

INTEGRATED CAD DEVELOPMENT IN THE US

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CIB W78 INTEGRATED COMPUTER-AIDED DESIGN COLLOQUIUM  
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In August, 1983, the CIB W78 Integrated Computer-aided Design Working Commission engaged upon developing a world-wide survey of integrated systems to support building design. Not only does the survey address current products, but also attempts to identify integrated systems under development among turnkey vendors, among academic institutions, among governmental agencies, and among hardware and software firms. The survey does not address fundamental research currently being conducted, but rather addresses available system products and applied development areas. The persons developing this survey include:

- Dr. Per Christiansson, Lund Sweden
- Mr. Dana Vanier, Canadian Research Council, Ottawa
- Mr. Anne Volbeda, Bouwcentrum, Rotterdam, the Netherlands and myself.

Although it is envisioned that no single, comprehensive system addressing the entire design process and all disciplines will be identified in this survey, we do expect that the results will show major ongoing developments to support several disciplines and parts of the design process. The responses to the survey are to be returned by 30 November. The data from the survey will be summarized on the IBM XT base system and reported by 31 January, 1985. Please find enclosed a copy of the survey and the addressee list. Any questions regarding the survey should be directed to one of the responsible persons above.

Although considerable progress has been made in integrated computer-aided design for other industries, the building industry faces barriers yet to be overcome. The barriers include hardware and software problems. Table 1, "Barriers" show the general categories of problems. To find the researchers in the US who are addressing these problems, one must explore fully since much of their work is yet unpublished.

The known software problems fall into four (4) categories:

1. Expert, knowledge bases for standards, codes, specifications for use in developing project-specific programming and technical information.
2. Design modelling to handle both project-independent data, e.g., libraries of assemblies project-specific data, e.g., physical model
3. Architectural and engineering expert systems.
4. Data exchange modelling across disciplines, stages.

The known hardware barriers are all "cheapers":

CHEAPER higher-performance engineering workstations.

CHEAPER higher-throughput, quality plotters.

CHEAPER higher-performance communications.

Table 2, "US Research" shows my knowledge of the major significant research sites dealing with the software problems. One might pose the question whether this on-going effort is fully sufficient to deliver a "cradle-to-grave" system in the near-future. It indeed is not. The role CIB W78 Integrated Computer-Aided Design may pursue to influence and strengthen research and development includes our:

(1) **Identification of productivity increase potentials inherent in integrated computer-aided design.** Recent tests of the CAEADS system at the US Army Corps of Engineers District, Sacramento, show considerable productivity increases in engineering design development. Evidence of costs savings due to integrated computer-aided design should stimulate further development by the Industry to deliver comprehensive systems, not just automated drafting to the building designers.

(2) **Coordinating and providing information throughout the world-wide building community.** The formation of W78 Integrated Computer-Aided Design provides a unique opportunity for information exchange. The upcoming survey of available products and systems under development should serve as a nucleus of information on which further research and development can be based.

(3) **International development of data exchange standards.** Presently, the US National Bureau of Standards is leading the development of the Initial Graphics Exchange Specifications (IGES), Architectural-Engineering-Construction (AEC) subcommittee. This work should be coordinated world-wide to assure comprehensive support once the specifications have been developed. Mr. Fred Stahl's report on the status of the AEC developments shows international work on the IGES electrical and manufacturing modules. W78 should assure international efforts are applied in the development of the AEC module.

(4) **Development of technical specifications for industry to develop engineering workstations, turnkey systems.** The Commission of the European Communities report, "The Specification of a Building Industry Computer Workstation," developed by the Construction Industry Computing Association and the report, "The Automation of Draughting Work," developed by the Association for Computer Applications in Applied Engineering represent efforts to influence the hardware and software industry.



Table 1 BARRIERS

Needed Technology	Problems Addressed
Expert/Knowledge Bases	<ol style="list-style-type: none"> <li>1. Organizing and extracting relevant codes, criteria, standards among complex, ever changing design guidance.</li> <li>2. Automatic design systems for layout synthesis, selection of assemblies, sizing members.</li> </ol>
Pattern Recognition	<ol style="list-style-type: none"> <li>1. Automatically scan manual drawings (existing site) for entry into the design data base.</li> </ol>
Data modelling	<ol style="list-style-type: none"> <li>1. Relational data bases for project-independent data: libraries of assemblies climatic data econometric and cost data</li> <li>2. High performance structures for project-specific data to model geometric properties, interfaces among building subsystems.</li> <li>3. Data exchange among design design disciplines, throughout stages of the life-cycle of building process.</li> </ol>

Table 2. US RESEARCH

Research Site	Description of Research
University of Illinois Prof Len Lopez Civil Engineering	Expert Systems for Standards Standards Interface for Computer-Aided Design (SICAD). Work funded by National Bureau of Standards, Center for Building Tecnology.
Carnegie-Mellon University Prof Steve Fenves Civil Engineering	Building specifications structure using decision-tree logic. Work funded partly by National Bureau of Standards, Center for Building Technology.
US Army CERL Mr. Ken Crawford	Architectural criteria-driven layout system based on space and proximity information.
Univ of Calif. Los Angeles Prof. William Mitchell Architecture	Architectural criteria-driven layout system based on space and proximity information.
SKANTEK Warren, New Jersey	Pattern recognition, raster to vector and layering.
Ellerbe & Assoc. Mr. Dave Jordani Minneapolis	Integrated data bases.
Skidmore, Owens & Merrill Mr. Doug Stoker Chicago	Integrated data bases.
US Army CERL Ms. Janet Spoonamore Champaign, Il	Integrated data bases.
NBS Center for Building Technology Mr. Fred Stahl Gaithersburg, Md	IGES AEC development.
TRICAD, Inc. Mr. Doyle Ridenour Milpitas, California	OBJECT data base