

## CIB W-78 : Integrated Computer Aided Design

### DESIGN SYSTEMS IN PRACTICE AND EDUCATION

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This short written contribution is structured in a way which is intended to promote discussion. It deals in turn with:

- i) the area of competence of the author
- ii) the concepts underlying ABACUS software
- iii) experience gained from its application
- iv) considerations for the future

A fuller discussion is given in the Chapter "The Impact of Computer-Based Models on Design Decision-Making" in Rebuild (Ed. Derricott and Chissik, John Wiley).

#### 1. Area of Competence

This contribution is concerned with

- design decision-making rather than design management
- the quality of the built environment rather than office profitability
- early conceptual design rather than production information
- client and user rather than architect and developer
- design rather than computing

#### 2. Concepts Underlying ABACUS Software

The ideas underlying the work of ABACUS are as follows

- computer-aided appraisal can be thought of in systems terms: input consists of the form and fabric of the design hypothesis; output consists of the cost and performance consequences of the input, predicted in the context of site, climate, etc.; feedback is via the designer.
- the appraisal suite and its associated databases should be constructed modularly to allow certain aspects of cost and/or performance to be modelled with greater or lesser rigour.
- the suite should be as applicable to parametric investigation of the causal relationships between design decisions and cost/performance consequences as to the design of a specific building.

#### 3. Experience Gained from Application of the Software

From the use of the software in practice and in education, the following conclusions can be drawn:

- improving the search for solutions. Access to programs which predict dynamically the cost and performance characteristics of optional design proposals can increase the scope of search for good solutions by up to tenfold. Not only is the search coverage extended, it is also directed more purposefully because designers are able to compare the quality of any one tentative solution against the quality of all previous solutions.

- Better integration of design teams. In conventional working a great deal of design time is lost as proposals are passed to and fro between the architects (who tend to be the 'originators') and the other specialist members of the design team (who tend to be the 'checkers'). Quite frequently the scheme on which the architect has lavished time and effort is found by one or other of the specialists not to be feasible. With access to appropriate appraisal techniques embodied in computer programs, it is possible to check a proposal against a wide range of criteria from the outset of the design activity. Moreover, it is entirely practical (although not yet a widespread working method) for all members of the design team to have access to, and operate on, the common design model whether or not they share a design office. The models, then, can provide a strong integrating force in design team working.
- improving design insights. Apart from the use of appraisal programs to search for better designs, the programs can be used in a research and development context to provide insights into the way in which particular design decisions affect cost and performance. Typically, a designer working in this mode would select an existing building for study, then, keeping all other design variables constant as far as possible, would vary one factor systematically while recording the cost/performance output from the program. In this manner, the architect can establish sets of causal relationships which provide powerful insights into the structure of design decision-making.
- distinguishing objective and subjective judgements. Contrary to the early fears of many architectural practitioners, the use of CAAD techniques focuses increased attention on subjective value judgements rather than less. As measurable attributes of optional designs are made more explicit, the necessary value judgements are forced to the surface of the design activity and thereby themselves become more explicit. The effect of this is to make it clear to designers and their clients which judgements are based on quantifiable criteria and which are based on subjective and intuitive concepts.

#### 4. Considerations for the Future

Some of the questions which should be addressed by W-78 are

- can we conceive of more appropriate mechanisms for the manipulation of 3-D geometry?
- can feedback on cost/performance be instantaneous?
- can we agree the form and content of a building database on which any appraisal module can draw?
- can we close the appraisal/analysis loop to provide forward inferencing in the search for good solutions and if so how does this relate to expert systems?