TOWARDS A PERFORMANCE-BASED CONCEPTUAL FRAMEWORK FOR SYSTEMATIC POES

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ABSTRACT

To date, in the field of post-occupancy evaluation there has been an apparent lack of coherent conceptual frameworks which are systematic, practice oriented, and which tie POEs to primary uses. The application of such frameworks would include feedback to the client organization regarding the performance of a facility, feedforward into the programming and design of future similar facilities, as well as improvement and sharing of state-of-the-art knowledge concerning performance-based design criteria and guidelines through POE data bases and clearinghouses for common facility types. This paper outlines the concept of building performance evaluations and their elements, and it attempts to relate these to a possible framework for performance-based evaluation research. This in turn is the basis for systematic POEs, for which a three-level process model is presented, along with phases and steps for carrying out POEs.

INTRODUCTION

This paper suggests a more systematic and rigorous approach to POEs through the adoption of the performance concept in building evaluation. Reconceptualizing basic evaluation approaches can improve POE in fundamental ways, resulting in changes to current practice that will integrate previous improvements and proposed new ones. Increased methodological rigor and improved utility of POE results will benefit both the public and private sectors by enhancing the quality of their buildings.

This paper presents the three basic parts of a systematic framework for POEs: the concept of building performance, the performance evaluation process, and a hierarchy of databases for dissemination. These three aspects of a POE assume high-quality measures on a performance basis, a formal and rigorous methodology for evaluating measures against appropriate criteria, and a system of dissemination that is useful and accessible to practitioners and researchers alike.

For purposes of clarification, a definition of POE is offered: POE is subsumed by the higher order type of evaluation called "building diagnostics" which has both diagnostic and prognostic capabilities. POE evaluates buildings in use and has short, medium, and long-term implications, the latter being evolutionary, based upon feedforward of POE generated information. Furthermore, POE focuses on the requirements and performance of building occupants' needs, and therefore, technical performance is only considered in so far as it affects the occupants of buildings.

1. THE PERFORMANCE CONCEPT IN THE BUILDING PROCESS

The "Performance Concept" proposes that POEs be built into design and construction programs of agencies from the beginning as an integral part of the building process. Planning for a POE should begin in the programming phase for a new facility.

Systematic and rigorous POEs are predicated upon the use of the performance concept in the building process. The performance concept facilitates an objective evaluation method by comparing explicitly stated performance criteria for buildings with the actual performance as measured or perceived by building occupants and evaluators (see Figure 1).

The performance concept is based on the assumption that a building is designed and built to support, and enhance, the activities and goals of its occupants. Early work on building performance was conducted by Ezra Ehrenkrantz and his associates on the School Construction Systems Development Project in California (Educational Facilities Laboratories, 1967). This work had been inspired by concepts developed at the Institute of Advanced Technology of the National Bureau of Standards (Eberhard, 1965). Subsequent projects executed by the National Bureau of Standards for the Department of Housing and Urban Development and the General Services Administration built upon these initial efforts (Wright, 1971).

Performance Evaluation

Performance evaluation and feedback, as shown in Figure 1, relates client goals and performance criteria to the actual, objectively and subjectively measurable building performance. The concept embodies two features. First, everything shown in the shaded area is dependent upon the relativity of person/environment relationships. A second and important feature is that the evaluator is inside the shaded area, implying the relativity of perceived building performance. Because the evaluator is

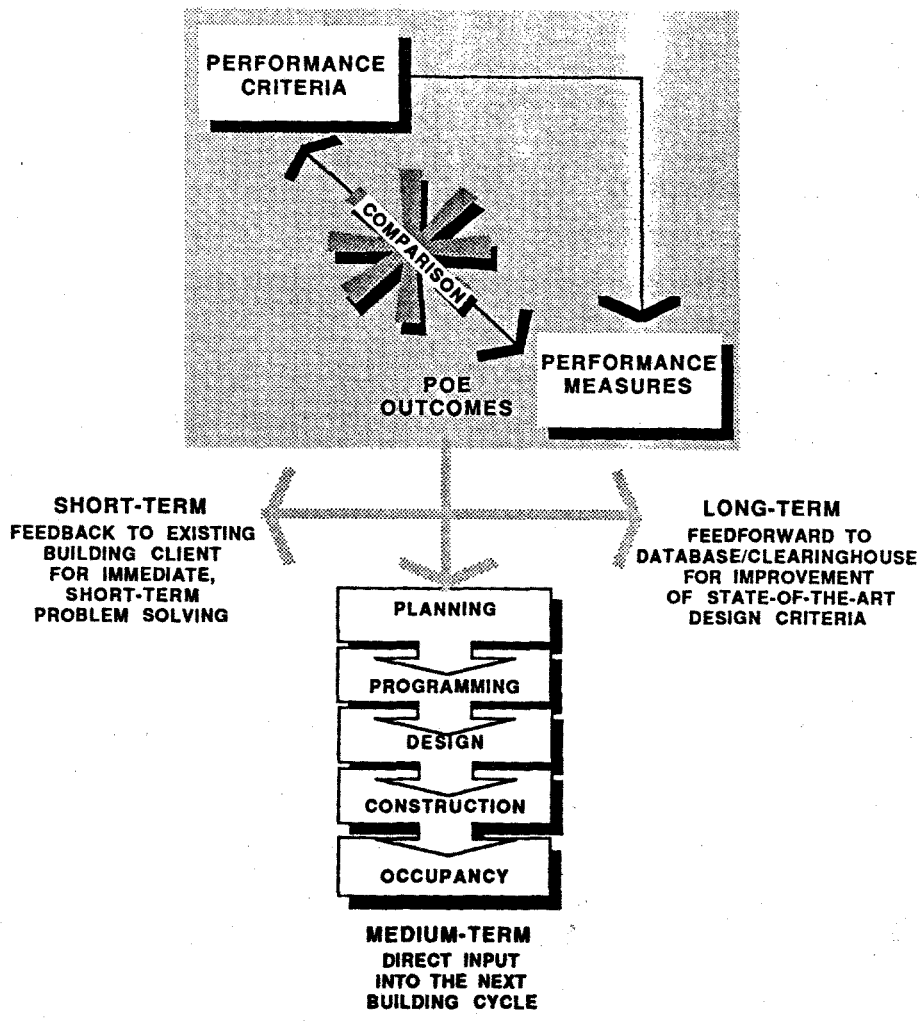

Figure 1: The Performance Concept in the Building Process and Outcomes of POEs

part of the evaluation system, he potentially introduces biases, sets the scope of the evaluation, and presents the findings to the client.

The performance concept can help improve the evaluation process by increasing objectivity and clarity of measurement, enhancing communication, providing incentives for innovation, and development of alternatives, aiding decision making, and advancing professionalism.

The term "evaluation" contains the word "value" which is critical in the context of POE since an evaluation has to state explicitly which and whose values are used in establishing evaluation criteria. For an evaluation to be meaningful, values need to be identified that govern the goals and objectives of those who wish their buildings to be evaluated, or those who carry out the evaluation. Thus, performance criteria used in evaluation are developed from goals and objectives which in themselves are derived from values held by individuals, groups, and organizations. Frequently, there are differences in values among various groups or units of the same organization.

Building Performance and Evaluation

Because the performance concept in the building process views buildings as dynamic entities, it requires a comprehensive attitude in evaluation. Performance measures are compared to performance criteria, and the differences are used as feedforward into improved planning, programming, design, and construction of future buildings, as well as the creation of data bases or information clearinghouses on building types, attributes, and occupant groups.

The elements of performance that are measured, evaluated, and used in POEs to improve buildings include three major categories: technical, functional, and behavioral. Although there are other building performance elements such as location and economics that influence physical performance and affect owners, organizations, and building occupants, the three elements listed are the most important.

2. THE PERFORMANCE EVALUATION RESEARCH FRAMEWORK

The performance evaluation research framework (Figure 2) connects the evaluation of buildings with: 1) measurement technology, 2) data bases and information systems (including clearinghouses), and 3) the development of performance criteria for buildings.

Measurement Technology

Measurement technology employs all those techniques and technological aids that are used in POE data collection and the analysis of POEs. They include interviews, questionnaire surveys, direct observation, mechanical recording of human behavior, measurement of light and acoustic levels, video recording, mapping of behavior, and still photography.

Programmatic Statements and Performance Criteria

It is essential that performance measures collected by POEs be compared with specific performance criteria in the form of programmatic statements which are contained in the program for a given facility. While these criteria can be of a general nature describing the design intent as expressed in the program (e.g., provide visual and acoustical privacy), the POE should document how the design was expected to meet these criteria (e.g., floor-to-ceiling walls, masking sound, a combination of acoustical treatments, etc.). In this way, the findings from each POE can be compared to other POE findings which address similar issues.

Often programs do not exist because of a change in use of the facility or because changes have been made to the design of the facility, without being recorded in a program. In this case it is necessary to reconstruct a program from which reasonable criteria can be developed and used to evaluate the performance of the facility. Performance criteria and guidelines are usually developed from data bases and information systems for a given agency and/or building type and from the programmatic criteria for a given facility. These criteria and guidelines are usually documented in technical manuals, design guides, or in specialized data bases. The criteria are building-specific and address particular sets of occupants and building functions. As such they are an evolving and improving set of performance "benchmarks" for a given building type. Performance criteria and guidelines feed the entire building process, and thereby the cyclic process of improving building performance can be accomplished.

Performance Evaluation Criteria

Explicit performance criteria need to be developed for purposes of evaluation and use in POEs. One needs to differentiate among the following:

* Criteria concerning the current use of a building
* Criteria pertaining to the original, intended use of a building, as documented in the program
* Criteria that pertain to the state-of-the-art in a given building type;
* Criteria which relate to management of the client organization versus those which pertain to the end users/occupants and
* Criteria as internalized knowledge and experience which the evaluators may apply as experts regarding certain building types.

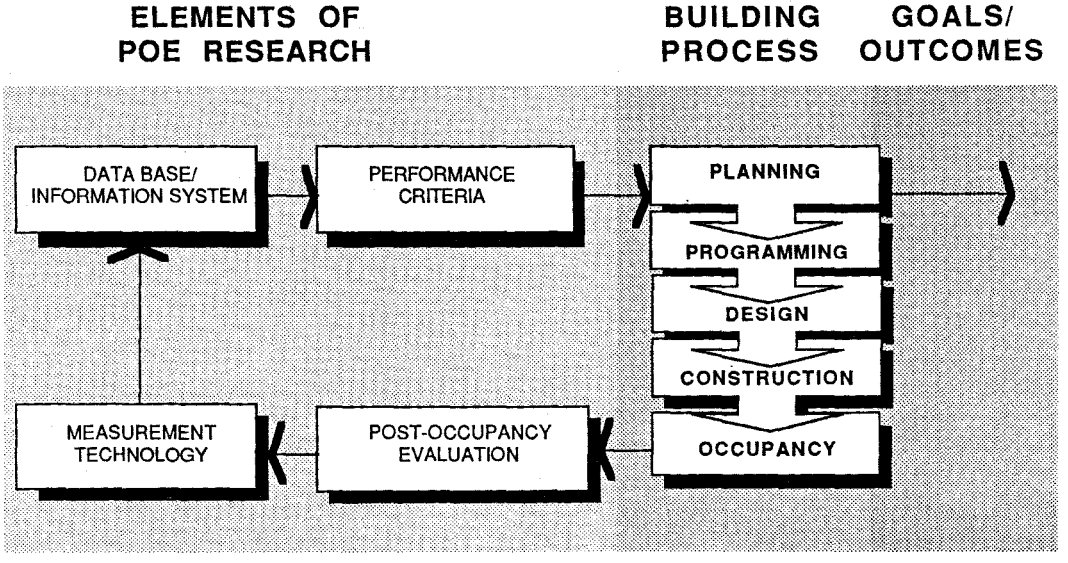

Figure 2: The Performance Evaluation Research Framework

A POE Process Model

General models of the POE process have been described by several authors in their writings (e.g., Daish et al., 1980; Marans and Spreckelmeyer, 1981). While there are variations in the process, depending on the nature and objectives of the respective POEs, three levels of effort can be generally distinguished in POE work. Preiser and Pugh (1986) described this as the "POE Process Model" and used it to outline the levels of effort involved in a typical POE. Thus, the model presented in Figure 3 is a further development of that POE Process Model (Preiser, Rabinowitz and White 1988).

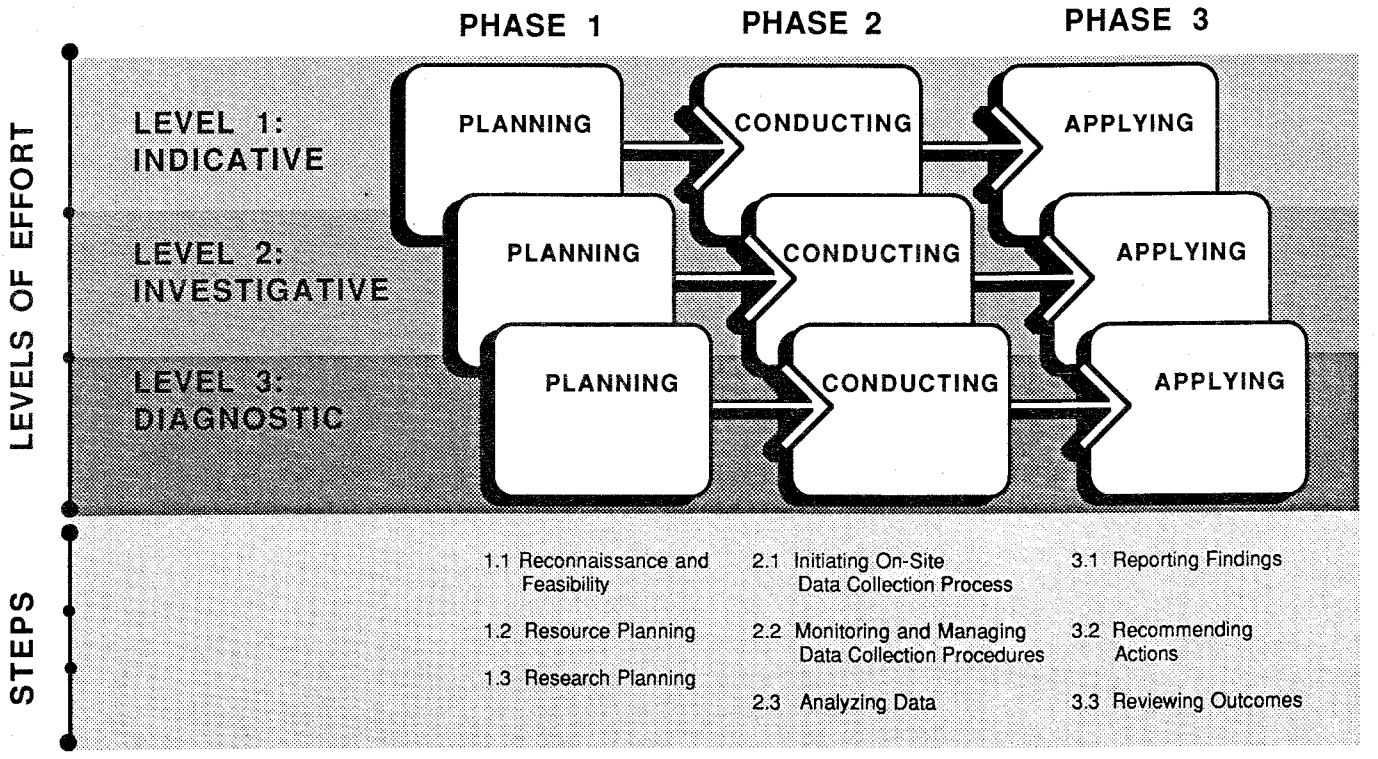

Figure 3: A Post-Occupancy Evaluation Process Model

Levels of effort refer to the amount of time, resources, and personnel, the depth and breadth of investigation, and the implicit cost involved in conducting a POE. The three levels are: 1) indicative, 2) investigative, and 3) diagnostic. Each higher level requires more data gathering and is more comprehensive than the previous level, as depicted in Figure 1.

1) Indicative POEs give an indication of major strengths and weaknesses of a particular building's performance. They usually consist of a walk-through and selected interviews with knowledgeable informants.

2) Investigative POEs go into more depth. Objective evaluation criteria are explicitly stated.

3) Diagnostic POEs require considerable effort and expense, they are time consuming, and utilize sophisticated measurement techniques. They correlate physical environmental measures with subjective occupant response measures, thus providing a higher degree of credibility for the results.

In carrying out a POE, there are three basic Phases with three steps in each:

1. Planning Phase
   - 1.1 Reconnaissance and Feasibility
   - 1.2 Resource Planning
   - 1.3 Research Planning

3. Applying Phase
   - 3.1 Reporting Findings
   - 3.2 Recommending Actions
   - 3.3 Reviewing Outcomes

Benefits and Limitations of Current POE Practice

Each of these POEs can result in several benefits and uses. Recommendations can be tied back to the client, and remodelling can be done to correct problems. Lessons learned can influence design criteria for future buildings, as well as provide information about buildings in use to the building industry. This is especially relevant to the public sector which designs buildings for its own use on a repetitive basis.

The many benefits which result from conducting POEs are listed below. These benefits provide the motivation and rationale for committing to POE as a concept and for developing POE programs for the following reasons:

1) Short-Term Benefits

* Identification and solutions to problems in facilities

* Pro-active facility management responsive to building user values

* Improved space utilization and feedback on building performance

* Improved attitude of building occupants through active involvement in the evaluation process

* Understanding of the performance implications of changes dictated by budget cuts

2) Medium-Term Benefits

* Built-in capability for facility adaptation to organizational change and growth over time, including recycling of facilities into new uses

* Significant cost savings in the building process and throughout the building life-cycle

* Accountability for building performance by design professionals and owners

3) Long-Term Benefits

* Long-term improvements in building performance

* Improvement of design databases, standards, criteria and guidance literature

* Improved measurement of building performance through quantification

3. DATA BASE DEVELOPMENT

In the performance concept data collected in POEs are input into data bases, information systems or clearinghouses. These can provide a much needed focus for the sharing of POE results, and they represent an activity which is guided by organizations and associations concerned with specific building types, such as offices, schools, or housing.

At this time, only one clearinghouse which disseminates POE research exists, i.e., AEPIC, the Architecture and Engineering Performance Information Center at the University of Maryland in College Park. It was created to collect and distribute information on technical failures in buildings. Its information core comes from the files of a major insurance company which donated them to the center.

Traditionally, POEs have been used to provide feedback to three groups: the programmers and designers of a buidling, and the facility managers. Facility managers are most likely to use information derived from POEs if they initiate the POE process. Programmers and designers initiate POEs in order to determine the degree to which occupants use the facility as it was intended, and the levels of satisfaction with specific attributes of the facility. While POEs can continue to serve designers, programmers, and facility managers, new opportunities for using POE data should be considered in connection with data bases that will become increasingly available, as well as knowledge-based systems which can encode decision rules and inference logic.

POE data should be incorporated into three types of databases. First, POE data should feed into a project data base which would also contain information produced in connection with each phase of the planning/programming/design/building process for a particular facility (i.e., programming design and performance criteria, engineering data, specifications, construction data, etc.). It would be maintained throughout the life of the facility and would be used by its facility managers and occupants for occupancy and maintenance activities, and further, by facility managers, and architects for renovation and expansion of the facility. Maintenance and use of the database over time would suggest that new information about the facility and its occupants be re-introduced through periodic POEs. The project data base, including data from the POEs, could also provide information to programmers/designers and owners/clients who intend to build another facility of the same type.

In addition to providing data for a project database, POEs can generate input into an accumulative projects data base. This database would be maintained by a public or private organization responsible for a particular facility type. The availability of cumulative project data bases can be the vehicle for storing and accumulating new information. Finally, POEs can serve the building industry and design community more generally by providing input to a generic data base covering buildings, building occupants, and the manner in which they interact. Such a data base could be maintained by professional organizations such as the American Institute of Architects or the International Facilities Management Association, by a government agency such as the National Bureau of Standards, or the General Services Administration), by a not-for-profit group like the International Center for Facilities, or by a university-affiliated data base archiving organization (see Figure 4).

4. LIABILITY CONSIDERATIONS

A final consideration of the performance concept of building evaluation concerns lawsuits. A POE-induced lawsuit could occur if appropriate safeguards are not taken beforehand. If, for instance, the POE is critical of the design

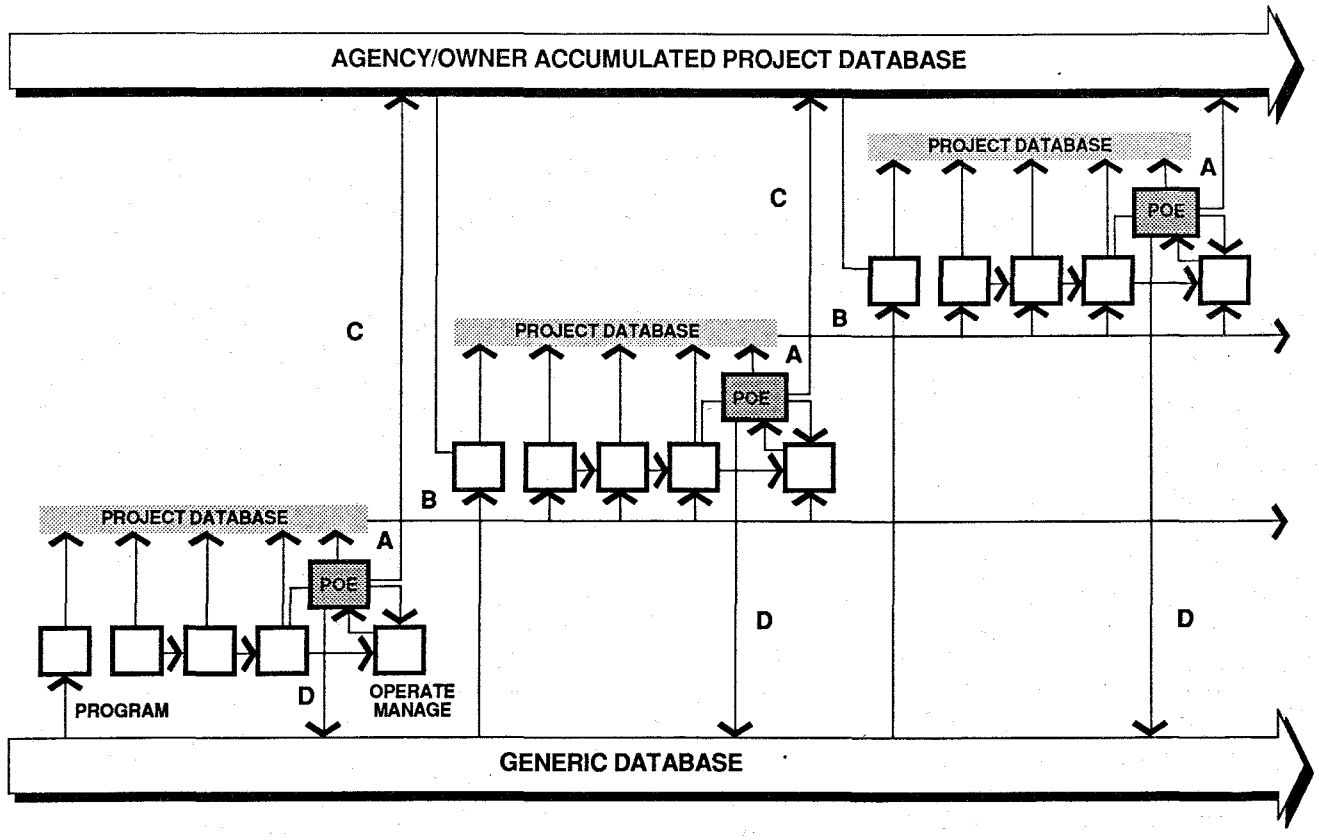

Figure 4: POE Data Base Development

entity for failing to satisfy the previously stated needs of the occupant, a dissatisfied owner or occupant could use the POE as the basis for a lawsuit. Besides generating ill-will, the POE team could become involved as witnesses or as third-party defendants.

In order to make POE as effective as possible, everyone involved or affected by the process should be able to approach it without fear of litigation. The parties could agree before a POE is performed that the POE would have no evidentiary value and that no one will have any liability as a result of the POE process. The POE team could be given contractual assurances through indemnity clauses that the owner will pay for the defense of any lawsuits, for any damages that might be awarded by a court, and for the time involved in the litigation process. On public projects, the POE team should be protected by legislation.

5. CONCLUSION

The performance concept and framework for systematic evaluation of the built environment as presented in this paper is a much needed and timely methodological approach toward achieving higher quality in buildings, accountability in the building process, and ultimately better building utilization and user satisfaction. Making explicit the performance requirements that are expected from a building, designing a building accordingly, and eventually comparing the actual performance of the building with that which was initially stated in the building program is the basis of the performance concept advocated for use in POEs.

Thus, post-occupancy evaluations can be carried out systematically and, as outlined in the POE Process Model above, yield comprehensive information in a cost-effective manner.

Foot Notes

Figures 1, 2, and 3 were produced by Architectural Research Consultants, Inc. of Albuquerque, NM and first appeared in Post-Occupancy Evaluation by Preiser, W.F.E., Rabinowitz, H.Z., and White, E.T., New York: Van Nostrand Reinhold, 1988. Permission of the Building Research Board and Van Nostrand Reinhold for the use of these figures and excerpts in this paper is gratefully acknowledged. The contributions of BRB staff member Ron Goodrich and committee members Art Kornblut and Robert Marans who provided the legal commentary and the data base development material, respectively, deserve special mention.

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