RESEARCH IN AUTOMATION OF BUILDING IN ISRAEL
(PANEL DISCUSSION)

ABRAHAM WARSZAWSKI

Building Research Station
Technion - Israel Institute of Technology, ISRAEL

Abstract An important part of research and development activities, at the Building Research Station of Israel, deals with automation of the total building realization process. The research projects, which are being carried out for this purpose, involve automation of design, of construction planning, and robotization of building works.

The objectives of the research and development effort at the Building Research Station of the Technion are the following:

- to improve the quality of building.
- to make its construction process more efficient.

The research takes place in five major disciplines, dealing with the following subjects:

- structural analysis of building systems and components.
- physical performance of buildings.
- architectural and functional performance.
- building materials and technology.
- construction management and economics.

The first three disciplines deal mainly with the improvement of building performance. The other two are mainly concerned with the efficiency of the building process.

The department of building materials and technology, at the Building Research Station, is engaged, among others, in development of high strength concrete, lightweight concrete, and composite elements which combine the features of both. It also examines the employment of polymeric materials for various finish works in building to make them more effective and more labor efficient.

The department of construction management and economics is engaged in two main subjects: the improvement of workers' productivity - as a group and as individuals, and the automation of the whole building process. The purpose of automation is to reduce, as much as possible, the human involvement in the routine design and construction works. For this end the building uses prefabricated structure and exterior walls, which are subsequently assembled and completed on the building site with automated finish works. The ultimate scheme of an automated building realization process is shown in Fig. 1. The process consists of several groups of activities: the design - preliminary and detailed, the construction planning and construction on site, the production planning and production of prefabricated elements, the control of production and construction, and various associated clerical activities.

The research and development in this automated building process focuses today, at the Building Research Station, both on the building design and on the building construction activities.

The building design is a subject of four research projects. The first engages in analysis of a data base for building information, which is to be used by all parties to a building process. The structure of the data base, the types of information to be included, and the access and updating methods are examined. The second project deals with preparation of a preliminary design of a building, based on owner's performance specifications and various information items stored in the data base. The third project develops a computerized system for evaluation of a preliminary design for conformance to codes and specifications of the various aspects of building performance. The fourth project deals with a system which automatically derives a detailed design of components to be prefabicated from the preliminary design compiled in the former stages.

The construction planning is examined in three research projects. One project deals with the scheduling of construction in a building complex executed with conventional construction methods. An expert system, developed for this purpose, is to indicate the number and composition of the building teams, their pace of progress and schedule. The second project deals with planning of robotized construction. It indicates the location of robot work stations, the content of work in each station, the duration and cost of robotized construction. The monitoring of the construction progress, with an aid of a graphic CAD system, has been investigated in a third project.

The automated construction is investigated with respect to two types of robots. One - for finishing of the building interior - has been explored in four research projects which were described in the keynote lecture on this subject. A fifth project, dealing with interaction between the robot and its environment, is to be started shortly. Another project deals with automation of a crane to be used for assembling of prefabricated components. The feasibility of the automated crane application to other building activities is also examined.

Another aspect of the integrated building procedure, which will be examined in the near future at the B.R.S., has to do with automated planning and production of prefabricated components.

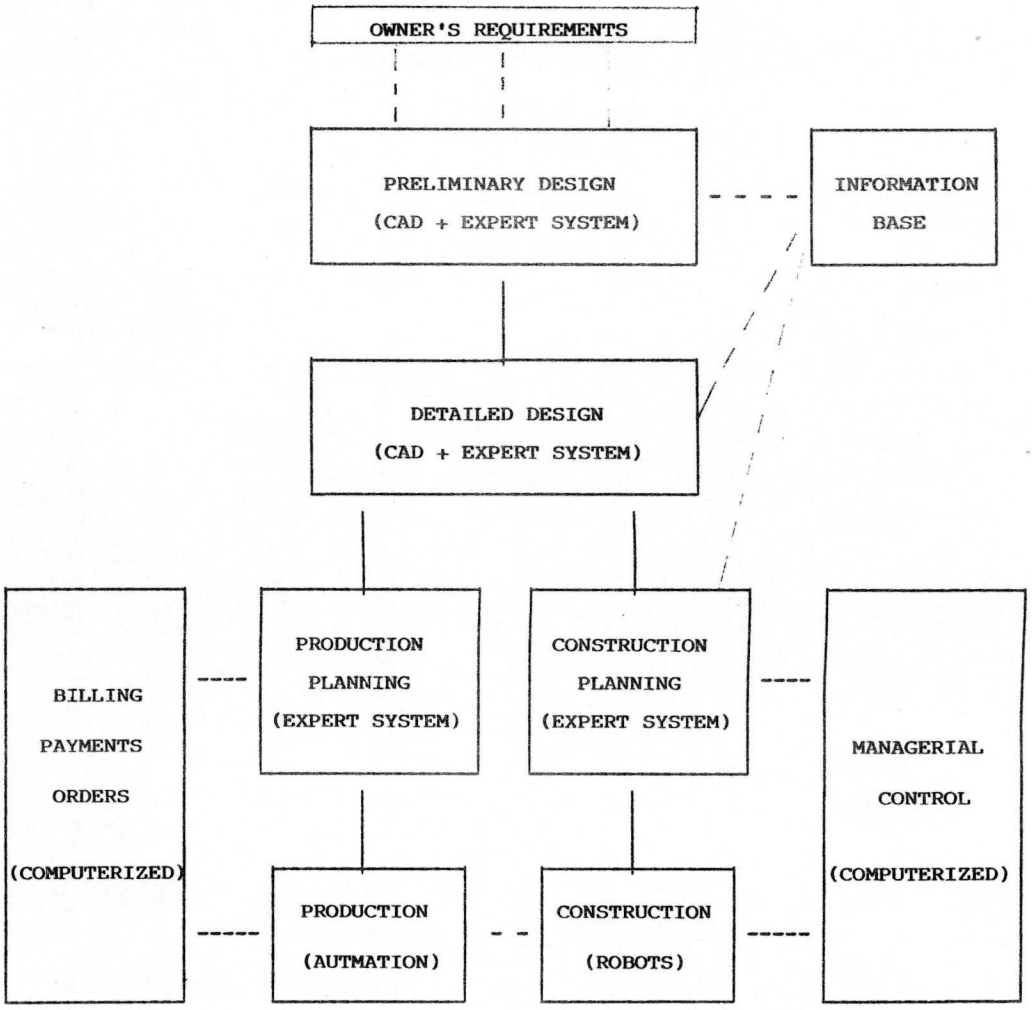

Fig. 1 - The automated building realization process