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Post-Occupancy Evaluation: A Case Study of the Evaluation Process

Jacqueline Elder
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Center for Building Technology
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National Bureau of Standards
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ABSTRACT

Within the past decade, growing numbers of architects, educators, building users and researchers have begun to question the state-of-the-art of building design. The most common complaint is that buildings do not adequately fulfill the needs of their users. This report addresses the problem by examining the need to identify, develop and apply user information as an integral part of the design process.

The study reported here was conducted for GSA at the Richard H. Poff Courthouse and Federal Building in Roanoke, Virginia. This was a limited study examining: (1) the design process, (2) the information available to those making design decisions, (3) how that information was used and (4) the effects of selective design decisions. In addition, design problems of particular interest to GSA were considered from the viewpoint of several groups involved with the design and use of the building -- GSA, the architect, the building manager, the agencies and the employees.

Keywords: Building evaluation; design process; man/environment research; post-occupancy evaluation; questionnaire; user needs.

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1. INTRODUCTION

Within the past decade, growing numbers of architects, educators, building users and researchers have begun to question the state-of-the-art of building design. The most common complaint is that buildings do not adequately fulfill the needs of their users. This assessment comes from informal critiques by laymen and experts, as well as from formal research studies into users' satisfaction with buildings.

One major shortcoming in today's design process is that buildings are seldom evaluated after they are built and occupied. Consequently, not enough is known about the extent to which buildings serve their intended users and function as envisioned by the architect. Without this type of feedback, how can we ensure that future buildings will be any more responsive to their users than those in use today?

This report addresses these issues. It examines the need to identify, develop and apply user information as an integral part of the design process. A major purpose of the study is to document the process used to develop user-related information -- a precondition for both effective building design and evaluation. This approach enables "before" information to be compared with the findings of post-occupancy evaluations -- "after" information. Such analyses may be used to test the information, as well as the process, employed to develop user data for design. The findings can serve to progressively upgrade the quality of user-related design data as well as the design process.

This work is an outgrowth of earlier work performed by the American Institute of Architects/Research Corporation (AIA/RC) and supported by the National Endowment for the Arts (NEA). The aim of this work was to see whether effective links could be developed between social and behavioral science research and architectural design decision making. Post-occupancy evaluation is seen as one of the means for accomplishing this "linking." Researchers at the National Bureau of Standards (NBS) participated in the project in order to develop a standardized methodology for post-occupancy evaluation and to explore a model for linking behavioral studies and the design process.

The research study started with four Federal agencies as sponsors: the General Services Administration (GSA), the National Institutes of Health (NIH), the Department of Housing and Urban Development (HUD), and the U.S. Army Corps of Engineers (Corps). A building was chosen from each participating agency and evaluated for one or two environment/behavior aspects of interest to the researchers and the agency. The involvement of agencies with different functions, but similar facility problems, made for a common project research framework. The National Bureau of Standards was given the task of evaluating GSA and NIH buildings.

The work described in this report (one project within the program) was performed for GSA. GSA is accountable for the design, construction,

leasing and space management of most buildings occupied by the Federal government and therefore serves several classes of users each with somewhat different requirements (Table 1).

Table 1. Users of GSA Buildings

Users	Requirements
GSA	Design, Maintenance, Security, Administration
Tenant Agencies	Performance of Missions
Building Occupants	Performance of Work
Visitors	Access to Building

Since user requirements vary widely, GSA needs information to determine:

- How well GSA buildings perform,
- How effective is GSA's design process.

This study, which dealt with a number of these topics, was carried out at the Richard H. Poff Courthouse and Federal Building in Roanoke, Virginia. The study was not intended as a comprehensive evaluation of the Poff Building. Rather, its goal was to explore several critical issues that are a part of post-occupancy evaluation studies and, while doing so, to evaluate a limited number of design features of special interest to GSA.

The goals and general approach of the study are summarized in Table 2.

Table 2. Summary of the Goals and General Approach

Activity	Purpose
Examination of GSA user-information development process	Trace how good and bad user-related design decisions are developed
Identification of problems related to the use of the Poff Building	Evaluate building performance from standpoint of several user groups
Evaluation of specific designs	Limited test of design decisions--e.g. install movable electrical outlets
Development of building evaluation model	Preliminary test of model describing relationship between the design process and development of user information
Determination of bases for design decisions which resulted in problems	Identify linkages between decisions and user problems

This was a limited study. It looked at: (1) the design process, (2) the information available to those making design decisions, (3) how that information was used and, finally (4) the effects of selective design decisions on building users. Design problems of special interest to GSA were considered from the viewpoint of the various groups taking part in the design and use of the building — GSA, the architect, the building manager, the agencies and the employees.

2. BUILDING EVALUATION

2.1 BACKGROUND

Michael Brill [3]*, a poineer of the building performance concept, sees two basic aspects of building evaluation -- (1) gaining information about the adequacy of buildings and (2) using that information in the design of new buildings. Evaluation, he says, is the first stage of a process which ends only when information is fed back in a useful form to those making later design decisions.

The payoff of a post-occupancy evaluation, according to Brill, depends on the nature (quality) and amount of useful data available to designers. Types of data can occur at each of three levels:

- Traditional design and construction documents -- building codes, architectural programs, working drawings and specifications.

* References are located in Section 12.

- Materials assembled for presentations and for design competitions -- photographs of completed projects, architectural renderings and commentary by the architect.

- Research documentation -- behavioral program, post-occupancy surveys of the building in use and site visits by interdisciplinary teams.

The first level of information is usually available for all post-occupancy evaluations. The second level is sometimes available and the third is almost never found. Fortunately, for the present study, information was available at all three levels.

Even though post-occupancy building evaluation research has been largely neglected, in recent years a number of such studies has been undertaken. Unfortunately, these investigations have typically been very narrowly defined -- concerned as they were with evaluating particular buildings or building features. Informational needs in such cases are highly specific, as are the research methods employed. Consequently, a review of post-occupancy evaluations reveals many detailed critiques of buildings, but a lack of information applicable to other evaluation studies. Of even greater importance is the lack of standardized methods for collecting information to be used, tested and refined by man/environment (M/E) researchers. It is only through the development of standardized methods that the quality of building user information can be upgraded in an orderly way.

Another major difficulty with past evaluations is that they dealt with general attitudes and preferences of respondents to environments, without adequately describing or measuring specific design characteristics of the building being evaluated. It is hard to determine, therefore, any relationship between the responses of people to the buildings examined and the particular design features of the buildings.

As Fields [7] indicates, "An evaluation, to be useful, should allow changes to be made to improve the performance of a particular building and provide information which can improve the design of and/or evaluation of other buildings. Regardless of its use, evaluation can achieve its potential only if the basis on which decisions were made can be traced and examined analytically."

2.2 A FRAMEWORK FOR EVALUATION

Post-occupancy evaluation entails the determination of the quality of performance of a particular building in use. The building in use can be thought of as an "occupant/building system." This is analogous to the man/machine system concept in human factors work, and the analysis and evaluation may be performed in much the same way. The occupant/task/building relationships can be evaluated in terms of a set of measures of how well the goals, performance requirements, etc., are being met. In any evaluation effort, the first issues to be resolved are:

- Which performance qualities are to be judged?
- To what extent are qualities to be examined?
- What is the observation/measurement method by which the examination will be carried out?
- How are the evaluation data to be used?

Once the performance qualities to be evaluated have been selected, the particular building characteristics associated with these performance qualities must be determined. For example, the building may be evaluated in terms of its performance with respect to fire safety, accident safety, economics of operation and/or any of several other characteristics. In much the same way, occupant behavior can be evaluated in terms of the efficiency with which tasks are performed, aesthetic satisfaction, comfort etc.

Table 3 represents a matrix for defining a particular evaluation effort. The framework lists many of the occupant/building concerns important in an evaluation. It indicates what is not being considered as well as what is being considered. The code (X) indicates the focus of the evaluation in this report. The evaluation took up occupant/building relationships mainly in terms of the capability of building users to perform required tasks, although particular design features were examined in some detail to see how effective they were.

3. RESEARCH APPROACHES

3.1 OVERVIEW

A narrow set of research approaches was used to collect the required data, due to the limited nature of the study. The methods used had to respond to two general questions directly affecting the links between building design and the user:

- How was user-related information developed?
- How well did the building work at the time the study was undertaken -- both in overall terms and with respect to specific design features?

To answer the first question, information was needed as to the planning, programming and design processes used for the Poff Building. The second question required an examination of the building in use. Fortunately, both aspects of the problem could be studied by using similar research methods, namely, review of project documents, interviews, casual observations and a questionnaire. Table 4 summarizes the research methods used. These methods are described in more detail in subsections 3.2, 3.3, 3.4 and 3.5.

Table 3. Evaluation Matrix

FOCUS OF THE EVALUATION		BUILDING SUBSYSTEMS INDEPENDENTLY	OCCUPANT ACTIVITIES INDEPENDENTLY	OCCUPANT/BUILDING RELATIONSHIP
BUILDING DESIGN PROCESS	Programming Decisions			X
	Design Decisions			X
	Working Drawing Decisions			
	Building Regulations			
	Zoning			
	Construction Decision			
ACTIVITY SUPPORT	Air Quality			X
	Illumination			X
	Acoustic Quality			X
	Accessibility			X
	Dimensional Quality			
	Aesthetic Quality			X
	Maintainability			
	Occupant Satisfaction			X
SAFETY	Crime Safety			
	Accident Safety			X
	Fire Safety			
	Natural Disaster Safety			
	Reliability			
HEALTH	Biological Attack Management			
	Air Toxicological Quality			
	Ingestive Water Quality			
	Liquid Borne Waste Removal			
OTHER ISSUES	Economic Characteristics			
	Occupant Organizational Structure			
	Relationships with Other Issues			
	Similar Project Comparison			
	Growth and Change			
	Surrounding Social Environment			
	Surrounding Physical Environment			
	Climate			
	Energy Consumption			

Table 4. Information Development Process

INFORMATION GATHERING METHODS	INFORMATION SOURCES				
	GSA HEADQUARTERS	ARCHITECT	TENANT AGENCIES	BUILDING MANAGER	INDIVIDUAL OCCUPANTS
REVIEW OF PROJECT DOCUMENTS	X	X			
INTERVIEWS	X	X	X	X	
OBSERVATIONS OF THE BUILDING			X		X
QUESTIONNAIRE					X

3.2 REVIEW OF PROJECT DOCUMENTS

A limited number of documents on the planning and design of the Poff Building was provided by GSA and the architect. Obtaining more complete information was not feasible considering the scope of the present study. The building manager commented on the operating records that are kept by him and provided the researchers with examples of several of them.

3.3 INTERVIEWS

The research team talked to a number of different people in order to try to understand issues from as many viewpoints as possible.

A representative from the GSA Space Management Office reviewed the GSA planning/programming process as it related to a specific building. The amount and type of information requested by GSA from the various tenant agencies and the sources of such information were discussed.

The architect discussed the extent of programmatic information available for design of the Poff Building. He also talked about his impressions of the completed building.

Conversations with the building manager dealt with background information on the Poff Building and with his perspective in determining successes and problems in the planning, design and operation of the building. The manager was asked about areas of specific interest to GSA such as: (1) functioning of the underfloor duct system, (2) experiences of occupants and visitors in finding their way about the building and (3) employee reactions to the open office concept.

Following the meeting with the building manager, the research team met with representatives of the various agencies occupying the Poff Building. Each agency head or his representative was invited to attend. The positive and negative aspects of the building were covered from the point of view of an agency's ability to function in the building.

3.4 OBSERVATIONS

The research team visited Roanoke and, with the building manager, walked through the Poff Building. Particular attention was paid to: general appearance, including condition of carpeting around the underfloor duct system; outlet locations; directional signs and building directory. Photographs were taken to illustrate pertinent aspects of these features.

3.5 QUESTIONNAIRE

The research team developed and pretested a questionnaire to assess employee reaction to the various aspects of the building. The questionnaire included open-ended questions (to which the individual could respond in any way judged appropriate), and multiple choice questions (which assessed response to specific aspects of the building). The

questionnaire was a broad one which dealt with most aspects of the sensory enviornment as well as with the topics which were of particular interest to GSA. (A copy of the questionnaire is included in Appendix A.)

The questionnaire was distributed to some 150 employees. Individuals employed by the courts (located on the 2nd and 3rd floors) and the Post Office (ground floor) were not included due to the special nature of the spaces occupied and activities performed. Those employees included in the survey worked in the five largest agencies: the Veterans Administration with about 300 employees, the Department of Agriculture (Forest Service) with about 50 employees, the Department of Health, Education and Welfare (Social Security Administration) with about 30 employees and the Bureau of Tobacco, Alcohol and Firearms with approximately 15 employees. The head of each of these agencies used an alphabetical listing of employees and distributed a questionnaire to every third employee on that list. This sampling allowed us to assess the reaction of a variety of employees on five different floors, while at the same time limiting the total number of questionnaires administered to manageable proportions in terms of scoring and analysis. All the questionnaires were returned -- a rarity in studies of this type.

4. THE BUILDING

The Poff Building (Figure 1) is a general purpose Federal building. It houses 25 Federal agencies and contains Federal court space as well as office space. Prior to moving to the Poff Building, the various agencies occupied space leased by GSA. The building was completed in December 1975, is 13 stories high, contains 190,000 square feet of space and houses some 650 employees.

Six major tenants occupy 50% of the building area. The remaining tenants include smaller agencies, several of which have only one or two employees. The U.S. Courts (not a part of this evaluation) are on the second and third floors. The other floors house various Federal agencies, the largest being the Veterans Administration located on the 10th through 13th floors. The Department of Agriculture (Forest Service), uses two-thirds of the 6th floor. Finally, the Department of Health, Education and Welfare (Social Security Administration) occupies part of the 8th floor. The remaining agencies are distributed over the remaining floors.

The building was designed using the open office concept (Figure 2) and laid out in five foot modules. About one-third of the space is still open; the rest has been subdivided by partitions into smaller spaces and/or private offices (Figure 3). Two sides of the building consist of single pane reflective glass. The windows cannot be opened, but there are drapes which can be opened and closed.

Utility services for the offices are provided by an underfloor duct system (Figure 4). The system contains three ducts; for electricity, telephone and a system for fire safety and FM radio reception. This

Figure 1. Richard H. Poff Courthouse and Federal Building, Roanoke, Virginia

Figure 2. Open Office

Figure 3. Partitioned Office

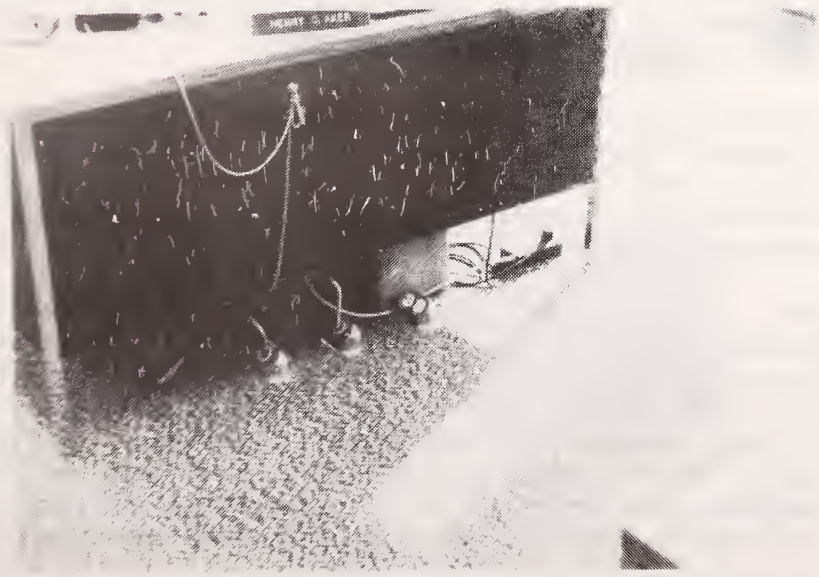


Figure 4. Outlets from Underfloor Duct System

utility system was intended to provide flexibility in locating desks and other equipment to conform to the open plan concept. Ducts run along the floor within five foot strips covered with carpeting which can be removed as needed to install, modify or remove telephone or electrical outlets.

The following features are not standard: (1) the size of ceiling tiles, (2) the thickness of partitions and (3) the placement of doorknobs (they are three inches higher than normal).

Several other aspects of the building are worth noting. The size and design of the parking garage (Figure 5) and the location of an exterior sculpture (Figure 6) were prescribed by GSA. The parking garage is accessible only from the outside of the building for security reasons having to do with moving prisoners to and from the courtrooms. Music from a local FM radio station is broadcast to the office spaces throughout the building. The building directory is table-top style (Figure 7) and located in the lobby directly across from the elevators. Agencies are listed by floor not alphabetically.

5. THE BUILDING PLANNING AND PROGRAMMING PROCESS

5.1 INTERVIEW WITH GSA REPRESENTATIVE

The interview with a representative from the Space Management Division at GSA focused on the planning process. Different groups within GSA have different responsibilities for the overall building process. A request for a new building, for additional space or for space within an existing building may be initiated by the Planning Group or Space Management Group within GSA, or by the agency desiring space. GSA Regional Space Planning and Management Groups have responsibility for assessing the space situation in their regions. The Poff Building was built in response to the need, in the Roanoke, Virginia area, for: (1) reducing the diversity of leased space and (2) providing additional space for agencies with growing space needs.

A building project usually starts with development of a Federal Space Situation Report by a Regional Space Planning Group. This report indicates a need for additional or combined space for one or more Federal agencies, and recommends that space needs be met either through lease acquisition or new construction.

Next, the Space Management Group contacts the agencies involved in the proposed change. Each agency is asked to help determine its space needs by completing GSA Form 1476, Space Requirements Worksheet. (A copy of this form is included in Appendix B.) The way this form is completed differs considerably from agency to agency. This variation is accounted for by the fact that some agencies have their own space planners who complete the form while in other agencies the form is filled out by individuals less familiar with the space planning process.

The GSA building process is summarized in Table 5.

Figure 5. Parking Garage

Figure 6. Exterior Sculpture

Figure 7. Building Directory

Table 5. Sequence of the GSA Building Process

1 SPACE ASSESSMENT

- from the inventory of regional building spaces, GSA space planners evaluate their regional space demands
- if additonal space is required, a decision is made as to how it will be acquired
- space is either leased or built

2 AGENCY NEED DETERMINATION

- when additional space is to be constructed, GSA space managers contact the agencies to be housed
- agencies are requested to complete Space Requirements Worksheets supplied by GSA
- from the equipment and space needs described by the agencies, GSA space managers produce a composite of all needs in a Space Directive document

3 PROJECT DEVELOPMENT

- GSA construction managers receive the Space Directive and use it in developing the scope and scale of the building project to be proposed
- a Prospectus document results from the efforts of the construction managers and is presented to OMB and Congress for the purpose of obtaining project funding

4 ARCHITECTURAL SERVICES

- once a project is funded, the selected A/E firm is given instructions as to how GSA expects the project to be managed, criteria for the contract documents and the user requirements in the form of the Space Directive produced by the space managers
- once a design solution is approved, agency representatives review their proposed spaces

5 CONSTRUCTION

- with the documents resulting from the A/E effort, the job is bid and the contractor selected for the job begins construction
- alterations and changes during construction may be initiated by either GSA, the architect or the contractor

6 USE AND OPERATION

- construction ends with delivery of a building to GSA
- user agencies move into the building

5.2 SELECTION OF THE ARCHITECT

The GSA Construction Management Group is responsible for selection of the architectural/engineering (A/E) firm for each building project. The firm of Hayes, Seay, Mattern and Mattern of Roanoke, Virginia was chosen to design the Poff Building. According to the architects, the firm has had a great deal of experience in designing office buldings, along with a broad background in dealing with the Federal government as a client. The A/E firm was chosen after most of the initial planning, including development of the program, had been completed. For the most part, the A/E firm had no role in the planning and programming phase of the project.

6. BUILDING DESIGN PROCESS

6.1 INTERVIEW WITH THE ARCHITECT

After the A/E firm was selected, GSA provided the firm with the following documents:

- A contract that covered the scope of the services to be rendered.
- Instructions to Contract Architects/Engineers, PBS P3410.1B.
- Architectural Criteria and Drawing Requirements, PBS P3410.5.
- The Space Directive for the project.

These documents defined the procedural demands and space program as required by GSA. At a later date, a revised Space Directive was issued to the architect. (According to the architect, these documents and the procedures specified by them did not hamper creativity or innovation in the design process.)

The architect did point out that some agency as well as general building requirements were not identified until the building was under construction -- in some cases, even after construction was completed. An example was the late addition of an employee cafeteria which had to be located on a middle story of the building. This location called for running additional venting up several floors, causing a loss of valuable floor space and adding needlessly to the cost.

To meet the GSA requirement for flexibility, the building was designed for open plan office space. Light switches and thermostats were placed on columns, and electrical power and telephone service distribution systems were located in ducts in the floor.

In order to save money, the heating, ventilating and air conditioning (HVAC) system designed by the architect was replaced at GSA's request. This change was called for after most of the building design had been

completed. The contractor for the HVAC system produced and submitted to GSA a report that called for a system different from the one GSA had originally asked the architect to incorporate.

The architect also said that one bank of elevators planned for the building was an optional bid item. (The contractors bidding for the construction contract for the building were required to bid a separate price for one elevator bank so that GSA would have the option of deleting it if overall bids came in too high.) GSA's reasoning was that the building would not be 100% occupied for some time, and that one bank of elevators would suffice.

The architect also stressed that at the time the building was designed, requirements for the handicapped were minimal and there were no prescribed energy conservation requirements.

6.2 INTERVIEW WITH TENANT AGENCY REPRESENTATIVES

At a meeting with representatives from the tenant agencies and the research team, the representatives critiqued the way in which information on their user needs was gathered as well as the effectiveness of the building itself. Their comments dealt both with the experience of individual employees and with that of agencies with missions to perform. The discussion, which was very open and lasted about two hours, reflected considerable agreement by participants as to the major shortcomings of the building as well as its positive features.

As might be expected, the major tenants (such as the Veterans Administration which occupies several floors) provided more information than did agencies with smaller staffs and occupying less space. The main reason for the correlation between the amount of feedback information (mostly negative) and agency size, may be attributed to the greater complexity and variety of activities performed by the larger tenant organizations.

7. EVALUATION OF THE BUILDING IN USE

7.1 EMPLOYEE CRITIQUE

The data for this category of users are based on responses to the questionnaire. The employees who work in the building day after day, usually in one specific location, have strong feelings about it. Although the questionnaire findings indicated that most of these responses relate to the physical and environmental aspects of the Poff Building, other factors, such as organizational structure, often affect employee responses to questionnaire surveys.

This section briefly reviews the questionnaire results. (Appendix A contains a copy of the questionnaire, with the response percentages listed beside each part of each question. Due to the limited scope of this project, not all responses were analyzed.)

Questions 1 and 2 asked employees what they particularly liked or disliked about the building. The questions were written so the responses were not structured in any way. Employees were free to answer a question in any manner they felt appropriate. The most prominently mentioned likes and dislikes about the building are shown in Table 6.

Table 6. Summary of Employee Likes and Dislikes

Likes	Dislikes
1. Exterior design and appearance	1. Heating, cooling and ventilating system
2. Nothing	2. Elevator service
3. View	3. Parking facilities
	4. Lack of health facilities

Responses to the more specific questions indicated that, on the whole, employees liked the lighting in the building, the amount of space, the general office environment (colors, carpet, decoration, etc.), the size of windows and appearance of the lobby.

Employees were particularly dissatisfied with the thermal environment. Respondents expressed this dissatisfaction on both open-ended questions, such as question 2, and on questions specifically related to the office environment. The offices were often cold (or warm) enough to make the employees uncomfortable. Employees also said their offices were often uncomfortably stuffy.

When asked about three physical features they felt made an office a pleasant place in which to work (question 10), the employees responded as follows: (1) comfortable temperature, (2) good light and (3) good ventilation. Freedom from noise ranked fourth and its relatively high ranking may be due to the fact that over 80% of the respondents worked in some type of open office. Of those who wished to change their office, most wanted more privacy--almost always in the form of walls or partitions. These results are summarized in Table 7.

Table 7. Rank Order of Building Features Mentioned and Responses Associated with Them

Importance of Physical Features in an Office	Employee Response to Physical Features in Poff Building
1. Comfortable temperature	Dissatisfaction
2. Good light	Satisfaction
3. Good ventilation	Dissatisfaction
4. Freedom from noise	Dissatisfaction

7.2 TENANT AGENCY CRITIQUE

We have already cited tenant agency representatives' opinion as to the design process and the building itself. Let us consider these two points in turn.

7.2.1 The Design Process

The major source of dissatisfaction was the lack of adequate communication between those responsible for designing the building and the tenant agencies who occupy it. Tenant agency personnel were asked to evaluate and fill out forms which described floor layouts (prepared by others). These forms were to be used to locate desks, electrical outlets and telephones. Many of the individuals (and agency representatives) asked to do this did not understand how to use the layout forms, and they made decisions that were later found to be inappropriate -- calling for costly changes late in the design process. Representatives from agencies did not see the physical space they would occupy. In general, tenants occupying the most space (such as the Veterans Administration) had less say in the design of their spaces than did other agencies, since their layouts were planned by staff architects in a central agency office in Washington, D.C.

The lack of communication between tenant agencies and GSA (as well as with the architect) led to many problems, which will be discussed later (Section 8.1). One decision made by GSA merits special attention: The architect was required to use the open plan office concept. Several agency representatives felt this concept was not compatible with their mission's requirements, for reasons to be discussed in the next section.

7.2.2 The Building

The VA representative declared the open plan office design was inappropriate for his agency which deals with "clients" on highly personal

issues that demand privacy and freedom from disturbances such as noise. These clients can best be served in an informal rather than a bureaucratic setting.

Unfortunately, the interviews revealed that the VA clientele as well as agency functions were hampered by several building features:

- Outer doors to the lobby are difficult to open. Specificially, some elderly and handicapped people are unable to open the doors.

- The automatic doors in the lobby are frequently out-of-order (or blocked in the closed position), making it difficult for visitors in wheelchairs to enter through the front of the building.

- Elevator service to the building was said to be inadequate for moving people and/or materials. (The VA's activities call for moving substantial amounts of records and supplies as well as accommodating many visitors.)

- The loading platform was designed to accommodate tractor trailers, yet many deliveries to the VA are by means of small trucks, which must be manually unloaded, since the elevation of the platform, while appropriate for tractor trailers, is too high for small trucks.

- The movement of materials is also hampered because two sets of doors must be opened to reach the elevator from the loading area.

The most general cause for complaint by tenant agency representatives was the thermal comfort conditions. They pointed out that during periods of direct sun exposure, the north side of the building becomes very cold, while the south side is too hot. Numerous compliants were also made about inadequate air circulation, especially during the summer, when on several occasions conditions were so bad that building occupants were released early.

The parking situation also raised several comments. The research team learned that the garage roof leaked caustic materials on several cars, resulting in considerable damage. Another source of dissatisfaction was that the garage is restricted to use by government vehicles only.

Finally, several agency representatives said that the piped-in sound system was disruptive. The system is tuned to a local FM station which transmits news, weather, advertisements and commentary as well as music. The voice broadcasts are said to disrupt work. The signals, which are transmitted by the communication system lines (also used for emergency warnings), cannot be turned off, nor can the volume be lowered.

On the positive side, one participant praised GSA for its foresight in including expansion space in the building.

Near the end of the discussion, agency representatives were asked to identify "one best" and "one worst" feature of the building. Table 8 summarizes responses to this request.

Table 8. Summary of Tenant Agency Likes and Dislikes

Likes	Dislikes
1. Attractive	1. Heating/cooling system
2. Colorful	2. Inflexibility caused by underfloor duct system
3. Good delivery of supplies*	3. Temperature control
4. Nice people	4. Elevator service
5. Clean	5. Design of garage
6. Conference rooms	6. Parking
7. Convenience of Post Office	7. Lack of volume control on piped-in radio music
8. Snack bar/cafeteria	

* Not true for VA

7.3 BUILDING MANAGER'S CRITIQUE

The building manager felt that, in general, the building was successful. He especially stressed his feeling that the fire safety system and automated monitoring system are excellent. He added that during a recent bomb scare, the building was evacuated in approximately six minutes using elevators as the primary means of exit. This is considered fast for a building the size of the Poff Building. According to the manager, complaints over elevator service usually have to do with the wait when leaving the building at the close-of-business, rather than at other times of the day.

A negative aspect, according to the building manager, is the fact that the deck above the garage was not properly sealed and a corrosive substance which destroys paint leaks onto cars in the garage.

7.4 ARCHITECT'S CRITIQUE

In the architect's opinion the complaints by building users as to the thermal environment stemmed from installation of a different HVAC system from the one originally specified. Also, the architect stressed that the building was designed for an open plan office layout, and this led to placing light switches and thermostats on columns. Not all agencies were agreeable to the open plan, however, and fixed, ceiling-high partitions have been installed. As a result, light switches and thermostats for some areas of space do not coincide with the fixed wall layout. This has caused a variety of thermal problems linked with temperature and air movement.

The architect assumed that any complaints about noise could be attributed in part to GSA's strict acoustical standards for the mechanical system. The system is required to be so quiet that the background masking sound such a system normally provides is missing. Thus, typewriters, telephone rings, telephone conversations and normal speech are more readily heard, causing distraction or annoyance.

The architect also thought that complaints as to waiting times for, and inconvenient access to, elevators resulted from the fact that the building was constructed with one bank of elevators rather than the two originally intended.

Finally, the architect thought that if energy conservation requirements had been called for at the time the building was designed, the final design would have been substantially different.

7.5 GSA REGIONAL REPRESENTATIVE'S CRITIQUE

A GSA regional employee conveyed to the research team some views on the planning, operation and maintenance of the building. He confirmed that the problem with the garage was that the "deck had not been properly sealed," thereby leaking corrosive material on the cars in the garage. He also cited examples of problems associated with the non-standard design features of the building. Thus, one difficulty has been that replacements for (or new) ceiling tiles, wall partitions, doors and even doorknobs cannot be purchased through GSA and GSA's suppliers. Instead, when changes are required, replacement parts have to be virtually custom made. Hence, modifications are subject to extended delays, and are much more costly than if they could be obtained through GSA.

7.6 COMPARISON OF USERS' VIEWS OF POFF BUILDING

The research team's evaluation of users' views of the Poff Building was based upon the results of personal interviews and a questionnaire survey. The data reveal major disagreements among these varied groups as to the building's effectiveness. Reasons for the judgments are understandable when one considers the varying responsibilities and/or viewpoints of these users.

The one user who, on the whole, liked the building was the building manager who is responsible for its day-to-day operation.

The architect acknowledged several shortcomings but attributed these to GSA's decision to go to open space planning; and with GSA's design decisions associated with acoustics, the HVAC system and elevators.

Representatives of tenant agencies and employees of the building were in agreement over the major problem in the building -- the lack of thermal comfort, including deficiencies in air circulation.

A look at the thermal environmental problems highlights the differing viewpoints of several user groups. The architect sees the problem as caused by the design change from the originally specified HVAC system. The building manager explained the "perceived" problems as being caused by a combination of newly prescribed thermostat settings, the wearing of inappropriate clothing and a minority of employees who are chronic complainers. The tenant agencies and employees are less concerned with the cause of the problem. They want a remedy because they claim the conditions result in discomfort, which in turn leads to poor job performance.

The GSA regional representative was aware of most of the problems cited by tenant agency representatives. He also recognized the difficulties that arose when changes had to be made -- mostly due to lack of standardization.

7.7 OBSERVATIONS BY RESEARCHERS

Two of the study authors (Elder and Rubin), accompanied by the building manager and the GSA representative, spent several hours on a walk-through of the building. This permitted them to make a few very general observations as to its appearance.

One major and obvious problem noted in the tour of the interior was the carpeting. There were numerous repairs and patches along the paths of the underfloor duct system (Figures 8 and 9). Many of the patches rose above the level of other parts of the carpet, appearing as potential safety hazards. The variety of styles, ages and finishes of furniture and equipment in some of the open space areas gave an impression of visual disharmony and lack of order (Figure 10). (Many of the tenant agencies brought their furniture to the Poff Building from previous locations.) Other areas, particularly those occupied by the smaller agencies, appeared more oderly (Figure 11).

The team's visit to the garage area revealed the problems caused by the leaky ceiling. The interior of the structure was badly stained and several cars were in need of repainting, reportedly due to leakage damage.

Figures 8 and 9. Repairs along Path of Underfloor Duct System

Figure 10. Example of Interior Design

Figure 11. Example of Interior Design

8. ANALYSIS OF FINDINGS

Using interviews, a questionnaire survey and observational research procedures, the research team identified a number of problem areas in the performance of the Poff Building. The team also succeeded in identifying some of the design features which caused or contributed to problems. Table 9 summarizes these findings.

Table 9. Behavioral and Design Feature Relationships

Problems (Behavioral/Performance)	Design Features
Thermal discomfort	HVAC system
Difficulty in moving materials	Ramp design
Difficulty in moving people	Single elevator
Lack of privacy	Open plan office concept
Safety and appearance of covering for underfloor duct system	Underfloor duct system
Disruption of work due to delays in making alterations or repairs	Selection of non-standard sizes: doors, panels

Having identified which design features led to problems for individuals and tenant agencies, the research team sought to determine how design decisions were made which resulted in these features. More specifically, the team wanted to find out the bases of making these decisions -- i.e., criteria, informational content and sources. The evaluators hypothesized a close link between the quality of design information and building performance. (Quality is defined in terms of accommodating user activities.) Naturally, information quality per se is not going to ensure buildings that serve their users better. The data must be used in a timely and appropriate way in the design process.

Most of the data dealing with development of design information stemmed from follow-on interviews with the architect and GSA central and regional office personnel. Documentation was scarce. The team, therefore, had to rely for source material on recollections by a number of major participants. Fortunately, these people generally agreed as to the major issues.

8.1 INFORMATIONAL PROBLEMS -- COMMUNICATIONS

The chief difficulty seemed to be the quality of communications among those persons making initial design decisions (and modifications) at the

user agencies. The procedure which requires tenant agencies to fill out forms as a means of determining office layouts appears to be questionable from the standpoint of user agencies. Representatives from the user agencies said they did not understand how to use the forms; nor did they visualize the effects of their choices. They suggested that a walk-through of spaces assigned to them before furniture arrangements were made, would be a good way of making such decisions.

In the case of the larger agencies, the problem was different, but the results seemed to be the same. The central office (with personnel who apparently knew how to fill out the forms) served as a connection between the actual tenants and the architect/GSA team making design decisions. This process did not appear to meet the needs of the tenant agencies any better than had the approach described earlier.

8.2 DESIGN ASSUMPTIONS

Two of the problem areas which the team identified apparently stemmed from initial decisions about the building which in turn resulted from GSA policies.

The open office concept, while acceptable to several tenant agencies, was judged inappropriate by others. In addition, while the underfloor duct system seemed to be a logical choice (assuming open office planning), tenant agencies were generally displeased with the system, for the reasons discussed below.

8.2.1 Underfloor Duct System

The underfloor duct system was intended by GSA to provide service outlet flexibility as required for open office planning. (The architect felt that ceiling poles would have accomplished the same result at lower cost.)

When asked about the effectiveness of the system, agency representatives described its inflexibility, especially when it was necessary to partition spaces. Desk locations, for example, were fixed by the location of outlets. Although outlets could be relocated (at a cost of $50 each), after an initial burst of activity (e.g. thirty changes by the VA), few changes were made (Figure 12). Agency spokesmen, when required to propose outlet locations on the original architectural plans, remember the forms to be filled out as something they did not understand. They stressed the need for a walk-through for making decisions about outlet locations.

On the other hand, the employees are not concerned with the system as long as they have adequate outlets suitably located. The employee questionnaire findings showed that almost all the respondents had an electrical outlet located in the floor. When asked if they would like to have the outlet moved, most employees responded "no." (Many of

them said a number of the inconvenient outlets had been removed just prior to the survey.)

Figure 12. Changes of Electrical Outlet Locations Since Occupancy

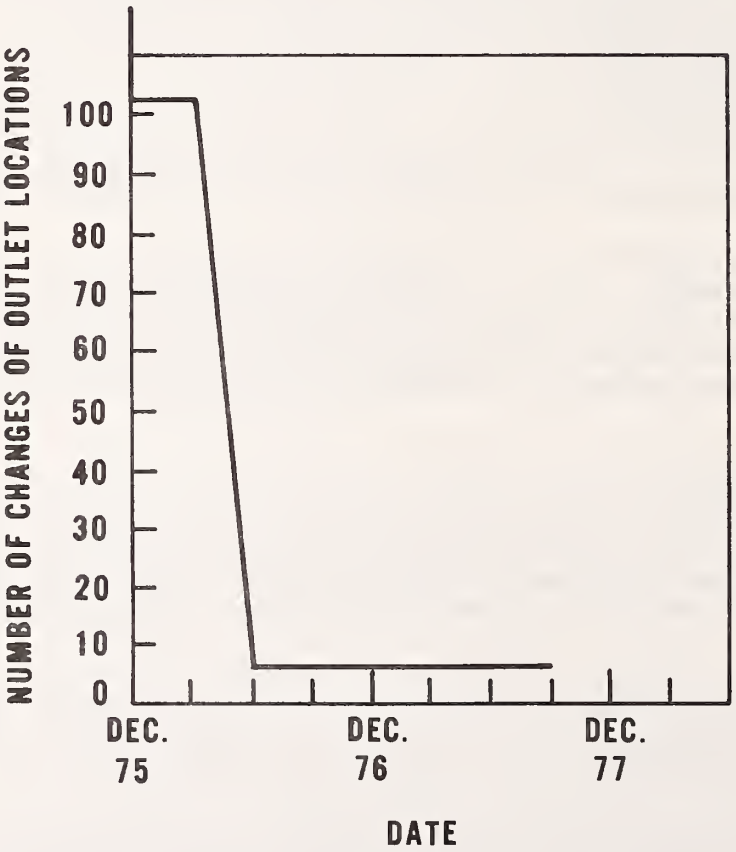


Table 10 lists equipment which the electrical duct system served, along with the average number of hours per day during which the equipment was used.

Table 10. Electrical Outlet Usage

Equipment	Average Number of Hours Per Day Used	% of Respondents Having Item
Desk-top Calculators	4	47
Typewriters	6	38
Hand-held Calculators	3	21

The major safety problem observed was the loose and uneven carpet sections which covered the duct system (Figure 13). Molding (covering underfloor electrical lines) was not properly replaced to prevent carpeting from pulling loose, and this became a safety hazard. Whenever telephone lines were modified, telephone company employees seldom bothered to cover the duct at all.

A secondary observed hazard was caused by the floor-mounted electrical outlet boxes (Figures 14, 15 and 16). In most cases, carpet sections over the ducts were firmly taped down and outlet boxes were placed under items of furniture. There were, however, instances where both the carpet and the boxes posed the potential hazard of tripping people walking in the area.

8.3 EARLY DESIGN DECISIONS

Two early design decisions appeared to create some difficulties for building occupants and visitors. One was the choice of a table-top building directory; the other was the selection of non-standard module sizes, wall widths and doors. The research team has not been able to determine the basis for these decisions, other than that of aesthetic preference.

8.3.1 Direction Finding

The building users were asked about finding locations within the building. Responses differed widely:

- The architect and building manager said the directory was effective and created few problems.
- Employees indicated that they soon learned their way around the building and therefore made little use of the directory. Those employees who had visitors said visitors "often" or "sometimes" had trouble reaching their destinations.

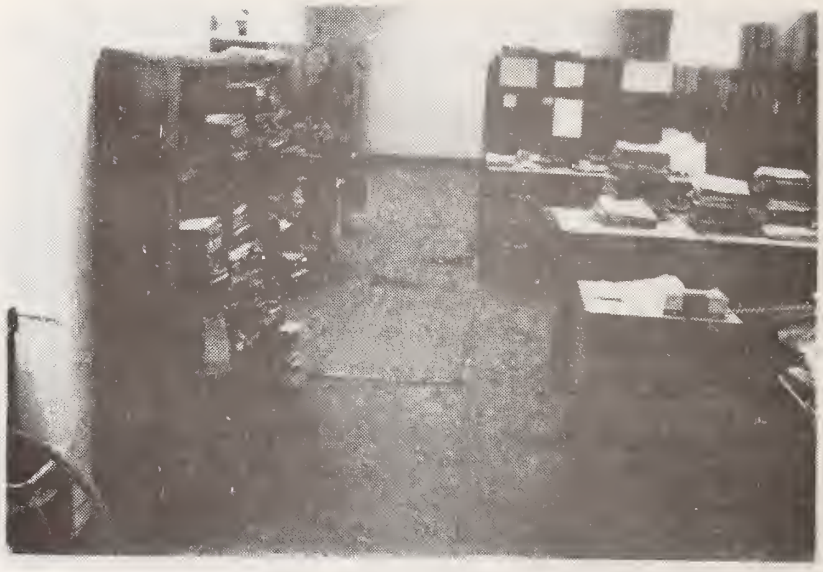
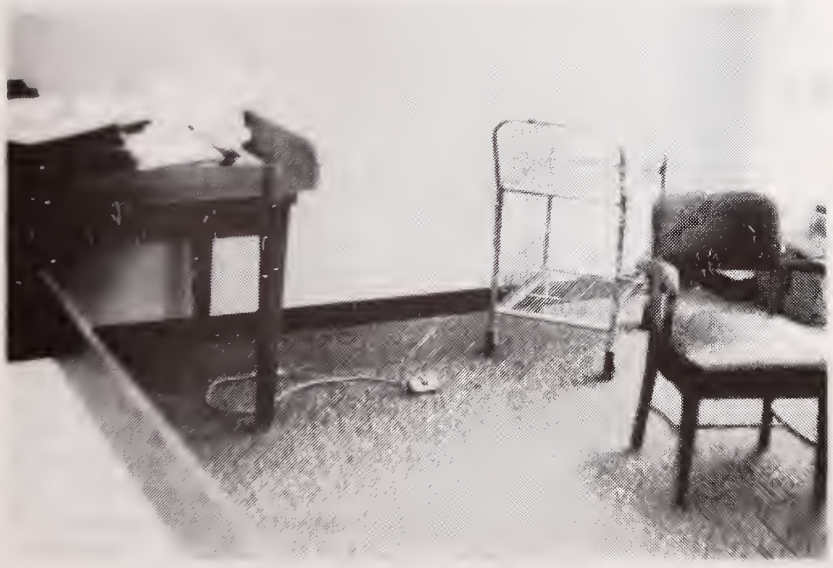


Figure 13. Loose and Uneven Carpeting

Figure 14. Floor-Mounted Electrical Outlet Boxes



Figures 15 and 16. Floor-Mounted Electrical Outlet Boxes

- Agency representatives wanted the name and locations of their organization to be displayed prominently in the lobby; the table-top directory did not achieve this purpose. (Agencies were listed by floor, not alphabetically.)

Many respondents felt the directory was hard to find and to use. The table-top format found little favor. Most users favored a wall location. The VA representative pointed out that many of the visitors to his agency were handicapped and people in wheelchairs were unable to use the directory.

As for content, agency respondents preferred an alphabetical listing of agencies, as opposed to the existing floor-by-floor listing. Several agencies use corridor signs to supplement the information provided by the directory (Figures 17, 18, 19 and 20).

8.3.2 Non-Standard Components

The decision to use non-standard sizes (not available through GSA procurement) for walls, doors and other building features makes changes difficult, time consuming and costly. For example, several agencies have changed from an open plan office layout to the construction of private offices. To do this, many items had to be procured on the open market as they were not available through GSA. These items often require custom manufacture, which adds to costs and leads to excessive delays.

It appears that many of the original design decisions did not take into account long term cost factors (life cycle costing). Such costs should account for extended disruption of service to the general public, as well as the additional expenses necessary to perform required activities.

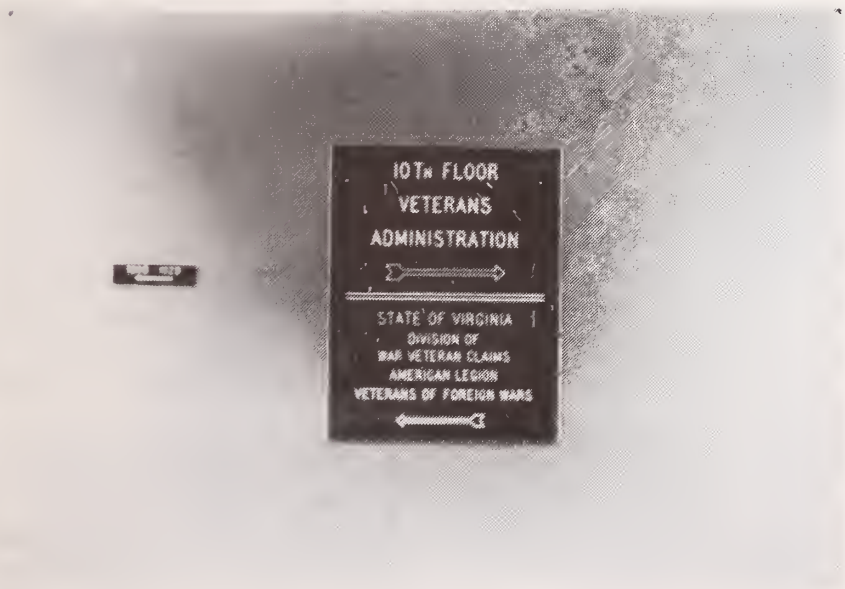
8.4 DESIGN/COST TRADEOFF DECISIONS

As noted, several design decisions said to hinder performance of the Poff Building were made early in the design process. But there was also a number of other decisions, made later in the design process which were intended to save on first costs, but led to additional operating costs. Three items will be examined to explore the rationale (and assumptions) that led to the final decision.

8.4.1 Elevators

The Poff Building contains one bank of elevators, situated at one end of the building. A second bank of elevators was included as an optional bid construction item, but was dropped in the final design, with the intent of adding it later, as building occupancy increased. The rationale appeared to be that the building would be only two-thirds occupied at first, making a single bank of elevators sufficient in the short term.

Discussions with agency representatives, especially from the VA, showed that their activities are severely disrupted because of insufficient



Figures 17 and 18. Corridor Signs

Figures 19 and 20. Corridor Signs

elevator capacity. They point out that available elevators cannot handle the people entering the building at the opening and close of business. They also point out that a good deal of material is moved to and from their offices (e.g. personnel records), requiring a service elevator. Furthermore, this material must now be moved the length of a building corridor, disrupting the activities of many employees.

In short, they claim the decision to save money initially has led to increased operating costs by making many activities unduly time consuming and difficult. (A bank of two elevators is now to be installed as a result of tenant agency requirements.)

8.4.2 Heating, Ventilating and Air Conditioning (HVAC) System

The building's thermal environment is the major source of dissatisfaction for building occupants and agency representatives. The most likely cause of this problem was substitution of the initially specified HVAC system for another, which was intended to serve the same function. Substitution resulted from a "value engineering report" which, as in the case of the elevator decision, stressed initial dollar costs. The responses by building occupants suggest that not enough attention was given to the need of the system to meet the thermal requirements of building users. What criteria were used to show that the installed system was equivalent to the one originally specified are unclear.

8.4.3 Loading Dock Design

The loading dock ramp was designed to conform to the height of large tractor trailers. Initial plans had called for a levelling device to accommodate smaller trucks, so the load could be lifted to the platform mechanically. In order to save initial construction costs, the levelling device was not purchased.

At present, most deliveries are made by small trucks. Unloading them is a time-consuming, inefficient manual operation with potential safety hazards due to the amount of lifting required. Agency representatives feel the present system uses more people and time for loading and unloading than would be the case if a levelling device were available.

8.4.4 Summary - Information and Design Decisions

The decisions to "save money" on the elevators, HVAC system and loading ramp share several characteristics:

- They stress first costs.
- They do not take into sufficient account the potential impact on building performance and user activities.
- They were made without including agency users in the decision process.

- They led to difficulties which might have been avoided if user agencies had been consulted in advance.

9. THE GSA DESIGN PROCESS AND THE POFF BUILDING

If the architect is working with inappropriate or insufficient information, he is forced to make decisions based on his best judgment and previous experience. While making a decision in this manner is acceptable professionally, it may, on occasion, not be the right decision for a particular situation.

The GSA process appears to run the risk of allowing the architect to make unsuitable design decisions by not having any mechanism for integrating directly with user agencies.

The most notable apparent shortcoming in the design process has to do with poor communication and not enough involvement by user agencies. One problem area seems to be the nature of information developed on the Space Requirements Worksheets, which consist of a listing of furniture and a description of actual space usage. These data describe the state of activities and functions performed in an agency's previous location, which does not necessarily relate to requirements for performing present job activities. For example, those who have worked in a job for a long time tend to accumulate equipment and materials which may or may not be relevant to their present assignment.

Table 11 shows hypothesized links between design features and the process used to make design decisions.

10. CONCLUSIONS

Buildings built for or leased by GSA should be designed and managed so they effectively support the work of tenant agencies and provide a satisfactory work environment for employees. The planning and design process used by GSA makes it difficult to achieve these goals, because of:

- The many organizational units within and outside GSA that are involved in the design process.
- The lack of good communication among participants in the design process.
- The relatively minor role played by the tenant agencies whom GSA buildings serve.
- The procedures and methods of documentation used to develop required user related program information.
- The emphasis on first cost instead of long term (life cycle) cost.

Table 11. Examples of Impacts of the Design Process

Design Feature	Design Decision	Implication	Effect
Underfloor Duct System	Decision on type of system made by GSA; related to decision to use interior open space planning, seen as providing flexibility	It would be difficult to partition space; it would be expensive to have outlets moved	Outlets were not properly placed when agenices moved in; an unfamiliar type of drawing was given to agency heads for the purpose of determining outlet locations; many outlets had to be changed; system is inflexible-desks must stay where outlets are; improperly located outlets are safety hazard; molding (holding carpeting in place) not replaced when changes made, causing carpet unevenness
Loading Dock	GSA provided architect with the design standards	Dock would be suitable for use in loading/unloading semi-trailers but be too high for loading/unloading smaller trucks	Safety problem (item must be lifted from truck to loading dock); time lost; manpower wasted (takes more people to handle deliveries)
Elevators	GSA made budget decision to make one bank of elevators an optional bid item	One end of building would lack elevators	Elevators may not suffice to handle traffic without long delays, especically at opening and closing of business day; excessive travel for those going from one floor to another (example: SE end of 13th floor to SE end of 10th floor)
HVAC System	GSA made decision to save on first costs	Thermal environment may not be adequately controlled	The major cause for complaints by agencies and individuals

- The lack of a systematic approach for evaluating buildings and incorporating the findings into future designs and procedures.

The research team's findings support the hypothesis that the quality of information used to make decisions influences their effectiveness. More specifically, when tracing the process used to make the design decisions which ultimately led to problems for building users, the team found that user agencies were virtually ignored as potential sources of such information.

The evaluators' attempt to identify and document linkages between design decisions and user impact by focusing on problem areas was only in part successful. While the methods of examining documents and interviewing participants seem appropriate for gathering this information, the lack of adequate documentation often hampered reconstruction of the rationale for making design decisions.

This study points to the need to establish and test design criteria based on the performance of user activities. Even though a clearcut relationship between design decisions and impaired task performance (e.g., lost dollars or work days) was not proven, the interview and questionnaire findings indicate strongly that the two sets of factors are closely related.

11. POST-OCCUPANCY RESEARCH

The evaluative procedure used to study the Poff Building proved feasible. It should be expanded, further tested and refined, and developed into a general building evaluation methodology. Above all, the development of user information and the identification of linkages between user behavior and design decisions must become part of an overall design process model (including such factors as site selection and economic analysis; operations and building programming). To meet this general objective, the following activities should be pursued:

- Exploration of means to improve interaction between architects, users and clients that will produce information needed to ensure a building design responsive to the needs of <u>all</u> building users.

- Further work to revise, test and standardize measurement methods when collecting data on user needs and building performance requirements.

- A detailed study of the building design process to better identify linkages between design decisions and their ultimate influence on building users.

- Development of a feedback mechanism so information about a building's operation may be incorporated in the design of new buildings and the operation of existing ones.

- Simplify and clarify procedures to enable user agencies to participate effectively in defining their needs to GSA and architects.

11.1 THE GSA BUILDING PROCESS

For the most part, a Space Management Group (SMG) in a GSA Regional Office provides architectural programming for building projects. A more systematic, analytical and controlled process for programming is needed if the types of problems encountered in the Poff Building evaluation are to be avoided.

Such an approach calls for a close link between the development of user information and the design process, by actively involving user agencies while the design program is being formulated (and modified). User requirements should be developed and incorporated into programming decisions.

A major criterion should be the potential impact of decisions on the way user agencies (and individuals) perform required activities.

User information should be collected by trained people who must not only focus on what data are required, but also know how to avoid errors due to lack of familiarity with methods used to collect information.

The information collected in post-occupancy evaluations should be fed back at once for use in correcting existing buildings or planning new buildings. Programming and post-occupancy evaluation processes must therefore be linked, and their information collection methods must be compatible.

Procedures should be developed to involve user agencies in the architectural programming and design process and to clarify the responsibilities of the many groups (within and outside of GSA) that take part in making design decisions.

The bases for architectural programming and design decisions should be better documented.

Post-occupancy evaluations of GSA buildings should continue, in order to determine what user information is needed, how its quality and usefulness can be improved and how it may be applied to all GSA activities.

The use of life cycle costing could have avoided a number of major problems encountered at the Poff Building.

Finally, GSA should have a central repository for post-occupancy evaluations of its buildings. The repository would serve as a key resource for all who require such information.

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APPENDIX A

QUESTIONNAIRE AND QUESTIONNAIRE RESULTS

Percentage Summaries of Responses

ROANOKE FEDERAL OFFICE BUILDING -
BUILDING ENVIRONMENT QUESTIONNAIRE

Number of Responses (N)

1. Is there anything you particularly like about the Roanoke Federal Office Building?

N		
144	/_/ Yes	72
144	/_/ No	28

If yes, what do you like? Design/Exterior appearance (31), View (13), Cleanness (12), Location (7), Windows (7), Music/Radio (6)

2. Is there anything you particularly dislike about the Roanoke Federal Office Building?

N		
146	/_/ Yes	92
146	/_/ No	8

If yes, what do you dislike? HVAC system (temperature) (57), Elevators (32), Parking (19), Lack of health facility or lounge (13), Ventilation (12)

3. About how satisfied are you with the following aspects of the building?

N		Very satisfied	Somewhat satisfied	Indifferent	Somewhat dissatisfied	Very dissatisfied
149	a. Lobby	/_/ 23	/_/ 29	/_/ 31	/_/ 9	/_/ 7
148	b. Building Directory in Lobby	/_/ 14	/_/ 22	/_/ 28	/_/ 24	/_/ 12
149	c. Elevators	/_/ 5	/_/ 19	/_/ 6	/_/ 31	/_/ 38
142	d. Parking	/_/ 5	/_/ 7	/_/ 11	/_/ 15	/_/ 62
134	e. Parking Garage	/_/ 5	/_/ 4	/_/ 47	/_/ 10	/_/ 34
149	f. Snack Bar/ Cafeteria	/_/ 19	/_/ 42	/_/ 14	/_/ 19	/_/ 5
149	g. Exterior Appearance	/_/ 57	/_/ 32	/_/ 9	/_/ 3	/_/ 0

149 Please comment No comments (54) Can't find directory (10), Dislike sculpture (8), Dislike snack bar (6), Lack of parking for visitors and handicapped (5).

4. Do visitors to your office have trouble finding their way?

N

118 /_/ Often 29

/_/ Sometimes 45

/_/ Only occasionally 23

/_/ Never 3

/_/ Don't know/no opinion

149 Please comment No comments (71), Can't find directory (6).

5. How does your office or work area in this building compare with the last office you had?

	Appearance			Comfort			Suitability for Performance of Job		
147	/_/ Better	88	143	/_/ Better	26	142	/_/ Better	35	
	/_/ Same	6		/_/ Same	22		/_/ Same	26	
	/_/ Worse	5		/_/ Worse	52		/_/ Worse	39	

6. Would you like to change your present office in any way?

138 /_/ Yes 78

/_/ No 22

138 If yes, how? Temperature (32), More privacy (24), Ventilation (11), Less noise (8), More space (7), Closer to window (7)

7. Please read all the categories and then check the kind of office you are in.

143

10 /_/ A private office enclosed with full height walls.

6 /_/ An office, enclosed with full height walls, shared with one other person

15 /_/ An open office (no dividers or furniture that blocks the view) shared with 2 or more other people.

19 /_/ An individual space enclosed (or mostly enclosed) by dividers, plants or file cabinets etc. in an otherwise open office. Have little or no view of other workers.

50 /_/ Have some dividers, plants, file cabinets that tend to break up an open office but do not enclose the work space. Can readily see other workers.

8. In your last office, how many people shared your room or work area?

N

/_/ Had an office alone

/_/ Less than 4 people

/_/ 5-10 people

/_/ 11-20 people

/_/ More than 20 people

9. How many people share your current room or work area?

/_/ Have an office alone

/_/ Less than 4 people

/_/ 5-10 people

/_/ 11-20 people

/_/ More than 20 people

10. Check the three physical features that are most important to you in making an office a pleasant place for you to work.

137

88 /_/ Comfortable temperature

61 /_/ Good light

40 /_/ Freedom from noise

42 /_/ Good ventilation

20 /_/ A window

20 /_/ Privacy

10 /_/ Plenty of space

18 /_/ General environment (colors, carpet, decoration)

3 /_/ Other (please specify) _____

11. About how satisfied are you with the following aspects of your office?

		Very satisfied	Somewhat satisfied	Indifferent	Somewhat dissatisfied	Very dissatisfied
149	a. Lighting	/_/ 62	/_/ 31	/_/ 3	/_/ 3	/_/ 1
147	b. Noise level	/_/ 20	/_/ 31	/_/ 5	/_/ 24	/_/ 20
145	c. Odor of office	/_/ 33	/_/ 26	/_/ 28	/_/ 8	/_/ 6
148	d. Ventilation	/_/ 4	/_/ 19	/_/ 5	/_/ 31	/_/ 41
147	e. Temperature	/_/ 1	/_/ 10	/_/ 1	/_/ 28	/_/ 59
132	f. Window size	/_/ 54	/_/ 17	/_/ 11	/_/ 3	/_/ 15
145	g. Privacy	/_/ 18	/_/ 25	/_/ 18	/_/ 16	/_/ 23
149	h. Plenty of Space	/_/ 34	/_/ 38	/_/ 8	/_/ 10	/_/ 11
146	i. General Environment (Colors, carpet, decoration)	/_/ 29	/_/ 44	/_/ 14	/_/ 11	/_/ 3

N

148 12. Does it ever get cold enough to make you feel uncomfortable?

/_/ Often 56

/_/ Sometimes 24

/_/ Only occasionally 14

/_/ Never 6

/_/ Don't know/no opinion

147 13. Does it ever get warm enough to make you feel uncomfortable?

/_/ Often 56

/_/ Sometimes 31

/_/ Only occasionally 10

/_/ Never 3

/_/ Don't know/no opinion

147 14. Does it ever seem uncomfortably stuffy?

/_/ Often 46

/_/ Sometimes 31

/_/ Only occasionally 19

/_/ Never 5

/_/ Don't know/no opinion

129 15. Does it ever seem uncomfortably humid?

/_/ Often 16

/_/ Sometimes 24

/_/ Only occasionally 31

/_/ Never 29

/_/ Don't know/no opinion

N

16. Do you ever notice unpleasant odors in your office or work area?

139

/_/ Often 7

/_/ Sometimes 14

/_/ Only occasionally 42

/_/ Never 37

/_/ Don't know/no opinion

17. What do you do if your office gets too cold? _____

_____

too warm? _____

_____

too stuffy? _____

_____

too humid? _____

_____

149 18. How does the noise level in this office compare with that of other offices in which you have worked?

/_/ More noise in present office 36

/_/ About the same 36

/_/ Less noise in present office 28

147 19. Does your office ever become so noisy that you find it difficult to work?

/_/ Yes 54

/_/ No 46

/_/ Don't know/no opinion

20. What noises bother you most as you work? (Check as many as apply.)

N

147

/_/ None 14

/_/ Office machines 29

/_/ Outside noise 3

/_/ Background music 12

/_/ Telephones 29

/_/ Voices 66

/_/ People walking around 22

/_/ Other (please specify) 4

21. Do you prefer working by natural light, artificial light or a combination of natural and artificial?

133

/_/ Prefer natural 13

/_/ Prefer artificial 7

/_/ Prefer combination 80

/_/ Don't know/no opinion

22. In general, do you think the light level, artificial and natural combined, is about right for your work?

140

/_/ About right 89

/_/ Too little light 11

/_/ Don't know/no opinion

23. Does the artificial light ever cause enough glare to bother you?

144

/_/ Often 3

/_/ Sometimes 17

/_/ Only occasionally 26

/_/ Never 53

/_/ Don't know/no opinion

24. Do you have an electrical outlet associated with your desk?

N

/_/ Yes 81

149

/_/ No 19

/_/ Don't know

If yes, please answer a, b and c.

If no, skip to question 25.

a. Is the electrical outlet located on the wall or on the floor?

120

/_/ On the wall 13

/_/ On the floor 96

b. Please check those items for which the electrical outlet is used and indicate for approximately how many hours each day the checked item is used.

119

39 /_/ Typewriter for 5.9 hours/day

21 /_/ Hand-held calculator for 3.2 hours/day

47 /_/ Desk-top calculator for 4.3 hours/day

5 /_/ Desk lamp for 6.0 hours/day

11 /_/ Coffee pot for 4.8 hours/day

14 /_/ Clock for 17.0 hours/day

3 /_/ Electric pencil sharpener for * hours/day

21 /_/ Other (please specify) _____

for * hours/day

6 /_/ None of the above

c. Would you like to have your outlet moved?

117

/_/ Yes 15

/_/ No 85

If yes, why _____

_____

_____

*Less than five in sample.

25a. Have you personally had any accidents which have occurred as a result of the electrical outlet boxes on the floor? Include even minor accidents such as tripping.

N

144 /_/ Yes 21

/_/ No 79

144 If yes, please comment Sidestepping tripping on outlet and cord (14), All others less than 2% each.

b. Do you know of any accidents which have occurred as a result of the electrical outlet boxes on the floor? Include even minor accidents such as tripping.

142 /_/ Yes 26

/_/ No 74

142 If yes, please comment Tripping (17), All others less than 2% each.

26. How important is it to you to have a window in your office or immediate work area?

143 /_/ Very important 50

/_/ Moderately important 36

/_/ Not important 13

/_/ Don't know/no opinion

27. Do you have a window or windows in your office or work area?

147 /_/ Yes 71

/_/ No 29

If yes, answer all questions.

If no, skip to question 36.

28. Are you able to see as much of the outside world as you would like from your desk?

N

104

/_/ Yes 71

/_/ No 29

/_/ Don't know/no opinion

29. Which of the following best describe the view out of the window closest to you? (Check as many as apply.)

105

/_/ satisfying	58	/_/ open	28
/_/ limited	11	/_/ bright	27
/_/ simple	6	/_/ uncluttered	7
/_/ pleasant	58	/_/ frustrating	2
/_/ confined	7	/_/ complex	1
/_/ dim	1	/_/ boring	4
/_/ stimulating	18	/_/ unpleasant	0
/_/ cluttered	4	/_/ spacious	35

30. Do you ever work using only the light from the windows?

104

/_/ Often 5

/_/ Sometimes 5

/_/ Only occasionally 10

/_/ Never 81

/_/ Don't know/no opinion

31. How about the light from the windows, does it ever cause enough glare to bother you?

103

/_/ Often 3

/_/ Sometimes 17

/_/ Only occasionally 21

/_/ Never 58

/_/ Don't know/no opinion

N

32. Does your office ever become too hot because of the sunshine coming in the windows?

97

/_/ Often 30

/_/ Sometimes 36

/_/ Only occasionally 9

/_/ Never 25

/_/ Don't know/no opinion

33. Do you ever notice cold drafts near the windows?

97

/_/ Often 32

/_/ Sometimes 33

/_/ Only occasionally 20

/_/ Never 15

/_/ Don't know/no opinion

34. Do you think the noise level near the window is noticeably greater than in other areas of the room?

83

/_/ Often 0

/_/ Sometimes 4

/_/ Only occasionally 14

/_/ Never 82

/_/ Don't know/no opinion

35. How about the size of your window, is it:

94

/_/ About right 86

/_/ Too big 13

/_/ Too small 1

/_/ Don't know/no opinion

N

36. Listed below are some of the advantages of windows. Check the three that are most important to you.

121

/_/ Let you tell time of day 3

/_/ Let sunshine in 50

/_/ Let you know what the weather is 67

/_/ Let in warmth 7

/_/ Let you see what's going on outside 18

/_/ Provide a way for fresh air to enter 19

/_/ Give a change of view to break monotony 78

/_/ Provide light for plants 7

/_/ Make a room seem more spacious 42

/_/ Other (please specify) 8 _____

37. Listed below are some of the disadvantages of windows. Check the three that you feel are the biggest disadvantages.

82

/_/ Let in too much heat in summer 82

/_/ Let in too much cold air in winter 76

/_/ Cause glare 48

/_/ Reduce privacy 1

/_/ Let in outside noises 18

/_/ Limit ways furniture can be arranged 24

/_/ Give too much sunlight 22

/_/ Present a hazard (might get broken) 20

/_/ Present a hazard (person might fall) 5

/_/ Other (please specify) 5 _____

38. Which of the following activities are a normal part of your job? (Check each one you usually do as a part of your job.)

N

/_/ Reading

/_/ Writing (including shorthand)

/_/ Typing

/_/ Using other keyboard machines (calculator, key punch, computer terminal, etc.)

/_/ Filing

/_/ Working with numbers

/_/ Making drawings

/_/ Laboratory work

/_/ Using the telephone

/_/ Interviewing or holding small meetings

/_/ Supervising the work of others

/_/ Other (please specify) _____

39. In general, how much time do you spend in your office or immediate work area?

/_/ All the time (7-8 hours a day)

/_/ Most of the time (4-6 hours a day)

/_/ Very little (less than 4 hours a day)

/_/ Other (please specify) _____

40. Do you have any other comments you would like to make about the Roanoke Federal Office Building? No comments (48), Improve HVAC

149 (temperature) system (17), More elevators (9), IMprove parking (7).

Please go on to the next page.

The following information is needed for data analysis only. It will not be used to identify any individual respondent.

41. How long have you worked in the Roanoke Federal Office Building?

_____

42. Which floor is your office on?

Floor number _____

43. Where was your last office?

_____
Number Street

_____
City State

44. Sex

/_/ Male

/_/ Female

45. Age

/_/ 17-25

/_/ 26-35

/_/ 36-50

/_/ Over 50

46. In general terms, what type of job do you have? (For example, clerk typist, supervisor, physician, etc.)

_____

_____

_____

Thank You Very Much

APPENDIX B

SPACE REQUIREMENTS WORKSHEET

SPACE REQUIREMENTS WORKSHEET

APPROVED	LOCATION	AGENCY
TITLE		BUREAU, SERVICE, ETC.
DATE	LEASE NO.	DIVISION

ORGANIZATIONAL UNIT	GRADE	NAME OF EMPLOYEE AND FUNCTIONAL TITLE	TYPE OF SPACE & PARTITION	SQUARE FEET REQD #	DESK & CHAIR: SD, PD, TB, UO, UNITIZED	MODULAR UNITS: TABLE UNITS	MODULAR UNITS: CREDENZAS	EXTRA CHAIRS	FILES: F	FILES: LF	TABLES: T, TT, TMT, TCONF	BOOKCASE SECTIONS: BC	STORAGE SECTIONS: S.S., ST	HAT TREE: CM COSTUMER (6 OR 12 HANGER)	OTHER EQUIPMENT MISCELLANEOUS REQUIREMENTS: PROVIDE DIMENSIONS
TOTAL SPACE REQUIRED					SEE OTHER SIDE FOR SYMBOLS & GENERAL INSTRUCTIONS.							BOOKCASE SECTIONS: INDICATE FILES			

REMARKS

SYMBOLS — USE THE FOLLOWING SYMBOLS TO ITEMIZE FURNITURE AND EQUIPMENT ON GSA FORM 1276. DESCRIBE OTHER REQUIREMENTS IF NOT SHOWN. * INDICATE DIMENSIONS IN PROPER COLUMN IF NON-STANDARD OR NOT SHOWN. SYMBOLS

ILLUSTRATION	SYMBOL	DESCRIPTION	STANDARD SIZE
DESKS	D	STANDARD SIZE DESK	34x60
	CD	CONFERENCE DESK	40x78
	SPD	SINGLE PEDESTAL DESK	34x45
	TDL	TYPEWRITER DESK (INDICATE LEFT OR RIGHT)	34x60
	TDR		
UNITIZED	UDL	UNITIZED DESK WITH FIXED SIDE UNIT. (INDICATE LEFT OR RIGHT)	68x66
	UDR		
MODULAR UNITS INDIVIDUAL — TABLE UNIT	MTU	MODULAR TABLE UNIT - INDIVIDUAL -	18x66
CREDENZA	CR	CREDENZA - INDIVIDUAL	18x66
MISCELLANEOUS TABLES — TABLES	T	STANDARD SIZE TABLE	34x60
	TCONF	CONFERENCE TABLE	36x72
	TS	SMALL SIZE TABLE	24x36
	TM	MEDIUM SIZE TABLE	34x45
	TT	TELEPHONE TABLE	18x24
	TWT	TYPEWRITER TABLE	18x42
FILES — F	F	LETTER SIZE FILE	15x27
LF	LF	LEGAL SIZE FILE	18x27
SF	SF	SAFE FILE	*
CHAIRS	C	ALL EXCEPT LOUNGE TYPES.	-
	LC	LOUNGE CHAIRS	*

ILLUSTRATION	SYMBOL	DESCRIPTION	STANDARD SIZE
BOOKCASE SECTIONS — BC	BC 3	STANDARD SIZE BOOKCASE (INDICATE NO. OF TIERS)	14x34 Max
BC4			
STORAGE SECTIONS	ST	STORAGE CABINET — INDICATE NUMBER OF SHELVES	18x36
	SS	STEEL SHELVES	15x36
	TC	TELEPHONE CABINET	16x24
HATS & COATS — +	+	HAT TREE	-
CM	CM 6	COSTUMER (INDICATE 6 OR 12 HANGER)	21x30
CM12			21x51
MISCELLANEOUS — DB	DB5	DRAWING BOARD - 5 FOOT	40x60
DB6		DRAWING BOARD - 6 FOOT	45x72
MC	MC	MAP CABINET OR FLAT PLAN FILE.	42x54
DI	DI	DIVAN, SOFA, COUCH, LOUNGE, ETC.	*
S	S	SAFE (ALSO SEE SAFE FILE)	*
OTHERS	AS REQD.	DESCRIBE OTHER FURNISHINGS OR EQUIPMENT IN NOTES	*

SPACE SYMBOLS -	
O	OPEN AREA
PO	PRIVATE OFFICE
CH	CEILING-HIGH PARTITION
BT	BANK-TYPE PARTITION

UTILITY SYMBOLS	
	DUPLEX OUTLET, 110V.
	TELEPHONE OUTLET
	SPECIAL OUTLET - (INDICATE VOLTAGE OR SPECIAL REQUIREMENT)

GENERAL INSTRUCTIONS

FURNISH A DETAILED LISTING OF SPACE REQUIREMENTS BASED ON PROGRAM AUTHORIZED FOR CURRENT FISCAL YEAR, PLUS ANY EXPANSION OR REDUCTION WHICH HAS BEEN INCLUDED IN BUDGET REQUIREMENTS FOR THE NEXT 2 YEARS. WHERE AVAILABLE, OCCUPANCY GUIDES ARE HELPFUL IN ASSEMBLING INFORMATION. PLEASE IDENTIFY SPECIFIC NEEDS: SHOWING ORGANIZATIONAL UNIT; AREA NEEDED FOR EACH ROOM, UNIT, OR WORK-STATION; AND TYPE OF SPACE AND PARTITIONING. (SEE SAMPLE BELOW.)

SHOW ALL AUTHORIZED POSITIONS, LISTING PERSONNEL BY NAME, GRADE AND SEX (F-7 FOR FEMALE, M-7 FOR MALE, ETC.), AND TITLE. IF POSITION IS VACANT, INDICATE IF IT IS AUTHORIZED IN CURRENT FISCAL YEAR CEILING OR FOR WHICH YEAR IT WILL BE BUDGETED.

LIST FURNITURE WHICH WILL BE PROVIDED FOR EACH EMPLOYEE, POSITION, OR ROOM, USING THE APPROPRIATE SYMBOLS (IF ADDITIONAL SYMBOLS ARE NECESSARY, PLEASE DESCRIBE AT BOTTOM OF SHEET). ALSO LIST ROOMS WITH NO PERSONNEL ASSIGNED, AND THE FURNITURE FOR SAME. OMIT FURNITURE WHICH IS TO BE DISPOSED OF. DIMENSIONS SHOULD BE SHOWN FOR NON-STANDARD ITEMS.

NOTE SPECIAL REQUIREMENTS IN LAST COLUMN AND DESCRIBE AT BOTTOM OF FORM.
NOTE WEIGHT OF HEAVY ITEMS WHICH MIGHT AFFECT FLOOR LOADING.

SAMPLE

SPACE REQUIREMENTS WORKSHEET — DATE

ORGANIZATIONAL UNIT	GRADE	NAME OF EMPLOYEE AND FUNCTIONAL TITLE	TYPE OF SPACE & PARTITION	SQUARE FEET REQD	DESK & CHAIR	MODULAR UNITS: TABLE UNIT	MODULAR UNITS: CREDENZA	OTHER CHAIRS	FILES: F	FILES: LF	TABLES	BOOKCASE SECTIONS: BC	STORAGE SECTIONS	HAT TREE	OTHER EQUIPMENT MISCELLANEOUS REQUIREMENTS
ADMINISTRATIVE DIVISION	M 14	John Doe Division Chief	PO CH	225	CD			LC 3C		2	T	2BC3		+	(1)
Secretary	F 5	Miss Mary Jones Clerk-steno	O	75	TDL		CR		3	1	TT		ST	CM6	
Reception Rm		- -	O	100				3C			T -			CM12	DI 28x72 (2)
Conference Rm		-	PO CH	150				6C LC			T CONF			+	" "
OPERATIONS BRANCH	M 13	Jim Jones Branch Chief		150	D			2C		2	TS	3C		+	
Clerk-Steno	F 4	Mill[illegible] Miles	O	65	TDR				1						
Statistical Clerk	F 7	Vacant Statistical Cl.	O	75	D			C	2		T				(3) FY 1972

NOTES:
(1) Locate next to conference Rm, with connecting doors. (2) Separate from general office by rail.
(3) Bookkeeping Machine and Table 30x42.

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WASHINGTON, DC 20234

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15. SUPPLEMENTARY NOTES

Document describes a computer program; SF-185, FIPS Software Summary, is attached.

16. ABSTRACT *(A 200-word or less factual summary of most significant information. If document includes a significant bibliography or literature survey, mention it here.)*

Within the past decade, growing numbers of architects, educators, building users and researchers have begun to question the state-of-the-art of building design. The most common complaint is that buildings do not adequately fulfill the needs of their users. This report addresses the problem by examining the need to identify, develop and apply user information as an integral part of the design process.

The study reported here was conducted for GSA at the Richard H. Poff Courthouse and Federal Building in Roanoke, Virginia. This was a limited study examining: (1) the design process, (2) the information available to those making design decisions, (3) how that information was used and (4) the effects of selective design decisions. In addition, design problems of particular interest to GSA were considered from the viewpoint of several groups involved with the design and use of the building -- GSA, the architect, the building manager, the agencies and the employees.

17. KEY WORDS *(six to twelve entries; alphabetical order; capitalize only the first letter of the first key word unless a proper name; separated by semicolons)*

Building evaluation; design process; man/environment research; post-occupancy evaluation; questionnaire; user needs.

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