OCA PAD INITIATION - PROJECT HEADER INFORMATION 05/01/91

Active

#: D-48-673 Cost share #: Rev #: 0
: 10/24-6-R7183-0A0 Center shr #: OCA file #: 168
Work type : RES
Contract#: DACA88-90-D-0011-0003 Mod #: Document : DO
Prime #: Contract entity: GTRC

Subprojects ? : N
Main project #:

Project unit: DEAN ARCH Unit code: 02.010.170
Project director(s):
MYERS J H DEAN ARCH (404)894-3390

Sponsor/division names: ARMY / CON ENG RES LAB, IL
Sponsor/division codes: 102 / 020

Award period: 910405 to 920405 (performance) 920405 (reports)

Sponsor amount	New this change	Total to date
Contract value	23,031.00	23,031.00
Funded	23,031.00	23,031.00
Cost sharing amount		0.00

Does subcontracting plan apply ?: Y

Title: EXPERT SYSTEM, PHASE III

PROJECT ADMINISTRATION DATA

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Security class (U,C,S,TS) : U ONR resident rep. is ACO (Y/N): N
Defense priority rating : NONE NA supplemental sheet
Equipment title vests with: Sponsor X GIT
(FIXED PRICE D.O. AND NO PROPERTY CLAUSE INCORPORATED IN BASIC CONTRACT)
Administrative comments -
FIXED PRICE DELIVERY ORDER SUBJECT TO THE TERMS OF BOA DACA88-90-D-0011 (OCA FILE #168).

GEORGIA INSTITUTE OF TECHNOLOGY
OFFICE OF CONTRACT ADMINISTRATION

NOTICE OF PROJECT CLOSEOUT

9352
SR

Closeout Notice Date 03/21/95

Project No. D-48-673 Center No. 10/24-6-R7183-0A0

Project Director MYERS J H School/Lab DEAN ARCH

Sponsor ARMY/CON ENG RES LAB, IL

Contract/Grant No. DACA88-90-D-0011-0003 Contract Entity GTRC

Prime Contract No.

Title EXPERT SYSTEM, PHASE III

Effective Completion Date 920405 (Performance) 920405 (Reports)

Closeout Actions Required:	Y/N	Date Submitted
Final Invoice or Copy of Final Invoice	Y	920923
Final Report of Inventions and/or Subcontracts	Y	921217
Government Property Inventory & Related Certificate	N	
Classified Material Certificate	N	
Release and Assignment	N	
Other	N	

Comments

Subproject Under Main Project No.

Continues Project No.

Distribution Required:

Project Director	Y
Administrative Network Representative	Y
GTRI Accounting/Grants and Contracts	Y
Procurement/Supply Services	Y
Research Property Managment	Y
Research Security Services	N
Reports Coordinator (OCA)	Y
GTRC	Y
Project File	Y
Other	N
	N

NOTE: Final Patent Questionnaire sent to PDPI.

D-48-673
1,2,3,4,5

A STANDARD METHODOLOGY FOR THE CONDITION ASSESSMENT OF WINDOWS - AN EXPERT SYSTEM

By: John H. Myers

The development of an expert system to assist design professionals and maintenance personnel in the evaluation of windows in historic buildings requires a methodology and procedures. This report is the methodological design and program procedures to support the Army's Expert System for evaluation of windows.

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EXPERT SYSTEM FOR WINDOW REPAIR AND REPLACEMENT DECISIONS

EXPERT SYSTEM FOR WINDOW REPAIR AND REPLACEMENT DECISIONS

This package contains documentation on the U.S. Army's pioneering effort to develop expert systems for evaluation and planning for historic building components. The objective of this program is to create a field based, standardized, automated system to assist Army personnel in identifying and evaluating the significance and condition of windows. The system contains decision making rules, designed by human experts, to make recommendations for appropriate action based on the findings.

The importance of this system, and the approach it represents, is potentially international in its significance to cultural resource managers. The Army recognizes the potential value of this system to other DoD components, numerous Federal Agencies, and to state and local agencies. When fully developed the system will provide several tools/methods which do not currently exist, including:

- *a standardized approach/method of inspecting windows.*
- *a rationale for making repair and replacement decisions.*
- *a taxonomy of window significance and condition*
- *an automated -- lap top computer system to prompt users in the application of the standard approach*
- *automatic, uniform reporting requirements to summarize and present findings to management*
- *the increased distribution of expertise to the field where it is in short supply*
- *automated vendor lists for repair and replacement*

To promote the sharing and use of this system by Army and non-Army users, the project leadership is promoting a review and comment by non-Army professionals in government and industry. The participation by a variety of experienced professionals/potential users will provide valuable input and expertise which will be incorporated into the expert system.

The attached material describe the program. Input from reviewers will be "built in" to the Expert System, so that any input will make a lasting contribution to an area where no standards have existed heretofore. Throughout the methodology outlined in the following chapters, every effort has been made to be comprehensive without getting overly complicated. The program is a first level planning tool whose purpose is the overall upgrading of decision making quality and consistency, and to provide an efficient, reproducible program which can be used manually, on a lap top computer, or an any IBM compatible PC.

The contents are arranged so that background and organizational sections precede the step-by-step procedures and guidelines. When reviewed in order, the reader will have a better sense of the purpose of specific questions which are asked about windows in the field evaluation procedures.

EXECUTIVE SUMMARY

EXECUTIVE SUMMARY OF PROJECT

Faced with growing rehabilitation needs and limited sources of expertise in the area of preservation technology, the Department of the Army has undertaken a significant initiative to develop new methods and tools in the field of historic preservation. This initiative seeks to develop a prototype expert system to assist in rational decision making, planning and problem diagnosis in the area of rehabilitation and preservation. This project is potentially internationally significant and places the Army at the forefront of preservation technology research and development. If it continues and proves successful, the outcome of this work will be the creation of one of the most important historic preservation tools in decades. The results can be shared with other Federal agencies, state and local governments and the public, thereby increasing the level of historic preservation expertise by making it readily available at the level of the resources to be protected; reducing inappropriate treatments; lowering costs; promoting earlier identification of potential deterioration, and promoting consistently high quality preservation and rehabilitation. The methodological concepts developed by the Army can eventually be applied to the entire spectrum of older building problems, beginning a new era in the appropriate use of computer technology for cultural resource management.

The preservation initiative began with the U.S. Army Historic Preservation Officer, in the Army Engineering and Housing Support Center and the Construction Engineering Research Laboratory (CERL) in co-operation with the Center for Architectural Conservation (CAC) at Georgia Tech. The focus of the effort is a single historic preservation/rehabilitation problem: the repair and replacement of windows in historic and potentially historic buildings. This is a problem which consistently confronts designers, planners and administrators in the development of sound maintenance and repair projects meeting the Secretary of Interior's Standards. The initiative to develop an expert system to address one problem will create a model for the use of this powerful and emerging information technology to assist with other longstanding or pressing technical problems.

PROJECT DESCRIPTION

Decisions regarding the repair and replacement of windows are a constant source of concern for owners and managers of older and historic buildings. Repair or replacement projects can run into the hundreds of thousands of dollars. The ability to make appropriate decisions requires a combination of knowledge, skill and ability not commonly found in a single individual. It requires knowledge of preservation standards and philosophy, architectural history, construction technology, energy, design and the local, national (and sometimes international) window manufacturing industry. Beyond simply the technical knowledge, professional judgement is required to evaluate and balance the multiple, often conflicting, requirements of any project. There is a need to arrive at solutions which meet the Secretary of Interior's Standards, maintain the integrity of both the feature and the building, and which also satisfy the practical owner requirements for affordability, performance and maintenance. The Window Conference and Exposition, held in Boston MA in December 1986, and the resulting publications, the "Window Handbook" and the "Window Workbook" demonstrated unquestionably that appropriate, cost effective solutions are available for both repair and replacement. The Army initiative presented here is intended to insure that the knowledge and judgement required to arrive at those solutions is made available throughout its planning, design and construction operations.

The pilot project objective is the design and development of a program which includes:

1) a methodology for assessing the significance and condition of windows and

2) the ability to make sound recommendations concerning appropriate repair and replacement, based on the assessments.

The program will be fully supported by standards and guidelines to assist users in performing assessments in a logical, step-by-step approach. The final version will be automated and usable on a lap top computer which can be easily taken into the field. This system will prompt inspectors to examine the significant areas of windows, and it will provide written and graphic "helps". In addition, the system will record and store the assessment results for summary printouts of significance and condition levels for the building, and it will search the already existing database of window manufacturer's capabilities to identify and report on available resources, through a "Vendor report".

Conceptually, the program is based on sound philosophy and standard practice from both the preservation and construction fields. The approach is divided into three stages as follows:

1) Identification of relevant aspects of the building in which the windows exist

2) Identification and assessment of the significance of each window type in the building by location, and

3) Evaluation of the condition of each window, within the type identified in number 2.

This three-level approach is the most important aspect of the program to understand before going deeper into the details and procedures. The program, forms, software and procedures all relate to this three-level, integrated process.

Basic standards will be developed for making repair vs. replacement decisions based on the relationships between significance and condition. The result will be an increase in the quality and consistency of rehabilitation work. There will also be increased information about available repair services and products for design and construction professionals faced with making these decisions.

The program recognizes that not all facilities will have laptop or other desktop personal computers. To assist with the planning in such facilities a manual set of forms has been developed, with instructions for completing them. these forms may be completed when no laptop is available to use at the building or in any situation where personal computers are not available. The format of the field data collection forms parallels the logic of the program and the structure of the software. Results may be entered directly into the expert system when available.

GOALS AND OBJECTIVES OF THE WINDOW EXPERT SYSTEM

GOALS AND OBJECTIVES OF THE WINDOW EXPERT SYSTEM

Windows represent one technical area of buildings where the U.S. Army, as well as many other Federal, State and local agencies, has large numbers of buildings containing vast numbers of windows. No standardized techniques or methodologies exist to aid in evaluating the condition of these windows, and experienced professionals are rare. There are few qualified experts in the country who can perform window evaluations. Often window companies themselves provide free consulting on whether or not windows should be replaced. It is desirable to eliminate any dependency on such potentially biased sources. The goals and objectives of this project center around providing new methods to assist the Army in efficiently arriving at sound technical decisions on the condition of windows and appropriate planning level recommendations for repair or replacement.

This project consists of the procuedural design to be used in the early prototyping of an Expert System to assist surveyors in window evaluation. The results will be used in the planning and design programs of the ARMY. The two phases are:

1) Development of a standard methodology and procedures for assessment of windows

2) The automation of #1 into an expert system shell so that it can be efficiently applied by users of limited technical experience

METHODOLOGICAL OBJECTIVES:

The objectives for a standard methodology include the following:

1) Defining a logical approach to data collection and decision making
2) Standardizing evaluation terminology
3) Creating procedures for inspecting windows
4) Producing item by item guidelines which support collecting relevant data
5) Establishing the logic base for an expert system to further enhance the Army's ability to make sound determinations in this area.

OBJECTIVES FOR AN EXPERT SYSTEM:

An expert system, like a human expert can grow and develop over time. Systems in the early developing stages are sometimes called "assistant systems" to reflect that they provide useful help and guidance without having obtained "expert" level. While the system will be developed as a follow-up to this project, there are several operational objectives which have been established.

Operational objectives include:

- be portable for field use on a lap top computer
- prompt users to identify important aspects of building significance
- prompt users to identify aspects of window significance
- prompt users to identify a full range of symptoms of deterioration
- compare existing windows to a standard appropriate for the age, type and style of building
- track the location of each evaluated window
- store all significance and condition findings
- make technically, philosophically sound treatment recommendations
- store all treatment recommendations by location

Additional objectives for reporting and enhancements include graphic interfaces where users select from drawings and mark them up on screen, as well as graphic output of findings.

- performance of partial evaluations and return to conclude survey

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- report statistical charts of total number of windows, numbers within type and recommendations for both
- store and report specific conditions by window for use by contractors
- provide resource information to users about repair services and replacement alternatives available with state, region or nationally
- provide graphic prompts to assist in type identification (future enhancement)

Ultimately areas of research may include:

- graphic identification of problems, and report output by window
- use of voice activation
- photo images of each window, linked to graphics

During the concluding phase of this project, the National Park Service convened a panel of experts to 1) determine if a standardized method of evaluating windows is appropriate and 2) if #1 is yes, to begin a process of developing such a method. The author is on the NPS task group and is seeking to identify and develop the maximum possible consistency and compatibility between the NPS Recommendations and the Expert System. Additional work and coordination are needed in this area, at this time. The actual coordination and modification necessary to develop a consensus system may have to take place in Phase III. The benefit would be a consensus system applicable government wide and in the private sector as well. This could result in very positive value added for the Army as the system was made widely available to assist building owners, managers, architects, planners and others with a need to evaluate windows.

A RATING SYSTEM FOR SIGNIFICANCE AND CONDITION

A RATING SYSTEM FOR SIGNIFICANCE AND CONDITION

The methodology for evaluating windows and developing planning level recommendations for repair and replacement must be based on reproducible techniques. Such techniques become the standards by which the program is operated, and they must be developed for the two major evaluation areas, significance and condition. The recommendations which result from the program are based upon combinations of significance and condition. In general terms, a non-significant window in virtually any condition may be repaired or replaced, but a highly significant window, even though it is in poor condition, should be repaired and retained wherever possible.

Establishing significance levels:

Architectural or historical significance is a qualitative term. It can be interpreted differently from one individual to another. It is necessary to establish some standards and terminology in order to produce a reliable technique of determining significance. This "frame of reference" may be changed periodically, but it will serve as a basis for common discussion and understanding. The evaluation technique must, a) produce a reasonably sound result and b) be repeatable by different surveyors so that results are consistent.

Significance depends on several factors, which may occur individually or in combination. When more than one significance factor is present, the result is "additive', i.e., if a window is significant for several reasons instead of just one, it will receive a higher significance rating.

A window may be significant to the design of the building because of

1) originality of dating from the "Period of Significance"
2) visual appropriateness
3) special characteristics of the window itself, e.g.:
   a) special shapes (arched type, round)
   b)drawn glass
   c)decorative hardware
   d)bulls eye glass
4) building context

In the additive process, a window which has all of these conditions will be a "vintage" window. The process to quantify this is a point system where one point is assigned for each of the significance factors. Windows with 4 points at the conclusion of the significance evaluation are the most important windows in the building, and are given the title "vintage".

It is also possible to have windows which are inappropriate later additions, or replacements. These are called "intrusions" and are rated "0". The automatic recommendation for intrusions will be replacement with a visually compatible new window. The actual condition of an intrusion may affect the timing or scheduling of the replacement.

The significance rating for the window will be considered in relation to the condition rating in making a planning level recommendation for repair or replacement. See Figure 1 on page 12.

Establishing a Condition Rating:

The level of deterioration of a window can vary from 0% to 100%. Making extremely fine-grained distinctions will not be productive for planning purposes. Instead a classification system based upon types or levels of repair will be far more practical. Such a taxonomy has already been established for wooden windows by the U.S. DOI, the standard setting agency for historic preservation, in

"Preservation Brief #9", (PB9). The approach outlined in PB9 is equally useful for evaluating windows of any type and material.

The classification system outlined in Preservation Brief #9 consists of three levels of condition based upon the general types of repair actions required to restore it to a fully functional condition, with sound finishes and features. Focusing on the types of repair required is more effective than classifying deterioration. Repairs may be grouped into these broad levels depending upon the amount of intervention required, the skill level necessary and the degree of removal and disassembly required. All of these are relevant to cost and feasibility.

Condition Level 1 is equivalent to "Repair Class I" of PB9. In includes windows with relatively minor, non-structural problems which may be corrected by some combination of the following steps:

1) some degree of interior and exterior paint removal,
2) removal and repair of sash (including reglazing where necessary),
3) minor repairs to the frame,
4) weather-stripping and reinstallation of the sash, and
5) repainting.

Condition level 2 applies to windows which require a greater level of effort to repair. They may require techniques of stabilization, patching, dutchmen or other crafts techniques. Some in-place surface repairs may be necessary using putties, fillers or epoxies. Generally, this will require an individual with some craft skills.

Condition Level 3 includes windows which may have some of the preceding symptoms but, in addition, have broken or missing parts. Correction of these structural failures will almost always require skilled craftspeople, and removal of components.

It should be clearly noted that none of the of the 3 condition levels precludes repair. There is very little which cannot be repaired or restored if:

1) warranted by historic or architectural value,
2) performed by skilled craftspeople,
3) supported by adequate funding.

The absence of any part of these three factors may make it infeasible to repair and retain certain windows. Decisions in this process should be made with careful consideration of all relevant factors. If this is done, the resources will be protected and owners, managers will usually be able to comply with any responsibilities under A106 review process.

The bibliography contained in this package lists several references with specific repair options and details. Individuals needing such detailed information should consult these sources.

DECISION MATRIX FOR WINDOWS

WOODEN WINDOW DECISION MATRIX

Condition Level: \ Significance Level	0	1	2	3	4
0	1	5	5	6	6
1	1	4	4	4	4
2	2	7/8	9	14	13
3	2	7/8	7/8	12	10
4	3	3	3	3	11

Note: If a matrix entry is on the left side of a slash, the window is located on the building's prime elevation. If it is right side of the slash, the window is not in the prime elevation.

DEFINITIONS:

CONDITION LEVEL:

0 = PERFECT
1 = GOOD
2 = DETERIORATED
3 = DAMAGED
4 = MISSING

SIGNIFICANCE LEVEL:

0 = INTRUSION
1 = IMPORTANT
2 = SIGNIFICANT
3 = DISTINCTIVE
4 = VINTAGE

Figure 1

RULES: (CORRESPOND TO MATRIX IN FIGURE 1)

1) Because this window is an intrusion, you should replace it with a visually appropriate new window. Since the window is in good condition, however, the schedule of replacement may depend on project economics.

2) Because this window is an intrusion in deteriorated or damaged condition, you should replace it with a visually appropriate new window.

3) Because this window is missing, you should replace it with a visually appropriate new window.

4) Because this window is important and in good condition, you should reglaze and/or repaint it as necessary. All windows should be routinely inspected and maintained after repair.

5) Because this window is in perfect repair, no work is necessary. It should be cleaned as required and put on a preventive maintenance program.

6) Because this distinctive or vintage window is in perfect repair, no work is necessary. It should be cleaned as required and put on a preventive maintenance program. Special care should be taken to preserve this window.

7) This window is important or significant and in deteriorated condition. But because it is located in a primary elevation of the building, you should reglaze, repaint and repair as necessary. All windows should be routinely inspected and maintained after repair.

8) This window is important or significant and in deteriorated condition since it is not located is a primary elevation of the building. Repair is desirable, but if project economics do not allow repair, the window may be replaced with a visually appropriate new window. All windows should be routinely inspected and maintained after repair.

9) This window is significant and in deteriorated condition, reglaze, repaint and repair it as necessary. All windows should be routinely inspected and maintained after repair.

10) This window is vintage but in damaged condition, repair this window, regardless of the cost. Should that be impossible, it should be replaced with an exact copy.

11) This missing window was a vintage window, you should replace this window with an exact copy, regardless of the cost.

12) This window is distinctive but in damaged condition, you should repair this window, regardless of the cost. Should that be impossible, it should be replaced with an exact copy.

13) Because this window is vintage but in deteriorated condition, you should repair this window, regardless of the cost. Should that be impossible, it should be replaced with an exact copy.

14) Because this window is distinctive but in deteriorated condition, you should repair, reglaze and repaint it as necessary. All windows should be routinely inspected and maintained after repair.

REPORTING REQUIREMENTS FOR PLANNING

REPORTING REQUIREMENTS FOR PLANNING

Assessments of window significance will be done by "type". Assessments of condition will be done by "window". Both will be evaluated in context of the building in which the windows are located.

The results of the evaluation effort are intended to support rehabilitation planning and decision making. The results will have to be organized and displayed in formats which convey the overall results of the field inspection. The communication of results is critical to effective use of the results Program output should be simple, logical and user-friendly. It should place the window by window findings of the system into the overall perspective of a building.

The reporting function also provides additional data to the user to assist in making decisions based on the recommendations. Currently this will be in the area of technical resources. The reports will check a reference database of resources and print out a list of companies in the state where the building is located, and which can provide repair services or products of the type and size needed.

The first sample report, Figure 2, on the following page is a key to the format and contents; the second example, Figure 3, is a dummy sample of a completed report.

KEY/FORMAT

WINDOW REPAIR/REPLACEMENT
ANALYSIS_____

BUILDING NAME/NUMBER:(Bldg #)
BUILDING ADDRESS:_____

This analysis has been prepared by the U.S. Army's expert system for evaluating the significance and condition of windows in older Army buildings. The building above is a (STYLE) styled (BLDG. TYPE), containing # windows in # types or configurations.

windows were identified in the building.
are (Material), (Type) whose size is (Size)
are (Material), (Type) whose size is (Size)_

(Program note: repeat the evaluated types until sum of configurations equals the total on the first line.)

TYPE 1: (Type) (# total)

are (Rating) significant and should be (Recommendation).
are (Rating) significant and should be (Recommendation).

(Program Note: repeat until all permutations for this is type are reported, then go on to next type>

TYPE 2: (Type) (# total)

are (Rating) significant and should be (Recommendation).
are (Rating) significant and should be (Recommendation).

(Program Note: repeat for all types evaluated.)

REPAIR AND REPLACEMENT RESOURCES:

According to the system records, the following companies may have repair or replacement products/services for the windows in this building:

(List Companies from window database with matches for size and type. This could be organized and formatted a variety of ways, e.g. separating repair from replacement, by state etc...)

Figure 2

SAMPLE REPORT

WINDOW REPAIR/REPLACEMENT ANALYSIS

BUILDING NAME/NUMBER: 223
BUILDING ADDRESS:2404 South Lake Street, Baltimore, MD

This analysis has been prepared by the U.S. Army's expert system for evaluating the significance and condition of windows in older Army buildings. The building above is a Victorian styled warehouse, containing 385 windows in 4 types or configurations.

385 windows were identified in the building.
125 are wood, double-hung windows whose size is 4x6.
125 are wood, casement windows whose size is 6x8
125 are metal, factory windows whose size is 12x12
10 are wood, arched top, triple hung windows whose size is 8x15.

(Program note: repeat the evaluated types until sum of configurations equals the total on the first line.)

The following information is a summary of the findings and recommendations of the program for building 223.

TYPE 1: Wood Double Hung (#125 total; 32.4%)

100 are highly significant, in level 1 condition and should be repaired.
22 are highly significant, in perfect repair and should be placed on a PM program.
3 are missing and should be replaced with exact copies.

(Program Note: repeat until all permutations for this type are reported, then go on to next type>

TYPE 2: Wood arched-top, 8 x 15 (10 total; 2.6%)

4 are extremely significant, in level 3 condition and should be repaired at all costs.
6 are extremely significant, in level 2 condition and should be repaired and placed on a PM program.
(If this is not possible, the windows should be replicated.)

(Program Note: repeat for all types evaluated.)

REPAIR AND REPLACEMENT RESOURCES:

According to the system database, the following companies may supply repair or replacement products/services for the windows in this building:

A & S Window Associates, Inc.	Glendale, NY
J. Zeluck	Brooklyn, NY
Kasson & Keller, Inc.	Fonda, NY

Figure 3

DESCRIPTION OF EXPERT SYSTEM HARDWARE/SOFTWARE

DESCRIPTION OF EXPERT SYSTEM HARDWARE/SOFTWARE

The second phase of the project is the automation of the logic into a system which can be implemented in the field, on a lap top computer.

The plans currently call for developing a system using multiple software packages as follows:

PC Plus by Texas Instruments - An expert system shell to be used for user interface, rule-processing, hooking into graphics and passing data to and from dBase III.

Clipper by Nantucket Software - A dBase compiler and procedural language used for interface, database management and reporting.

dBase III Plus by Ashton Tate - A microcomputer DBMS used to create database file structures and passing data to and from SDF files.

AutoCAD by Auto Desk - A microcomputer CAD program to be used for graphic production, possibly for user interface to produce database files for interaction with PC Plus.

Hardware will generally consist of IBM compatible PC's, including laptops with 1 megabyte RAM and minimum 20 megabyte fixed disks. Use of AutoCAD might require a math co-processor. Every effort will be made to avoid machine dependent routines so that the program will be likely to run on the maximum number of IBM compatible machines.

Additional information on hardware and software options and requirements will be developed in the second phase of the project, currently in process.

Program Features

Functioning practically in the field will require that the system have several features to permit flexible use. A partial listing of these features include:

- Tracking of building identification
- Tracking of window location within a building
- Ability to stop and start after each window (to allow for breaks, lunch, close of business)
- Ability to reload data and resume with the last window
- Techniques of "carrying over" common data to minimize re-entry of similar data
- Use of help screens to include definitions and graphics

See the Phase II report for a technical description of the system structure.

PROCEDURES FOR EVALUATING WINDOWS

PROCEDURES FOR EVALUATING WINDOWS

The components of the program have been described in preceding sections. The actual on-site evaluation of windows requires a checklist of questions and "helps" which supports the data collection in a form consistent with the program design. Questions must flow directly from the need for specification information by the program. While this checklist can be applied manually to achieve the same result as with the Expert System, the time and tedium would be overwhelming, especially on large projects.

The specific questions to be asked are included in the following sections, one on wood and one on steel. The same concepts of significance and condition apply to both wood and steel, but the specific questions and conditions leading to the ratings are different for each material.

The automated Expert System will prompt the surveyor to proceed in a certain sequence and answer questions required by the program logic. A minimal amount of training and hardcopy documentation should be required.

The general approach will be readily seen in the order of the three part checklists. It includes:

I. Establish certain basic information about the building. This is the information which has a direct bearing on later decisions, evaluation of the data, or control of the system.

II. Identify and evaluate the significance of each type of window in the design. This is done prior to condition assessment and only once for each type. Significance level may vary with type.

III. Evaluate the condition of a selected number windows within each type. If totally accurate planning data is required, all windows should be evaluated. If planning level assessments are being conducted where time and resources are limited, a sampling technique is possible. The system is being designed to capture duplication and eliminate tedious redundancy of questioning where possible.

Helps and explanations will be provided to the maximum degree possible. Surveyors should be instructed to seek assistance when instructions or conditions are unclear.

The recommendations regarding maintenance, repair and replacement of windows are generally made based upon two major factors. These include:

1) The significance of the window, including:

   a) its design context with a building,
   b) the characteristics of the window itself.

2) The physical condition of the window unit,

Two factors of significance and condition are key to making technically and philosophically sound recommendations. These two factors are tempered by economic considerations and technical feasibility. The ultimate decision regarding repair or replacement will by made by the owner/manager based in large part on the feasibility of performing recommended work. An ultimate goal of the program is to provide support in these areas as well. Currently the system will provide some technical resource data to users, on sources of products and services.

Philosophically, it is always desirable to maintain original and significant material. Practically, however, it is not always possible to perform philosophically, hence the need for a program to evaluate windows, and establish values for significance and condition. Repair and replacement

alternatives will then bear upon the ultimate decision, and cost will be an integral part of that process. Any method or program should recognize and address the realities without unduly compromising principle.

Each of the factors listed above has several aspects which, in combination, yield a valid rating in each case. The ultimate complexity of the process dictates that qualified professionals conduct evaluations and make judgements. The rationale and knowledge which professionals use to develop sound decisions can be articulated. Once articulated and organized, the rationale can be applied by other professionals and less skilled surveyors as a standard approach to evaluating window condition.

The step-by-step procedures and guidelines which follow constitute such an approach or methodology for wood windows. Separate procedures and guidelines have been developed for steel windows and are covered in a separate section. Both methodologies follow the logic addressing in the preceding sections on ratings and decision making.

A balance must be maintained between procedures which are detailed and comprehensive enough to assure sound technical coverage of the subject and procedures which are efficient to apply. The need for thorough evaluations must be tempered by an awareness of human factors. Many buildings have hundreds of windows and excessive repetition of detail leads to fatigue and boredom, which ultimately results in reduced accuracy. The automated system design considers this issue and attempts to eliminate needless repetition, allowing the surveyor to concentrate on problems and differences.

See the checklists for evaluating wood and steel windows which follow. In all standard "look-up" or "code" tables, established Standards are used as a basis, but where possible, terms have been left generic enough to serve both Army users and other public and private users. The list of architectural styles is derived from several sources including Marcus Whiffen's' "American Architecture since 1780", and "What Style is it?" published by the National Trust for Historic Preservation. The list of building types has been drawn from the Army's Facility Codes so that all types are compatible with other organizational references in the Army.

Manual Surveys

Many facilities will not have battery powered portable computers available to carry to the site. In other cases it may simply be easier to mark up some forms for field use and enter the data into the system for analysis at a later time.

To facilitate this process, we have designed manual survey forms which parallel the software logic and content. Completed forms should be easily entered into the expert system. The forms and instructions for their use included as Appendix A, "Manual Inspection Forms".

STANDARD PROCEDURES FOR INSPECTING WOOD WINDOWS TO DETERMINE CONDITION

STANDARD PROCEDURES FOR INSPECTING WOOD WINDOWS TO DETERMINE CONDITION

The entire expert system is based on a three step logic. Understanding this fact, what the three steps are, and how they relate is the most important basic thing to know about the program. All else is detail in support of the three levels, which are:

1) Identify important aspects of the Building.
2) Identify and evaluate each different type of window in the building.
3) Identify and evaluate the condition of windows by type.

These three areas guide how the software runs, how questions are asked, how data is stored and the design of input forms and reports.

The following questions/guidelines form a preliminary method of evaluating the significance and condition of wood windows. The evaluation is a prelude to determining the most appropriate course of treatment, during rehabilitation. Generally treatments will consist of one or more of the following general types.

1) Repainting and reglazing
2) Sash and frame repair
3) Replacement in kind
4) Replacement with visually appropriate new products
5) Replacement of incompatible windows.

The selection of the most appropriate treatment depends not only on condition, but on the architectural significance and the options available to the designee/owner.

The step-by-step approach to developing an expert system must address both significance and condition. It must also address multiple combinations of significance and condition and generate professionally sound recommendations.

The overall methodology has five steps, and is intended to address the three factors outlined in the introduction.

1)Determine the building context in which the windows exist
2)Determine significance of each window type
3)Determine condition of individual windows within type
4)Evaluate #1-3 against repair/replacement options and standards
5)Make recommendations

PART I - DETERMINE THE CONTEXT IN WHICH THE WINDOWS EXIST

The purpose of Part I is the brief development of an understanding of the architectural context in which the windows exist. A knowledge of building type and style is needed to understand the significance of the window to the design of the building. Decisions may also depend upon the importance or visibility of the facades where the window units are located. The overall design or style of the building depends on the nature of the elements in it and their relationship to one another. Different sizes and types of windows may contribute differently to the design or may have different levels of significance. Part I is designed to collect the foundation of information at the building level, which can later be considered appropriately when deciding on the recommended treatment. This data is entered only one time for the building, even though each window will be evaluated in part based on this data.

1. What is the type of building being examined?

- Administrative/Office
- Auditorium
- Bank
- Barracks
- Chapel/Religious
- Commercial/Store
- Correctional
- Dining
- Fire Stateion
- Gymnasium
- Headquarters
- Hosptial/Clinic
- Housing/Residence
- Lab
- Library
- Museum
- Plant
- School
- Shop
- Warehouse

2. What is the style of the building being evaluated?

- Adam
- Art Deco
- Beaux Arts
- Brutalist
- Bungaloid
- Chateausque
- Commercial
- Eastlake
- Eccleasiastical
- Egyptian Revival
- Federal
- French Colonial
- Georgian Revival
- Gothic Revival
- International
- Italiantate
- Italian Villa
- Jacobethan Revival
- Jefferson Classic
- Late Gothic Revival
- Miesian
- Mission
- Modernistic
- Neo Classical Revival
- Neo Expressionist
- New Formation
- Novelty
- Octagon Mode
- Prairie
- Pueblo

3. What is the construction date of the building? _____

4. How many different types or styles of windows exist?

5. How many total windows are there of each style?

6. What is the primary elevation of the building? N - S - E - W

PART II - ASSESSMENT OF SIGNIFICANCE (FOR EACH WINDOW TYPE)

The significance of a window to the overall design and quality of the building in which it is located, is an important aspect to understand. If some change, treatment, work or problem is anticipated, such work should be planned with a full awareness of the reasons for the window(s) significance.

Significance may vary from one window type/style to another, therefore a multi-level significance rating structure has been defined which allows for a escalating level of significance, depending on a variety of characteristics. The characteristics which can imbue significance include:

- originality
- visual appropriateness
- special features/examples of craftsmanship
- location in an exceptional building
- position or location in the facade

In many cases, these characteristics relate to one another, such as an original window which will almost always be visually appropriate, however a visually appropriate window may or may not be original.

Significance is evaluated once for each style or configuration of window. Buildings often have multiple types of windows and it is the pattern or placement of windows and the juxtaposition of sizes and types which is a strong element in the design character of each building. Obviously the significance of a limited number of large and/or ornate windows in the facade may be greater than hundreds of simpler/smaller units. Both may be significant to the appearance of the building but if choices must be made about the allocation limited resources, such differences will have to be understood.

Examine the window; outside first if possible.

1. What is the window operating type being inspected?

   - Fixed
   - Single-hung
   - Double-hung
   - Triple-hung
   - Casement
   - Pivoted
   - Projected
   - Hopper
   - Other

2. What is the size of the window? _____

3. Pick any distinguishing characteristics (wavy or bulls eye glass/arched tops/hardware).
4. Indicate the configuration (no. of sash plus no. of panes per sash, e.g. 6/6 - said as "6 over 6").

5. Do these windows appear to be original? (Y/N)

6. Are the windows visually appropriate? Do they match adjacent windows in style and size, or are they part of a pattern of sizes or styles? (Y/N)

7. Are windows in a building which is the work of a known builder/architect?

PART III - ASSESSMENT OF CONDITION

Windows and other building components would never deteriorate or fail in the ideal, theoretical situation. In reality however, many forces such as deferred maintenance; severe service conditions; neglect and/or vandalism may cause a range of physical problems with windows. Many of these problems require more than simple maintenance to correct and when this is true, questions of financial and technical resources, appearance, service life, serviceability, energy and security often give rise to pressure to replace old windows.

Condition evaluation is vital to understanding what is technically feasible to accomplish. If funding is unlimited, almost any degree of restoration is possible. Since windows are only one of many

components competing for resources in the typical rehabilitation project, it is likely that compromises will be necessary in most projects. Owners/managers should not overlook that the most philosophically correct solution of repair may also be the most economical.

Part III systematically looks at components of the window to determine condition, then assigns one of three overall condition ratings based upon level of deterioration and repairs required. The three level condition taxonomy is taken from the approach introduced in "Preservation Briefs 9: The Rehabilitation of Historic Wooden Windows", published by NPS, U.S. DOI. The evaluation of condition is done for <u>each</u> window, up to a predetermined percent of the total number of windows of each type.

Visually examine <u>outside</u> face and inside face then answer questions below:

1. Is there missing glass? What percent?

2. Describe condition of glazing putty.

    a) In place, sound, firm and pliable
    b) In place, cracked and dry
    c) a above plus some missing
    d) b above plus some missing

3. Describe wood condition on exterior

    a) Is there any exposed wood? If yes, where?

        top rail-%
        meeting rail-%
        bottom rail-%
        muntins-%
        stiles-%

    b) Is there any cracked, split, broken or missing wood? If yes, where?

        top rail-%
        meeting rail-%
        bottom rail-%
        muntins-%
        stiles-%

    c) Are joints covered with sound paint? (Y/N) If no,

        1) "what percent of joints are exposed?"

        2) "Are any joints separated, broken?"

        3) "What percent of joints are damaged/broken? #?"

4. Describe general condition of exterior paint.

    a) clean, sound, not flaking or peeling
    b) dirty, generally sound but with crazing or less than 10% flaking or peeling
    c) dirty, generally flaking and peeling especially at rails, bottom
    d) generally missing, only area remains - base and exterior?

5. Describe the condition of the frame (check all which apply)

- unpainted and weathered joints
- deteriorated or damaged joints
- sound and intact sill
- deteriorated or damaged sill
- deteriorated or damaged head

Note: A special trigger mechanism will allow immediate indication of missing windows.

STANDARD PROCEDURES FOR INSPECTING STEEL WINDOWS TO DETERMINE CONDITION

INTRODUCTION:

The recommendations regarding maintenance, repair and replacement of windows are generally made based upon two major factors. These include:

1) The significance of the window, including:

   a) its design context within a building,
   b) the characteristics of the window itself.

2) The physical condition of the window unit,

Two factors of significance and condition are key to making technically and philosophically sound recommendations. These two factors are tempered by economic considerations and technical feasibility. The ultimate decision regarding repair or replacement will by made by the owner/manager based in large part on the feasibility of performing recommended work. An ultimate goal of the program is to provide support in these areas as well. Currently the system will provide some technical resource data to users on products and services.

Philosophically, it is always desirable to maintain original and significant material. Practically, however, it is not always possible to perform philosophically, hence the need for a program to evaluate windows, establish values for significance and condition. Repair and replacement alternatives will then bear upon the ultimate decision, and cost will be an integral part of that process. Any method or program should recognize and address the realities without unduly compromising principle.

Each of the factors listed above has several aspects which, in combination, yield a valid rating in each case. The ultimate complexity of the process dictates that qualified professionals conduct evaluations and make judgements. The rationale and knowledge which professionals use to develop sound decisions can be articulated. Once articulated and organized, the rationale can be applied by other professionals and less skilled surveyors as a standard approach to evaluating window condition.

The step-by-step procedures and guidelines which follow constitute such an approach or methodology for steel windows. Separate procedures and guidelines have been developed for wood windows and are covered in another document. Both methodologies follow the logic addressed in the preceding sections on ratings and decision making.

A balance must be maintained between procedures which are detailed and comprehensive enough to assure sound technical coverage of the subject and procedures which are efficient to apply. The need for thorough evaluations must be tempered by an awareness of human factors. Many buildings have hundreds of windows and excessive repetition of detail leads to fatigue and boredom, which ultimately results in reduced accuracy. The automated system design considers this issue and attempts to eliminate needless repetion, allowing the surveyor to concentrate on problems and differences.

PROCEDURES FOR THE EVALUATION OF STEEL WINDOWS TO DETERMINE REPAIR VS. REPLACEMENT OPTIONS

The procedure for evaluating steel windows is the same as for wood, only the specific technical questions are different.

1. Determine the context in which the windows exist
2. Determine significance of each type
3. Determine condition of individual windows within type
4. Evaluate numbers 1-3 against repair/replacement options and standards
5. Make decision(s)

Part I - DETERMINE THE CONTEXT IN WHICH THE WINDOWS EXIST

The purpose of Part I is the brief development of an understanding of the architectural context in which the windows exist. A knowledge of building type and style is needed to understand the significance of the window to the design of the building. Decisions may also depend upon the importance or visibility of the facades where the window units are located. The overall design or style of the building depends on the nature of the elements in it and their relationship to one another. Different sizes and types of windows may contribute differently to the design or may have different levels of significance. Part I is designed to collect the foundation of information at the building level, which can later be considered appropriately when deciding on the recommended treatment. This data is entered only one time for the building, even though each window will be evaluated in part based on this data.

1. What is the type of building?

- Administrative/Office
- Auditorium
- Bank
- Barracks
- Chapel/Religious
- Commercial/Store
- Correctional
- Dining
- Fire Stateion
- Gymnasium
- Headquarters
- Hosptial/Clinic
- Housing/Residence
- Lab
- Library
- Museum
- Plant
- School
- Shop
- Warehouse

2. What is the style of the building?

- Adam
- Art Deco
- Beaux Arts
- Brutalist
- Bungaloid
- Chateausque
- Commercial
- Eastlake
- Eccleasiastical
- Egyptian Revival
- Italiantate
- Italian Villa
- Jacobethan Revival
- Jefferson Classic
- Late Gothic Revival
- Miesian
- Mission
- Modernistic
- Neo Classical Revival
- Neo Expressionist

- Federal
- French Colonial
- Georgian Revival
- Gothic Revival
- International
- New Formation
- Novelty
- Octagon Mode
- Prairie
- Pueblo

3. What is the date of construction?

4. Note metal type of window.
   -steel
   -aluminum
   -iron

5. How many different styles of windows exist?

6. Note types of windows:

   -single or double hung
   -casements (including hoppers and awnings)
   -projected
   -fixed
   -pivot
   -sliding
   -other

7. Describe the size and profile of sash, frame, mullions and muntins for each style used.

8. How many configurations of similar window types exist?

   Note: One window type may be used in many configurations. It is important to identify each configuration type and assign an identifier to the composite. (For example, fixed sash and hoppers may be combined in various ways; i.e, fixed/operable/fixed, operable/fixed/operable and fixed/fixed/fixed. This represents 2 window types and three configurations.

Part II - ASSESSMENT OF SIGNIFICANCE (FOR EACH WINDOW TYPE)

The significance of a window to the overall design and quality of the building in which it is located, is the most important aspect to understand. If some change, treatment, work or problem is anticipated, such work should be planned with a full awareness of the reasons for the window(s) significance.

Significance may vary from one window type/style to another, therefore a multi-level significance rating structure has been defined which allows for a escalating level of significance, depending on a variety of characteristics. The characteristics which can imbue significance include:

- originality
- visual appropriateness
- special features/examples of craftsmanship
- location in an exceptional building
- position or location in the facade

In many cases, these characteristics relate to one another, such as an original window which will almost always be visually appropriate, however a visually appropriate window may or may not be original.

Significance is evaluated once for each style or configuration of windows. Buildings often have multiple types of windows and it is the pattern or placement of windows and the juxtaposition of sizes and types which is a strong element in the design character of each building. Obviously the significance of a limited number of large and/or ornate windows in the facade may be greater than hundreds of simpler/smaller units. Both may be significant to the appearance of the building but if choices must be made about where to allocate limited resources, such differences will have to be compared.
Inspect window exterior first.

1. Note exterior hardware type and mounting location. These may include shutter dogs, grilles, etc.

2. Note type of glazing and reflective quality of glass.

   - clear
   - translucent
   - textured
   - wire
   - stained

3. Note distinguishing characteristics - stained or colored glass, cast metal design integral to frame or sash, irregular shaped sash or frame, etc.

4. Note configuration (include number of sash plus the number of lites (or panes) per sash - example 4/4 spoken "four over four")
5. Generally, are windows original?

   Note: If windows are integral part of construction (i.e. frame imbedded in masonry) it is likely they are original.

6. If not original, what is the age of the replacement window?

   Note: It is possible that frame has not been replaced but that sash has been replaced.

7. Do windows appear to be other than machine made?

   Rule: If window is located in a residential or ecclesiastical structure and style = Prairie or Art Deco, glasswork in frame is potentially example of period craftsmanship.

8. Are windows the work of a known craftsman; or are they in a building which is the owrk of a famous architect or builder?

Part III - ASSESSMENT OF CONDITION

Windows and other building components would never deteriorate or fail in the ideal, theoretical situation. In reality however, many forces such as deferred maintenance; severe service conditions; neglect and/or vandalism may cause a range of physical problems with windows. Many of these problems require more than simple maintenance to correct and when this is true, questions of financial and technical resources, appearance, service life, serviceability, energy and security often give rise to pressure to replace.

Condition evaluation is vital to understanding what is technically feasible to accomplish. If funding is unlimited, almost any degree of restoration is possible. Since windows are only one of many components competing for resources in the typical rehabilitation project, it is likely that compromises will be necessary in most projects. Owners/managers should not overlook that the most philosophically correct solution of repair may also be the most economical.

Part III systematically looks at components of the window to determine condition, then assigns one of three overall condition ratings based upon level of deterioration. The three level condition taxonomy is taken from the approach introduced in "Preservation Briefs 9: The Rehabilitation of Historic Wooden Windows", published by NPS, U.S. DOI. The structure and approach are equally valid for steel or any windows, only the specific technical issues will vary from type to type. The evaluation of condition is done for each window, up to a predetermined percent of the total number of windows of each type.

Visually examine outside face.

1. Is there missing glass? What percent? Which pane(s) or lite(s)?

2. Describe the method of glazing.

    a. Putty or glazing compound
    b. Glazing beads
    c. Gaskets

    Note: If answer is a., then answer question 3.
    If answer is b., then answer question 4.
    If answer is c., then answer question 5.

3. Describe condition of glazing putty.

    a. In place, sound, firm and pliable
    b. In place, cracked and dry
    c. a above plus some missing
    d. b above plus some missing

4. Describe condition of glazing beads.

    a. Good, free of rust and corrosion
    b. Fair, some rust or corrosion, less than 10%
    c. Poor, rust and corrosion over much of the area.

5. Describe condition of the gaskets.

6. Describe general condition of exterior paint.

    a. clean, sound, not flaking or peeling

    b. dirty, generally sound but with crazing or less than 10% flaking or peeling

    c. dirty, generally flaking and peeling

    d. little paint remaining

7. Is window sash operable?

    a. operates smoothly
    b. operates with some effort
    c. inoperable
    d. permanently closed

8. Are sash within prescribed "crack" tolerances when closed?

   Note: This might require a simple gauge which could be adapted or developed for this program.

9. Describe condition of metal.

   a. Is there rusting?

   top rail %
   meeting rail %
   bottom rail %
   muntins %
   stiles %

   b. Is there pitting?

   List locations and %'s

   c. Is there other corrosion?

   List locations and %'s

   d. Is there structural failure? If "Y" indicate specific type of failure.

   -racking
   -bowing
   -failed connections or joints

   List locations and %'s

10. Are windows weatherstripped? If "Y" select type.

    a. Continuous pressure sensitive rubber, vinyl or fiber
    b. Sweep type, rubber or metal
    c. Other

11. Please indicate the sill condition: (Check all that apply)

    - slight cracking, flaking
    - serious cracking, spalling
    - heavy rust staining
    - minor rust stains, no structural failure

12. Please indicate the condition of the frame: (Check all that apply)

    - paint peeling and flaking
    - general rusting
    - bent, racked or warped members
    - missing members

A mechanism will be developed to allow passing on windows which are missing.

AUTOMATED VENDOR SOURCELIST

The final phase of the Expert System provides additional technical information to the user to enable users, to assist in the procurement of appropriate repair and replacement services. Vendor information is often unavailable to field personnel and difficult to identify, evaluate and maintain. In a cooperative project between the Center and the National Park Service, a database of windows companies, which manufacture or repair windows, has been produced. This database contains specific information on companies which have been pre-screened to determine that they provide both repair services, and sensitive replacement products. In general these companies provide prpoducts and services which could be used in projects to meet the "Secretary of Interior's Standards for Rehabilitation Projects". Some level of professional design expertise must still be applied to evaluate and select actual products or services to be used in rehabilitation or repair projects.

The Expert System was expanded in Phase III to provide a link between the results of the window evaluation and the capabilities of the companies listed in the vendor database. This is accomplished by a report option which automatically appears at the conclusion of each working session. The user is prompted to run the Vendor sourcelist, or to decline. If the user elects to run the list, they may select either to search within a single state, or broaden the search to include the entire United States. In the future, and intermediate level is recommended which could be at the level of Corps. of Engineer Districts. When the search scope is determined, the report will match up vendors by the type, (wood), and the closest maximum window size which the vendor can repair or supply. A list of vendors is then displayed on the screen, and the user has the option to print the list.

The Vendor sourcelist is a potentially valuable tool to be used in the procurement process. Searches can be broadened to develop a tentative list of vendors to be provided to procurement offices as potential bidders on window repair and replacement projects. The database represents a list of companies identified by the National Park Service as providing appropriate window products and services for use in rehabilitation projects. It is always recommended that the services of a design professional, with historic architecture experience, be employed in the final treatment approach and product selection.

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APPENDIX A

MANUAL INSPECTION FORMS

WINDOW CONDITION ASSESSMENT FORMS
INSTRUCTION FOR COMPLETING MANUAL SURVEY

Note: These forms are to be used to complete the physical survey only. The results of the survey should be entered into the software program to determine significance level, condition level and action recommendation.

Instructions:

1. Complete Part I.A. only one time for each building surveyed.

2. Complete one entry in Part I.B. for each type of window in the building. ("Type" means a unique combination of material, operating type, configuration and size.)

3. Complete one entry in Part II for each window surveyed. Indicate the nature of the problem with the single letter code, and the approximate % of the component affected. The key to problems is printed at the bottom of each Part II form.

4. Use as many Part II sheets as necessary to inspect the number of windows required. Use a unique identifier for each window, such as the room number followed by a letter, (e.g. "223A"). (Be consistent with your numbering scheme.)

5. Only use a Part II form for windows of a single type. Indicate the type number from Part IA in the location provided at the top of the Part II form.

Part I. WINDOW CONDITION SURVEY FORM (BLDG/TYPE)

A. BUILDING

BUILDING ID: _____ (maximum 5 characters)

BUILDING NAME: _____

ADDRESS: _____

INSTALLATION: _____ CITY/ST: _____

TYPE OF BUILDING (see list): _____ STYLE OF BUILDING (see list): _____

DATE OF CONSTRUCTION: _____ PRIMARY ELEVATION(S): N E S W (circle all which apply)

BUILT BY KNOWN ARCHITECT OR BUILDER (Y/N): _____ NUMBER OF WINDOW TYPES: _____

B. TYPES

				# OF PANES					
#	MATERIAL	OP-TYPE	SIZE	SASH1	SASH2	SASH3	APPROP	ORIG*	CHAR**
1.									
2.									
3.									
4.									
5.									
6.									
7.									
8.									
9.									
10.									

*CHOICES: *: Yes - Documented, Yes - Judgement, No, Unknown **: None, Drawn Glass, Bullseye, Special Shapes, Decorative Hardware*

Building ID:_____ Page No.___

PART II. Window Condition Survey

(Use multiple pages as required - only one type per sheet)

Type #:___ (from Part I)

	ID#	ELEV	SILL	JAMBS	HEAD	T-RAIL	M-RAIL	B-RAIL	STILES	MUNTINS	FRAME	SASH	GLASS/ PUTTY	OPEN JOINTS (Y/N)	SASH CORDS	INT TRIM	EXT TRIM	WEATHER STRIPPING
1.																		
2.																		
3.																		
4.																		
5.																		
6.																		
7.																		
8.																		
9.																		
10.																		
11.																		
12.																		
13.																		
14.																		

CONDITION CODES: B = BROKEN D = DETERIORATED P = PAINT PROBLEMS M = MISSING

APPENDIX B

SUMMARY OF TESTS AND PRESENTATION

SUMMARY OF TESTS AND PRESENTATIONS

The system has been presented in several locations and field tested in one. A summary follows.

1) APT-BOSTON - Sept. 1988 - PRESENTATION

   First presentation of system concept to special pre-conference seminar of the Association for Preservation Technology. Concept was introduced and explained. Plans were announced to demonstrate the system at the next year's meeting in 1989.

2) Vancouver Barracks, WA - August 1989 - FIELD TEST

   First official field test on three buildings. Kathy Jerbic, Horace Foxall, Lt. Col. Walker and representatives from real estate and maintenance programs attended. Richard Hayes attended from CERL. Results indicated need for field forms in hard copy.

3) Presentation and demonstration of system at APT as a follow-up to 1988 meeting. All positive comments, no changes indicated as a result. Minor delays in interfacing between PC Plus and dBase were noted.

4) DEH Conference - Baltimore - December 1989 - PRESENTATION

   Booth designed and set up for DEH Conference. Three days of presenting results to attendees. Vendor lists and summary reports got the biggest positive reaction. Indication that the vendor list alone would be valuable as an automated search tool.

5) Ft. Belvoir

   Informally, the system was presented to Jean McGinn of Ft. Belvoir and a test was planned. Rehabilitation work and schedule conflicts prevented our testing the system but Beth Grashof briefed personnel on the system and left some draft survey forms for staff to complete and send back. No response as of this date. Indications of the need for a detailed survey tool for design/contract development.