Fact Sheet:

Knowledge Base for Alternative Construction Methods

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The Problem

The U.S. Army Corps of Engineers (USACE) usually takes a single approach in its acquisition (design, procurement, and construction) of military facilities. However, other private and public construction markets are increasingly accepting and using other facility acquisition methods and innovative building technologies. Developments, such as new management systems, new materials, and new processes in construction, are increasingly being explored. The House of Representatives Committee on Appropriations recognized potential advantages in these alternative construction methods and asked that the Department of Defense use them more often where advantageous. The Corps does not have much experience using some of these different approaches. Therefore, a system is needed to provide guidance and track experiences using alternative construction methods on military projects and to transmit that knowledge to others who will use these methods in the future.

The Technology

The U.S. Army Construction Engineering Research Laboratories (CERL) has developed a Knowledge Based Expert System (KBES) to assist Corps management and technical personnel in using the Design-Build method of construction contracting. KBES is an intelligent computer program that uses

knowledge and inference to solve problems. Developing a way for the program to process, identify, and represent knowledge is essential for making KEBS a useful advisory tool.

The Design-Build Advisor KBES uses an object-oriented representation scheme, which means that the steps in its "thinking" process and the decisions it makes are represented as objects. Elements of project-independent and project-dependent knowledge are represented as attributes of each process step. Relationships and heuristics are represented by rulesets. Capturing, organizing, and synthesizing process knowledge and providing it to a project planner or manager for any activity, at any time, is the primary goal of the Design-Build Advisor. The Design-Build Advisor provides advice in three levels of detail. The first level is a graphic "road map" of the Design-Build process that describes the activities and decisions encountered throughout a Design-Build project. The second level contains general advice about conducting each activity. This advice would apply to any Design-Build project and would contain guidance similar to that found in a text guidance document. Examples would include general information on selecting a project for a Design-Build approach, preparing specification documents, or evaluating the technical merits of a Design-Build proposal. While this advice is useful, it often does not address all the specific conditions of each individual project. For example, specification content, proposal content, and the criteria on which a contractor will be selected may differ from project to project. The third level of advice provides project-specific guidance. In response to queries from the system, the user provides information representing specific project conditions, such as local Design-Build practices, the applicability of commercial engineering standards, and mission-critical project features. Advice is then provided that reflects the specific project conditions.

The overall structure of the Design-Build Advisor will allow for updating and upgrading of knowledge as greater expertise is developed. It will also allow for the inclusion of additional types of alternative construction methods.

Benefits/Savings

KBES will support decision-making and management of military projects using alternative construction methods by making advice and lessons-learned available from those who have conducted similar projects. Personnel with little first-hand experience in a particular alternative construction method will benefit from the expertise gained through others' experiences. As a result, a project will have a greater chance for success, even though those managing it may have limited experience. Furthermore, the system generates a comprehensive record of a project's progress and results, allowing for a more accurate assessment of an alternative construction method's effectiveness, and enabling the upgrading of advice and guidance.

Status

Military Construction, Army (MCA) and other selected military construction projects currently using Design-Build construction are being monitored. USACE has had positive experience with the MCA projects. Two Physical Fitness Centers were designed and constructed for approximately 29 percent and 16 percent less than estimated for conventional procedures. The design and construction of a commissary was accomplished in approximately half the time that it would have taken using conventional procedures. Design-Build procedures enabled an Unaccompanied Officers' Quarters to be built when using conventional procedures might have jeopardized the project.

A field-ready Design-Build Advisor has been transferred to Headquarters, USACE for implementation, pending final field review and revisions.

Point of Contact

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