

## From CAD to iAD

### *A Web-based Steel Consulting of Steel Construction in Architecture*

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**Abstract.** Information technology has become so powerful that what is conventionally called CAD might evolve to iAD (Internet Aided Design) (Zhou 2000). For Internet applications in the AEC industry, most of the efforts and success have been concentrated on project management and collaboration, while in the design and engineering consulting area, limited progress has been made. At the same time, contemporary development has not changed the nature of the fragmentation of the AEC industry. Based on previous research of surveys of development of Internet applications in the AEC industry (Zhou 2001), and the proposal of conceptual model of Internet-based engineering consulting in architecture (Zhou2002), we try to apply these theories and concepts into a specified area, steel construction consulting for architects. In previous research, first of all, we defined the contents and scope of steel construction consulting and their potential application. Second, we proposed a solid working model covering structure organization, audience, services provided and technology. In this research, a web-based application will be out by prototyped by conducting a conceptual design consulting in steel structure in order to show the whole process of how this Internet-based consulting model works.

**Keywords.** Internet Aided Design, Web-based Engineering Consulting, Dynamic Web design

### 1. Working model organization: behavioral approach

The relationship between new technology and designer's behavior has been an interesting phenomenon in design fields through out the industry period. Figure 1 shows the cycling development of such relationship. Technology changes the way of people's working. After people get used to certain kind of technology and tools, the relationship between human behavior and technology become stabilized and harmonious. As new technology develops and introduce to existing working environment, the conflict happens between them. People struggle and are unwilling to use the unfamiliar and uncomfortable tools unless these new tools show great advantages and profitability in their practice.

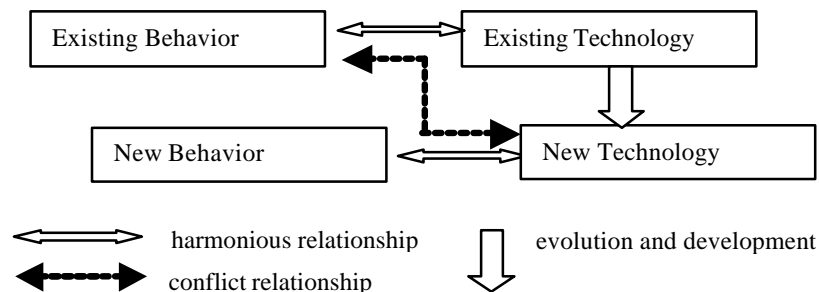


Figure 1. The Relationship of Behavior and Technology

**Procedure or process.** Figure 2 shows the conventional working procedure of structural consulting for architects in the entire design process from planning to construction. We only concentrate on earlier process for conceptual design and preliminary decision making of steel structural systems. Normally, there are four steps leading to make the preliminary decision on the structure system. First of all, architects have to understand the function and requirement of client's desired building. Secondly, based on the thorough investigation of building function, architects have their initial space studies, and then form-giving is another natural behavior. Upon this step, all basic geometric parameters for designed building have been made. Next step, that is step four, the preliminary decision on selecting the structure system must be made. In this proposed working model, every consulting procedure is designed to follow the above steps, which makes architects feel familiar and comfortable.

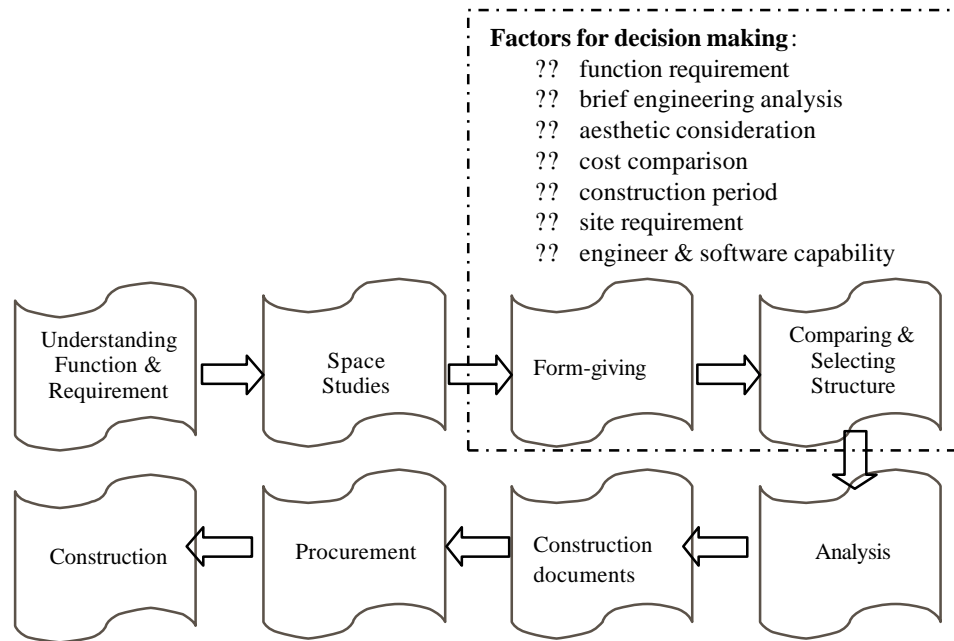


Figure 2. Typical Procedure of Structural Consulting in Architecture

**Interface.** User-friendly interface is another key factors for any online application system to succeed. In previous chapter of proposing a conceptual model of engineering consulting in architecture, we already discussed interface issues regarding new technology and tools, such as, 3D object, voice input and so on. Here we will focus on pen-pencil sketch method as a more behavioral approach while asking designer to input geometric shapes and parameters in consulting of conceptual structural generations. This consulting application provides multi-choices for importing basic geometric parameters. One of them is to select and reorganize the basic shapes on platform provided by the system. The other is to send user's space study shape to the consulting system by uploading standard CAD drawing formats, such as DWG or DXF. This method has been successfully and widely used in the design profession.

## 2. Consulting Process and Web Design

In this prototype simulation, we will take steel structure as the application content and limited to conceptual design phase. Figure 3 shows the general

web site organization of this consulting process. Design consulting is the main focus here.

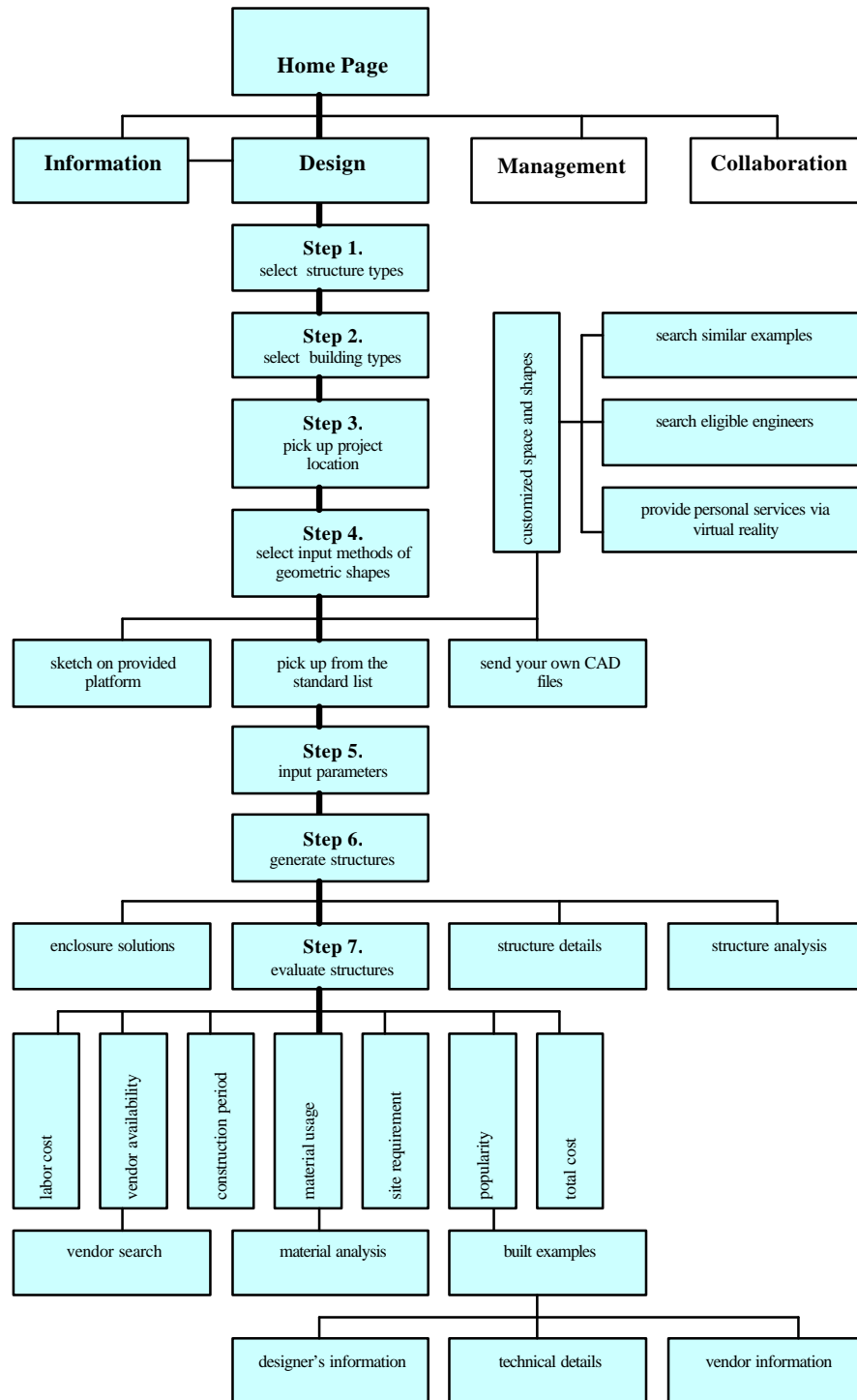


Figure 3. Consulting Process and Web Structure

There are a number of key steps in steel structure consulting during the conceptual design period. First, the system asks the designer to input three kinds of data: building type, structure type and project location, by which, the system can recognize and basic project conditions, such as, building codes, structural loads and physical environment. The second step is for user to decide geometric shape based on previous space study. Three choices for user to input: select from provided shape list, send designer's own CAD files, or sketch on the sheet-like platform. After getting all the above information, it is ready for the system to generate structure systems. Next step is to evaluate these systems by the factors of material usage, labor cost, vendor availability, total cost and so on. Designer can make preliminary decision on the specific considerations. There are hyperlinks to both in-house database and external resources, such as vendor search, built examples related to certain structure system.

### 3. Future Research

In the future research, there will be a number of issues to be further implemented as follows:

1. Continue to review Web Services technology and its application in manufacturing industry because it could be the ultimate platform for computing and networking integration. Manufacturing industry always leads the role for AEC industry.
2. Determine more effective methods and technologies in Internet application of design consulting to improve creation and reduce the routine burden (balance between creation and automation).
3. Develop further studies on steel construction technology in the entire production chain in order to apply this working model to the whole process from design to construction to management.

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