

SWEDISH AND NORDIC ACTIVITIES WITHIN CAAD.

Computer Aided Architectural Design -
Developments in Education and Practice.
Singapore, May 28-30, 1986

Per Christiansson, Ph.D.
Lund Institute of Technology
Department of Structural Engineering,
Box 118, 221 00 Lund, Sweden.
== 1986.03.21 ==

ABSTRACT

During the last few years there has been an increasing interest in the Nordic countries concerning effective use of computer resources in the building process. Swedish and Nordic research and development within Caad and adjoining areas is shortly accounted for to give a flavour of ongoing and planned activities. A Nordic Action Program for promoting Nordic joint research and development efforts is also presented. The Nordic educational activities within Caad are also shortly commented on.

1. INTRODUCTION.

The aim of the paper is to give a flavour of the the Nordic activities within the Caad field and partly of other related activities involving use of computer resources in the building process.

Specific research and development projects will not in general be referred to, but can be found in Ref. (1). Also the coordination groups mentioned below will act as contact surfaces to ongoing and planned activities.

2. NORDIC COORDINATION GROUPS.

During the last few years there has been an increasing interest in the Nordic countries about how the computer resources should be effectively utilized in the building process. There is a notable awareness about the necessity for directed research and development efforts to ensure a high quality of the utilization of computer resources, see also Ref. (2).

In 1983 a Working Group for Information Technology, NBS-DATA, was formed under the Nordic Building Research Cooperation Group, NBS. The five Nordic countries are represented in the group by

Fritz Sigrist
(chairman)

Danish Building Research Institute

Hans Petter Sundh

The Norwegian Building Research Institute

Per Christiansson	Lund Institute of Technology, Sweden (BFR/BST Cad-committee)
Per Miakel Henriksson	BFR/BST Cad-committee, Sweden
Bo-Christer Björck	Technical Research Centre of Finland, VTT
Matti Pöyry	Construction Industry Council for Cad in Building, (RACAD), Finland
Hafsteinn Pálsson	Building Research Institute, Iceland
(Tor-Ulf Weck	NBS secretary, Technical Research Center of Finland)

The task of NBS-DATA is to continuously work out and account for propositions to common Nordic projects aiming at effectively introducing computer resources into the Nordic construction Industry. The group also arranges seminars where people involved in research and development meet and change experiences.

In February 1986 the group published two reports, see Refs. (1) and (3), which partly forms the basis for this paper. The research behind the reports was financed by the Nordic Councils of Ministers.

In Ref. (1) a brief survey is given of the state of the art in the utilization of computers in the construction industry in the Nordic countries. The survey deals with actual use in design and construction firms, development of software, research and standardization efforts. The report also contains an extensive catalogue of on-going or recently finished projects.

In Ref. (3) a Nordic Action Program for the promotion of information technology in the construction Industry in the Nordic countries is presented. The aim of the report is to facilitate the establishment of Nordic cooperative research and development projects. It is also intended to form a better basis for financial support for projects within the field. The content of the Nordic Action Program is accounted for in more detail later.

In each country the architects organizations as well have founded Cad-societies which play an important role in collecting ideas from architects and promoting a sound development of computer tools for architectural design.

In addition to the building research institutes in respective country special coordination and information committees are formed. Some of them, which are of interest in connection with Caad, are mentioned below.

In Denmark the Society for Computer Applications in the Construction Industry was established in April 1984 as a society of the Danish Academy of the Technical Sciences (ATV). The society has

some resemblance with the CICA, Construction Industry Computing Association, in the United Kingdom. The major source of fundings for research and development projects in Denmark will come from the Technology Development Programme of the Council of Technology together with contributions from firms carrying out development projects.

The Swedish Council for Building Research, BFR, together with the Building Standards Institute, BST, has founded BFR/BST Cad-committee. The committee coordinates and initiates research and development projects within the field of Cad. The main fundings in Sweden comes from BFR and in case of projects linked to the building industry also from the industry itself. The Swedish firm BYGGTJANST-DATA publishes since 1985 a monthly news journal which is locally distributed also in the other Nordic countries. The name of the journal is Datorn i Bygget (The Computer in Construction).

In Finland the research and development activities are mainly funded through and by the Technical Research Center of Finland. In 1983 a special organization was created to cope with integration problems within Cad, the Construction Industry Council for Cad in Building (RACAD).

The major funding source in Norway is the Royal Scientific Council for Scientific and Industrial Research, NTNF, and its permanent subcommittee for construction, the BA-committee. NTNF initiated in 1983 the establishment of an Information Center for Computers in the Construction Industry, BA-Data. BA-Data is at present tied to the Norwegian Building Research Institute.

BFR/BST Cad-committee roughly fulfills the same tasks as the above mentioned RACAD of Finland, ATV-association of Denmark and the NTNF in Norway.

3. THE CAD HISTORY OF THE NORDIC COUNTRIES. HIGHLIGHTS.

In 1981 the first Medusa system was installed in Sweden which provided for a series of installations of the system at Swedish consultancy firms. The first Intergraph system was installed the same year. By now there are roughly 15 Medusa installations in Sweden. The system has been further developed by a civil engineering firm, the MEDUSA-BUILD system, and by a Cad center for mechanical and electrical engineering, the MEDUSA-INSTALLATION system. Other Cad-systems installed in Sweden of that size are Computervision, GDS and Rucaps. In 1984/85 the total number of work stations were 110 and the total number of systems 30. The systems were and are mainly used by engineers, contractors and architects.

In Finland half a dozen consultancy firms installed turnkey systems during the period 1980-82 mainly to support structural, mechanical and electrical design. The architects interest in purchasing Cad equipment was at this stage rather limited.

Norway is the only Nordic country that has a strong tradition in developing Cad-systems (for example CDM300 and later smaller systems to support design and fabrication of single family houses). At the end of 1984 there were approximately 20 Cad-system installations in Norway. Half of the installations were at single family house or building element producers and the rest equally spread among architects, engineers and consultants. The number of Cad-system installations in Norway has increased significantly during the last year and there are now approximately 17 Cad systems from Computervision, Intergraph and Medusa (13) installed.

In Denmark a few Cad-systems are used by architect firms. These systems (GDS and Intergraph) were installed after a survey of British architectural Cad-systems was undertaken in 1984.

In general it seems as if the rate of installation of "grown up" systems is decreasing now (mainly because those who can afford to buy the systems now have done so). The slow process of implementing the system into the existing organizations is at present a big issue.

The smaller consulting firms often have access to own micro computers and also have small Cad-systems like AutoCad installed on them. In many cases these systems are used as tools to explore the usefulness of the technique. The number of micro based Cad-system installations is rapidly growing. In Norway several hundreds of micro computer based systems were installed last year.

The integration problems were early recognized when it came to practical use of the Cad-systems. Pioneering efforts to investigate the improved potential for co-ordination of design team members were initiated in Sweden in 1982, see Ref. (4). Similar projects have started up in Denmark and Finland and are separately reported at the conference (the Finnish efforts).

Several of the big contractors in Sweden are involved in joint projects. One of the projects which recently went into its second 2 year phase focuses on the the handling of quantity data during the whole building process. (Four main contractors are participating).

The Swedish building contractors have within their association, The Associated General Contractors and House Builders of Sweden (SBEF) started a project concerning classification and coding of building process information mainly for the purpose of planning and follow-up during building construction. This project is of type project management but of interest for designers as it involves classification and coding problems and use of computerized systems.

In Sweden common issues concerning classification for the whole building community is handled by the Systems Committee of the Swedish Building Centre, Byggtjänst.

The impact of information technology on work at the construction site is studied by the Swedish Building Workers Union. Among other things the structure of the flow of information between the construction site and the (design) office is studied with regard taken to the workers' possibilities to participate in corporate decision making.

4. RESEARCH AND DEVELOPMENT AREAS. LISTING.

BFR/BST Cad-committee continuously makes smaller revisions of the plans for development and research efforts in Sweden. For the time being the following areas are under special considerations.

- (1) Administrative aspects in Cad
 - Planning of work
 - Work routines (revisions, document filing)
 - Communication with external databases and systems
 - Legal implications
- (2) Structure and content of documentation
 - Demands from clients, users and maintenance organizations
- (3) Cad tools during sketch design (theories for sketch design, 2D/3D, graphic tools, need/no-need for new tools).

Basic research are going on within the field of man-machine interface, design theories, database structuring, system design and knowledge based systems.

From Ref. (1) the following main research and development areas are distinguished (in a Nordic perspective). The main activities within (a)-(e) is shortly referenced through "keywords".

(a) Cad and the design process

Co-ordination between designers, structuring design data in Cad-databases, user interaction with Cad-systems, design tools, information flow structuring, knowledge based systems, analysis of the design process, automated design, evaluation of Cad in use, demonstration projects, facility management.

(b) Cad software

Integrated Cad-systems, Cad-spreadsheet (-calculation modules), micro-Cad for architects, micro-Cad for design of prefabricated single family houses, Cad-system evaluations, reliability of structural calculation software, software catalogues.

(c) Data exchange and draughting software

Building document exchange, data exchange between Cad-systems (point to point translators, coding), draughting standards (layers, colors, symbols).

(d) Information services

Software service, advice, catalogue databases, video-disc, building regulations, expert systems.

(e) Computers in the construction process

Classification, project management, cost calculations, expert systems, organization on construction site, working environment, communication construction site-(design) office, quantity data (description) transfer, robotics.

5. NORDIC ACTION PROGRAM.

"The purpose of the Nordic Action Program for the promotion of information technology in the Construction Industry in the Nordic Countries is to facilitate the establishment of Nordic cooperative research and development projects which promote the application of information technology in the construction industry. The program is also intended to form a better basis for financial support for projects within the field.

The report sketches problems, objectives, strategies for realization, evaluation criteria and themes for projects. Examples of relevant projects for such an action program are also described." See Ref. (3).

The action program will be continuously updated. It is below presented in its entirety although some parts only are of peripheral interest in connection with Caad.

It is indicated in the report that mainly three types of projects are of interest to the building industry.

- (a) projects that will promote development of systems that are adapted to the building industry (that can be marketed and sold)
- (b) projects that provides for effective use of information technology (standardization etc.)
- (c) projects that will demonstrate more convenient working methods.

There are three groups of criteria for assessment of project applications:

Political criteria: (examples)

Is Nordic coalition policy promoted? Will the Nordic building industry be more productive? Will the quality of products, organizations and working environment increase? Who will benefit by the results (broad interest)? Are at least two countries engaged? Synergy effects? What are the implications if the project is not carried through?

Research and development directed criteria: (examples)
 Impact on existing research and development? Is duplicated work reduced? Is new knowledge gained? Are new problem areas surveyed? Is method development promoted?

Criteria concerning use of computer technology: (examples)
 Economic benefits? Will the project promote use of new technology? Effect on communication within the building process? Are prerequisites for adequate development of systems obtained? Are working routines improved?

The projects are distributed under the following headings:

- (a) Quality and risks - overlapping issues
- (b) Existing buildings
- (c) Knowledge about the building process
- (d) Information handling and methodological issues
- (e) Systems- and equipments

The following types of project are distinguished:

- (P) Prestudies
- (R) Research (basic and applied)
- (D) Development activities
- (E) Demonstration and pilot studies
- (S) Standardization
- (I) Information transfer and collection

The projects may be either short, (s), (less than 5 year) or long term, (l), (more than 5 years)

a1 High technology	P s
a1.1 "Intelligent" houses	(e E l)
a1.2 Advanced modelling and visualization techniques	(d D l)
a1.3 Robotics	(e E l)
a1.4 Knowledge engineering	(d R l)
a1.5 Construction and handling of big databases for information	(d D l)
a1.6 Data communication	(e D l)
a2 Color slide and videos concerning computers in construction	I s
a3 Information activities (technology transfer)	I s
a4 Databases containing construction industry knowledge	I s
a5 Social impacts	R l
b1 Qualities of existing buildings	P s
c1 Workshop on empirical methods to study the design and construction process	R s
c2 Qualities of planning and design methods	R l

d1	General questions about databases and information transfer (classification, layer, legal issues, access rules)	R 1
d2	Building regulations	D 1
d3	Integration of Nordic building information databases	D 1
d4	Overlay technique in the planning process	I s
d5	Nordic standardization work (overview, actions)	S s
e1	Quality through use of Cad (client, user)	E s
e2	Interfaces, user-system	R s
e3	Interfaces, system-system	D 1

6. EDUCATIONAL ACTIVITIES.

In Ref. (5) a short account is given on the Nordic educational activities within Caad. There are in total 10 architectural schools in the Nordic countries. Due to lack of equipment and teachers with adequate knowledge the process has been rather slow to incorporate Caad in the curricula. In some cases the systems and software were donated to the universities by the vendors, (for example IBM's CADAM system to the Helsinki University of Technology). Collaboration between architect and civil engineering schools exists in some cases (Helsinki, Finland and to some degree in Lund, Sweden).

At the Department of Structural Engineering at Lund Institute of Technology, we introduced Cad in the curricula 1984. Exercises on Cad-systems were introduced in the design courses with emphasis on modelling aspects. In the graduate courses structuring of and exercises on relational databases were added as well as introduction to knowledge based systems.

REFERENCES

1. B-C. Björck, "Computers in Construction. Research, Development and Standardization Work in the Nordic Countries". Cooperation Organization of the Nordic Building Research Institutes (NBS), Working Group for Information Technology (NBS-DATA). (Technical Research Centre of Finland, 1986), 80 p.
2. P. Christiansson, "Integrated Building Cad at the Lund Institute of Technology", (Department of Structural Engineering, 1985), pp. 1-9.
3. "Handlingsprogram for fellesnordiske dataprojekter i byggesektoren", edited by H. P. Sundh, Cooperation Organization of the Nordic Building Research Institutes (NBS), Working Group for Information Technology (NBS-DATA), 1986, 32 p.
4. "The Elk and the Computer. Computer Aided Design in the construction of an administration building in Bollnäs, Sweden", The National Board of Public Building, Report 163, 1985.

5. "ECAADE'84. The third European Conference on CAD in the Education of Architecture", Edited by Matti Pöyry, (Helsinki University of Technology, Department of Architecture, 1985)