



Construction Industry Institute®

Evaluation of Design Effectiveness

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**Prepared by
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SUMMARY

Design is basically a subjective process which is influenced by many factors. Nonetheless, it provides a project's central point of translation of ideas into specific instructions.

This publication is the first of several relating to the design function. The purpose is to present a *method* for evaluating design effectiveness. Subsequent publications will provide additional data for use in such evaluations as well as information relating to the factors that influence the design process.

The method presented herein is for evaluation of a design, not a designer. It is recognized that many parties and factors influence the final design product. The proposed method is based upon the following seven evaluation criteria:

- Accuracy of Design Documents
- Usability of Design Documents
- Cost of Design
- Constructability
- Economy of Design
- Performance Against Schedule
- Ease of Start-Up

Not all of the criteria influence a design to the same degree. A method is presented for combining weights and performance ratings of the seven criteria into a single performance index. The method utilizes an objectives matrix approach and provides the flexibility of using a variety of criteria, weights, and measuring systems to compute the performance index. An example is shown, using piping design, for calculating the performance index.

The method has the flexibility to be useful in a wide variety of circumstances, including:

- a. Widely differing types of products
- b. Mixtures of objective and subjective measurements of design effectiveness
- c. Differing objectives and criteria for design effectiveness
- d. Measurement of overall design effectiveness regardless of influence source, or measurement of designer performance when influences of designer and owner can be separately identified

The ability to measure design effectiveness using the proposed method represents an important step in a broader effort to improve the total design process. Such a broader effort encompasses identification of the effect on design effectiveness of (a) various inputs to the design process and (b) the systems and techniques employed by the designer.

INTRODUCTION

Design is basically a subjective process, limited by rules of mechanics and physics, but oriented toward optimizing certain features as determined by a client and reflected in the stated criteria of the client. Many additional factors, such as schedule requirements, vendor capabilities, environment, and cost also must be incorporated into the design process. Nonetheless, design is perhaps the most central point of definition for a project in that ideas and information are transcribed to paper in the form of specific and coordinated instructions for the project's construction and documentation.

The Construction Industry Institute (CII) Design Task Force was established in the spring of 1984. Its activities relate to the management of design and are organized into the three general areas listed below:

- Inputs to the Design Process
- The Design Process Itself
- Outputs of the Design Process

Identification and evaluation of the factors influencing design (*inputs*) are presently underway in a separate study. Studies related to the design process itself will be undertaken at a later date. This publication is related to studies of *outputs* or products of the design process, and is specifically limited to presenting a method for evaluating those outputs. Subsequent publications will address other activities of the task force.

MEASUREMENT OF DESIGN PRODUCTIVITY

Increasing attention has been given in recent years to productivity and productivity improvement in the industrialized nations. In the United States, particular interest has focused on productivity in the construction industry, which is often criticized for slow technological growth and escalating costs. Yet productivity studies often yield less than satisfactory results because of the difficulty in establishing industry standards of measurement. The need for standardized methods of measurement and a common database has been emphasized by The Business Roundtable's Construction Industry Cost Effectiveness (CICE) Project¹. Indeed, one of the early task forces established by CII was to study productivity measurements useful in the construction phase of a project.

Measurement of design productivity is perhaps more difficult than measuring productivity in the construction phase. Simplistic measurements such as cost per drawing or work-hours per drawing have obvious limitations because of variations in drawing size and content. Also, an increasing realization is that the real measures of the effectiveness of the design effort are found in the construction, start-up, and operational phases of a project. Thus, it may be more beneficial to develop a method for evaluating the effectiveness of a design rather than the productivity during the design activity itself.

In evaluating design effectiveness it must be recognized that the owner may have as great an influence as the designer on the final result. Among the impacts of the owner are proprietary technology inputs, design requirements or constraints, schedule or cost constraints, and changes imposed while the design is in progress. Furthermore, design effectiveness must be measured with recognition of the objectives of the owner rather than against absolute or independent criteria.

This publication presents a method for systematically evaluating the effectiveness of a design project. The method has the flexibility to be useful in a wide variety of circumstances including:

- a. Widely differing types of projects
- b. Mixtures of objective and subjective measurements of design effectiveness
- c. Differing objectives and criteria for design effectiveness
- d. Measurement of overall design effectiveness regardless of influence source, or measurement of designer performance when influences of designer and owner can be separately identified

The ability to measure design effectiveness using the proposed method represents an important step in a broader effort to improve the total design process. Such a broader effort encompasses identification of the effect on design effectiveness of (a) various inputs to the design process, and (b) the systems and techniques employed by the designer.