This software program provides the analytical basis for dimensioning images and defining the specific graphic parameters necessary to create measured drawings. The VCAD software is an interactive videographic data base manager which has been developed by VideoCad, Inc. of Blacksburg, Virginia (USA). As the foundation component of this documentation method, the software enables the user to combine and manipulate data from a variety of verbal and visual media sources.

In addition to the obvious architectural applications for video recordings that consist of dimensionable graphic images, videographics can serve as the basis for investigations into building techniques and materials, public perceptions toward existing architectural resources, the cumulative effects of historical change, and the effects of proposed management strategies and modifications on the contextual fabric of "place."

In developing this method for documentation, analysis, and interpretation, various sites were selected for test exercises. Consequently, the system is configured for recording a range of cultural resources, from individual historic structures to urban historic districts or rural cultural landscapes. National Park Service sites in Richmond, Virginia, including such diverse resources as the Richmond National Battlefield Park and the Maggie L. Walker National Historic Site in the Jackson Ward Historic District, have been utilized in testing the viability of the method. A study site currently being monitored is Poplar Forest, Thomas Jefferson's plantation near Lynchburg, Virginia. A major preservation effort is planned for this landmark, which exemplifies Jefferson's mastery of the classical style. The timeliness of the Poplar Forest project and the complexity of the preservation effort presents an opportunity to further test the parameters of the documentation system by tracking a restoration project from conception to completion.

Through the ability to economically and comprehensively record (with dimensionable video images) individual historic artifacts and structures in their environmental context, this methodology facilitates:

- 1... documentation of cultural resources by merging video images, verbal commentary, and archival data. Buildings that might not prove economically or logistically feasible to document with extensive hand measurements and drawings can be effectively recorded with the videographic system.

- 2... analysis of resources through the extraction of information from images relating to building dimensions, materials, code compliance, and stylistic character. Specific information relating to building character or structure can be generated as required to fulfill management or design needs. Once the videographic database exists, the system user can exercise a high degree of discretion in determining the information to be extracted from visual and tabular attributes.

- 3... simulation of the historic context and proposed designs or treatments through the addition of information to the recorded image. A more comprehensive understanding of the environmental and cultural context, and the impact of proposed changes, is possible through the computer animation of video images, supplemented by oral commentary, drawings, photographs, and text. When a new building is designed for an historic district, or changes to an otherwise environmentally or culturally sensitive

area are contemplated, the effects of these proposals can be studied by merging the video record of the existing context with the graphic simulation of the proposed project. These visual computer simulations can promote dialogue between cultural resource professionals, architects, developers, public constituencies, and public administrators that result in more informed decisions about the effects of proposed design or management strategies.

4... prescriptive treatments in the assembly of construction documents, maintenance management guides, and monitoring systems. The development of a highly accessible, interactive, visual information base contributes substantially to formulating strategies for addressing maintenance, rehabilitation, and restoration issues. In complex or large scale conservation projects, detailed recordings of building parts to be removed during construction can be made and placed in the system's data base prior to removal. After repair or replication, these parts can be efficiently identified and correctly replaced according to the specifications or instructions contained in the video document.

Methodological parameters for this documentation system have been shaped by consultations with representative professionals from the architecture and planning community, public administrators, and private developers. As a result, two of the primary attributes of the system relate to the speed and accuracy of a recording project. The time advantage of videographic documentation over traditional hand-measuring techniques is comparable to that of conventional photogrammetric methods. It is estimated that photogrammetric techniques can offer as much as an 80% time savings over hand-measuring methods. The VCAD software is able to perform in both low and high resolution environments, with the accuracy of the image analysis a direct function of the sophistication of the electronic hardware employed in the system. High quality results which match those of conventional recording techniques can be achieved. The technology is readily available to assemble a digital system that yields an image density in excess of 2000 lines, the equivalent of high resolution photographic films. The videographic method offers additional advantages over conventional photogrammetry through real time audio-visual recordings that encompass a range of contextual issues, providing a greater capacity for image analysis and manipulation. Repeated trips to the project site no longer bear a negative connotation, as they can simply be accomplished by activating the videographic data base at a desktop work station.

Summary

The documentation of existing architectural resources is fundamental to the shaping of successful cultural resource management strategies for both the rural and urban environment. Effective documentation has significant national implications for preservation policy delineation, project feasibility analysis, and maintenance management. Through a documentary method that permits image manipulation and design simulations, a thorough examination of appropriate use strategies is possible. Additionally, speed and economy are essential to the widespread and successful application of the methodology. Consideration of this new methodology acknowledges the growing awareness of the architectural significance, quality of construction, or cultural value of many existing structures. The conservation of such resources represents a means of ensuring and reinforcing a continuity of cultural identity and expression. The VCAD system can support conservation efforts by capitalizing on advanced, proven technology which supports CADD systems and facilitates the transmission of complex graphic data forms.

The objective of this new methodology is not only to document historic architectural resources, but additionally to analyze, manipulate, and disseminate the documentary material in support of a broad range of international preservation issues. The mechan-

ical framework for this new methodology has been assembled by merging the existing technology of micro-computers, videographics, computer-aided design, data management, and terrestrial photogrammetry. Consequently, the system allows a high degree of interactivity with a uniform, highly accessible data base. At the most basic performance level, it is possible to dimension buildings without resorting to cumbersome hand-measuring techniques. At a more sophisticated level, visual simulations of complex design proposals are possible. With these capabilities, the VCAD documentation system is uniquely suited to fulfill the architectural conservation needs of the preservation profession.

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UNA NUEVA METODOLOGIA PARA LA DOCUMENTACION: DE UN ANALISIS ARQUITECTONICO VIDEOGRAFICO.

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Resumen

El primer objetivo de esta investigación, fue crear un nuevo método para documentar recursos arquitectónicos usando nuevas tecnologías en videografía y en el procesamiento de datos para computadores con el propósito de mejorar el método tradicional de grabar información arquitectónica. Los sistemas para analizar datos arquitectónicos de imágenes de video han sido creados usando en conjunto mecanismo (hardware) y software de computación con los principios para interpretar imágenes de fotografía y fotogrametría. Al aplicar estas nuevas tecnologías en el proceso de efectuar una investigación que permita presentar elementos topográficos, características tridimensionales o de otra naturaleza en un plano se podrá hacer un documento amplio y extensivo que describa más completamente el medio ambiente. La facilidad con que una persona podrá extraer dimensiones exactas de imágenes de edificios grabados usando una máquina fotográfica de video sin tener que medir a mano, reducirá el costo y el tiempo para hacer un plano fotográfico. Este sistema fue desarrollado para documentar las propiedades del Servicio de Parques Nacionales (National Park Service) y otros centros culturales del país.

El elemento clave para este sistema de documentación es "VCAD", "Videographic Computer Assisted Designer" software package desarrollado por "VideoCad, Inc". el cual es un programa que permite administrar una base de datos interactivos videográficos. No solamente deja al operador combinar y manipular datos de diferentes tipos pues deja usar datos en forma visual y verbal. En consecuencia el operador tiene cuatro tipos de datos fundamentales para su uso:

1. Tiene un archivo de documentos audio-visual que combinan imágenes de video de dimensiones exactas con sonidos de ese ambiente y con comentarios verbales.
2. Tiene un sistema analítico para extraer datos cuantitativos sobre el medio ambiente.
3. Tiene un programa para simular cambios históricos, que demuestran la evolución del espacio en una manera visual que le permitirá a una persona entender las características y los recursos culturales de ese espacio.
4. Tiene un programa para proyectar que materiales serán los mejores, que requieren menos mantenimiento, maneras de desarrollar el proyecto y métodos de controlar el progreso del proyecto.

Este análisis arquitectónico videográfico proporciona la base para desarrollar estrategias en estudios de revitalización y conservación. Le ofrece a la agencia de regulación, a profesionales en diseño y planeamiento, a los urbanizadores, y al sector público un mejor método para entender los problemas asociados con la arquitectura. Estos programas interactivos podrán ser la base para adoptar más informadas decisiones sobre el futuro de nuestro patrimonio cultural.