



**MODEX:
AUTOMATED DECISION SUPPORT
SYSTEM FOR MODULAR CONSTRUCTION**

Bureau of Engineering Research
The University of Texas at Austin

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The purpose of this publication is to make available to industry the results of research conducted by the Construction Industry Institute (CII). The publication does not necessarily represent the views of CII member companies, but is offered as a contribution to the industry.

CII was founded in 1983 to improve the cost effectiveness of the nation's largest industry. The members, who represent a broad cross-section of owners and contractors, believe that many of the problems that limit cost effectiveness are common ones, and that real improvements can be best accomplished in a cooperative environment with the benefits being shared by the construction industry at large.

CII uses the acronym TOPICS to describe the research effort. TOPICS signifies the six research thrust areas: Technology, Organization, People, Information, Controls, and Sigma (meaning others). The task forces for each area are listed below.

Technology

- Advanced Technological Systems
- Computer Integrated Design & Construction
- Design
- Electronic Data Management
- EPC Flexibility
- Environmental Remediation Technology
- Modularization
- Technology
- Technology Strategy
- Technology Survey

Organization

- Constructability
- Constructability Implementation
- Contracts
- Project Change Management
- Partnering
- Pre-Project Planning
- Project Organization
- Project Team Building
- Project Team Risk/Reward Allocation

People

- ADA Impacts
- Construction Work Force
- Continuing Supervisory Education
- Drug-Free Workplace
- Education and Training
- Employee Effectiveness
- Safety
- Zero Accidents

Information

- CICE Impact Evaluation
- Industry Data & Statistics
- International Construction
- Owner Engineering Organization

Controls

- Change Order Impacts
- Contracting; Phase II
- Cost/Schedule Controls
- Dispute Prevention and Resolution
- International Standards
- Materials Management
- Overtime
- Productivity Measurement
- Quality Management
- Quality Performance Measurement
- Schedule Reduction
- Total Quality Management

Sigma

- Barriers to Implementation
- Construction 2000
- Insurance
- Piping Function
- Retrofit Projects
- U.S. Navy Demonstration Project
- Workers Compensation

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for Modular Construction**

**Prepared by
The Construction Industry Institute
Modularization Task Force**

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EXECUTIVE SUMMARY

This document is presented as a reference for industry professionals to examine the feasibility of modularization. The purpose of this document is to introduce a decision support system that enables the user to perform an initial feasibility study on the use of modular construction.

The motivation for this research is threefold:

1. A lack of documented information about modularization decision support and the need to compile knowledge from experts in the field.
2. The absence of a systematic process to perform modularization feasibility studies.
3. The development of a computer-based application tool to aid Engineering and Construction industry professionals and owners in the performance of an initial feasibility study.

This summary document introduces a new decision support tool, MODEX (MODularization EXpert). This PC-based program enables owners and engineering and construction (E&C) firms to make preliminary engineering decisions regarding the use of a modular approach to plant design and construction during early planning and conceptual design phases. Based on initial feedback from E&C decision makers, MODEX can determine if the use of a modular design can contribute to significant cost savings in facility construction and operation.

INTRODUCTION

Why Modular?

Construction professionals who have “stick-built” a plant may have experienced weather problems, material delivery delays, out-of-sequence construction, labor interruptions, or excessive cost overruns. A modular approach to plant construction might have alleviated some of these problems. (See definition of a module in Appendix A.)

At the beginning of any major construction project, both the owner and the contractor make many decisions that will impact project outcome. These construction professionals can choose from an assortment of approaches which affect the time, cost, and quality of the project. As an alternative to traditional construction techniques, modularization is an approach which can, when used effectively, improve the overall quality of a project while reducing time and cost.

At one time, modularization was a controversial issue among many owners and construction firms, although it was accepted and used for certain projects. One major problem was the determination of ideal project characteristics. No widely available and commonly-accepted quantitative or qualitative methods for performing modularization feasibility studies existed. In many of the successful historical cases of modularization in industrial construction, an expert in the field had to be consulted before a decision was made.

Many owners and E&C firms, however, needed a simpler, more expedient procedure to determine the feasibility of modularization. The advent of the personal computer and its accessibility in the construction industry has made it possible to implement a computerized decision support system to accomplish this task.

The Tool

The research summarized in this document has led to the development of a decision support tool to enable project personnel to perform quick and simple preliminary modularization feasibility studies. The decision support system framework is the result of numerous interviews with experts in industrial project modularization. The decision support process focuses on three major issues:

- If the plant can be modularized
- If the plant should be modularized
- Potential savings of modularization (cost and/or schedule)

MODEX results will confirm the level of confidence and potential for modularization. Since the results represent an initial feasibility study, the user should proceed with a detailed modularization study prior to implementation and project execution.

The research in this document is described in CII Source Document 72 in terms of the following:

- Acquiring and structuring the knowledge of experts in the field through knowledge of engineering and construction procedures.
- Developing a decision model for modularization feasibility.
- Developing a decision support system for modularization feasibility and sensitivity analysis.

This system should enable any construction professional to define the characteristics of a particular project, and to determine the feasibility of modularizing the project. This application should enable the user to perform a sensitivity analysis to determine the effect of each decision factor on feasibility and/or projected savings.

Purpose

The purpose of this document is to:

- Discuss the factors influencing the pros and cons of modular versus "stick-built" construction of industrial facilities.
- Introduce a PC-based computer program to assess any potential benefits that modular construction may offer relative to the conventional "stick-built" method.