

# BUILDING REGULATIONS AS A PART OF A DIGITALISED BUILDING INFORMATION SYSTEM

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## ABSTRACT

This paper presents a practical and cost-effective approach to disseminate building regulations and codes as a part of a digitalised building information system. The proposed approach takes into account the most important characteristics of the building regulations and codes. These characteristics are: inner semantics comprising the indexing system, definitions and cross references and different data types for representing various data captured in building regulations and codes.

## INTRODUCTION

The National Building Code of Finland consists of 35 parts which include regulations and performance guidelines particularly meant for architects and building designers. It is the highest legislative system in Finland for setting technical constraints for the performance of new buildings. The Building Code considers many aspects of building design, for example thermal insulation, energy conservation, fire safety, acoustics and structural design.

At present, architects and building designers obtain different parts of the Building Code as a written format from bookshops or as a part of a larger building information service. On the other hand, while the use of computers and computer networking have reached more advanced levels amongst building construction practitioners, the computer based delivery of building information has developed into commercial applications in several countries and some applications also cover the delivery of building codes and regulations. This paper presents some results of a work in which a solution for the computer based updating, delivery and use of the National Building Code of Finland was designed.

Researchers have focused their work on many aspects relating to the computerization of the updating, delivery and use of the building regulations and codes. Also some commercial products have arisen as a result, for example, see Sharpe 1991 and Bourdeau 1991. In some of these applications, the data are stored in a data base using a format in which the most important characteristics of building regulations and codes have been taken in account. Typically, four or five data type definitions (DTD) are used covering representation of textual parts, tables, figures and mathematical equations. Additionally, building regulations and codes include a great number of various concepts and definitions which need a specific treatment in order to make a resultant system easy to interpret and use (Vanier 1991).

The approach in which building regulations and codes are stored in a data base using a number of specific data definitions has been adopted by the authors. It seemed likely, that using this approach one can reach a cost-effective system in terms of storing, updating and accessing nation wide building regulations and codes system.



## RATAS INFORMATION SERVICE

Research and development of applications and standards which are important elements in the infrastructure of the computer-integrated construction (CIC) environment of the future, has in Finland been co-ordinated by the RATAS-board. This board, which formally is under the jurisdiction of the Building Information Institute, is composed of representatives of all branches of the building industry, of public organisations and of research institutes.

The RATAS process has in fact been going on since 1985. The most significant phase was in 1987, when the basic framework needed for CIC was defined. Four necessary elements were defined (Enkovaara et al, 1988):

- A single uniform user interface to digital building information services;
- Standards for the exchange of drawing data, tables etc.;
- A Building product model standard; and
- New types of documents.

In 1987 only the basic principles of these were laid down, and since then considerable work has been done for the further development of the building product model standard, in developing EDI-messages and new document types.

The authorities in charge of building regulations in Finland (Ministry of the Environment) have since the beginning participated in the RATAS work. The policy they have adopted is to do their own development work in co-ordination with the other elements within RATAS. In particular this means integration with the developments in digital information services.

## DELIVERY OF BUILDING CODES AS A PART OF THE TELERATAS-SYSTEM

TELERATAS is a computer-based building information service system developed by a number of Finnish companies (Salmi, 1992). The system has now reached a saleable product stage, and, thus can be used as a basis for disseminating building information of many kind. Features of the TELERATAS system are:

1. the system provides structural solutions in the cad drawing and symbol format, building specifications, cost information, building materials information, expert systems, calculation programs etc.;
2. data are stored in a centralised database which is accessible via modems 24 hours per day;
3. programs for accessing appropriate data, expert systems and calculation programs are on users' personal computer (IBM-PC or compatible with MS-Windows 3.1 or later);
4. data can be copied into a local network server for faster data communications, and, after some data have been copied the system can automatically handle data updating routines; and
5. new services (data and specific programs) can be added into system according to the needs of users;

The architecture of the TELERATAS system provides also sufficient possibilities for developing a cost-effective solution for the needs of updating, delivering and accessing building regulations and codes. First, the MS-Windows multiprocessing environment forms a basis for the development of some specific programs and the user interface which meet the characteristics of building regulations

and codes. Second, access to the regulations and code data which are updated can be ensured in a centralised data-base system.

## REPRESENTATION OF VARIOUS DATA TYPES

A set of data types have been designed to cover the representation of data captured in the building codes. These are

1. Textual parts;
2. Graphics (drawings, diagrams and nomograms);
3. Tables;
4. Mathematical formulae;
5. Definitions; and
6. Cross-references.

Textual parts are classified using the original index of the building codes. In practice this means the table of contents for each part of the building codes. As usually in literature this index system is hierarchical comprising maximum 5 *header* levels (for example, *D2 4.2.2.1 Exhaust ducts should be erected entirely separately in every room*). Two attributes can be assigned to headers. These are: date on and after the regulation is valid and the replaced regulations.

Using hierarchical headers, the user can access a textual section of a certain part of building codes. Furthermore, *key words* can be assigned to the textual sections. The key words provide an alternative means to find relevant sections of building codes.

## ARCHITECTURE OF THE PROPOSED SYSTEM

The basic idea of the system's architecture is to link graphical data, tables, mathematical formulae and cross-references to individual textual sections presented above (Figure 1). For example, after selecting a particular textual part the user can see the lists of tables or cross-references to other textual sections of the building code (Figure 2). When an item from a list is selected then the appropriate data are shown on computer screen. An obvious advantage of this approach is that, for example in MS-Windows environment, specific computer programs can be designed to undertake the representation of each data type and, thus, the characteristics of each data type can fully be taken into account. In practice this means that besides of the representation of the data some useful functions can be integrated with the actual representation. These functions are

1. *Drawings (2D+3D)*. Explanations and cross-references to the relevant sections of the codes.
2. *Diagrams and nomograms*. An assistance is needed in order to determine required input data which is often determined using mathematical formulae and/or definitions presented elsewhere. Furthermore crosshairs are used in order define accurately the resultant datum.
3. *Tables*. The relevant part of a table for a particular design situation is shown as a highlighted part.
4. *Mathematical formulae*. Assistance for calculation operations.
5. *Definitions*. After selecting a definition from a textual part the user can obtain its explanation.
6. *Cross-references*. Immediate access to the referenced section.

A prototype computer program has been built in order to develop and test the data structuring with a real example.

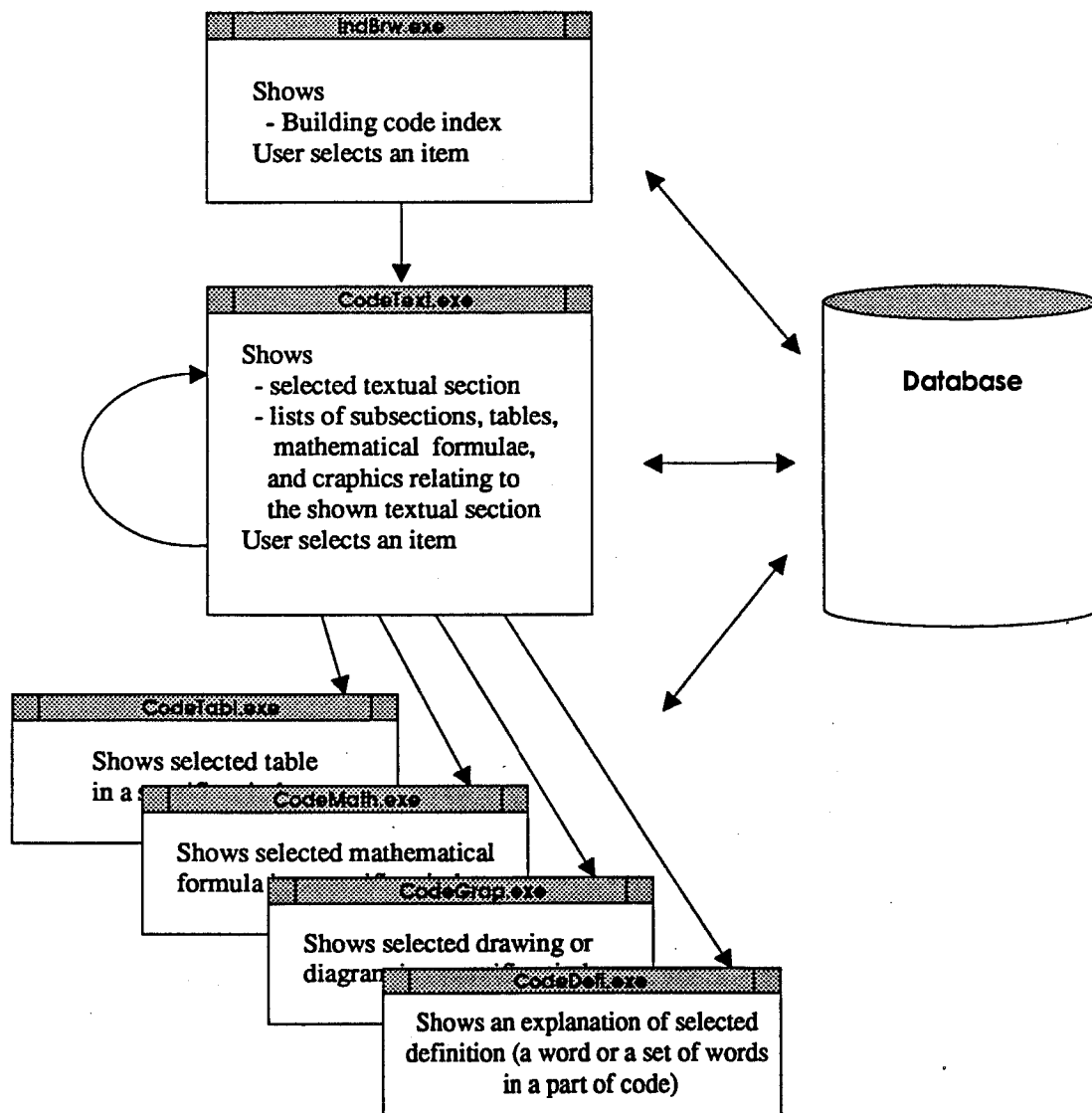


Figure 1 Architecture of the proposed system

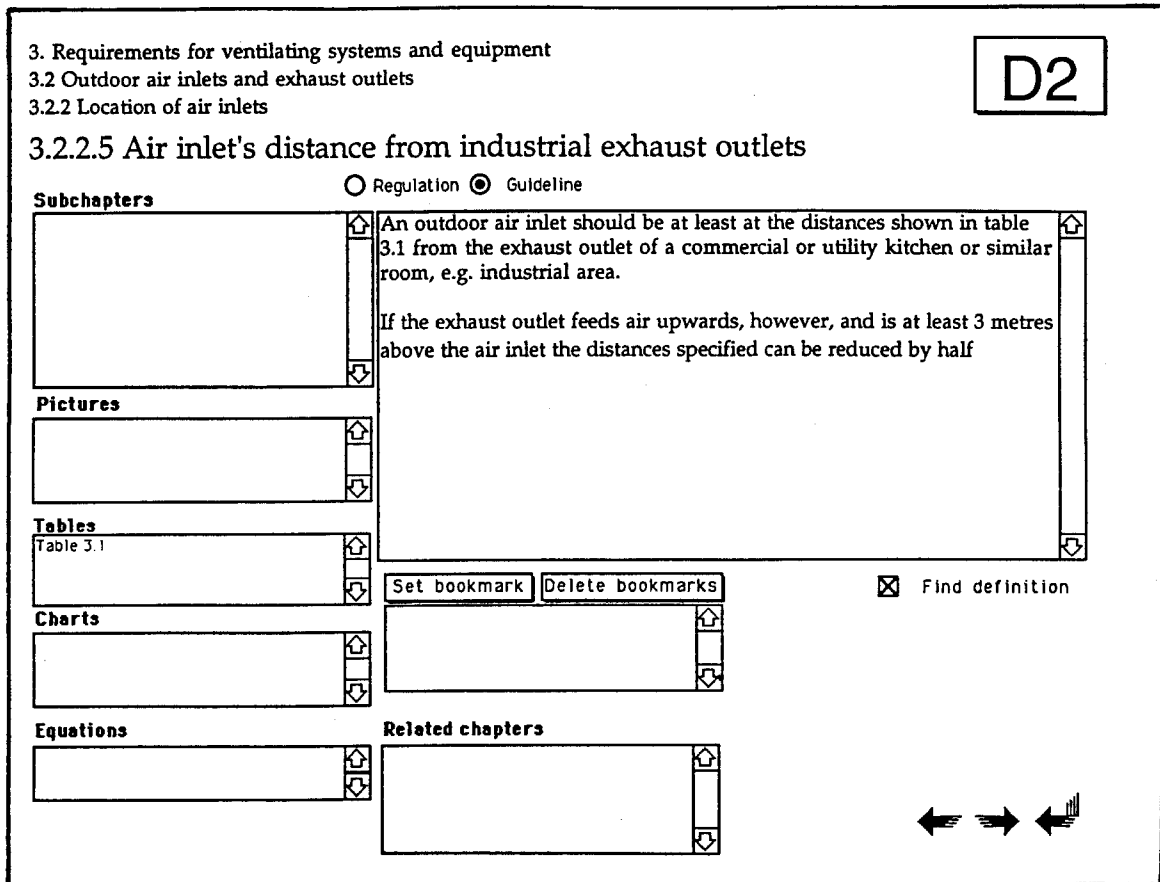


Figure 2 Tool for accessing data relating to a selected textual part of a building regulation or code

## DEVELOPMENT OF TOOLS FOR INPUTTING AND UPDATING BUILDING CODES

It is considered as a desirable situation if the authorities in charge of the preparation of the building regulations and codes would themselves at least partially create and update the computer based building regulations system. This would have following benefits:

- Within the preparation of a manual document also an authorised computer based application of a part of a building regulation would be finished;
- The computer version would be used to test and simulate the new or updated part of a building regulation in an early phase. This can speed up the testing and approving process.

In order to reach a stage where the practitioners in charge of the preparation of building regulations would undertake the inputting and updating of computer based building regulations or codes some specific tools need to be developed. An individual tool is needed for each data type presented earlier. At present a tool for the preparation of typical graphical data for computer based building regulations system is being developed. This tool enables the user to create easily diagrams which can be linked to textual sections of a building regulation or code. The tool is being programmed in MS-Windows environment using C++ programming language (Figure 3).

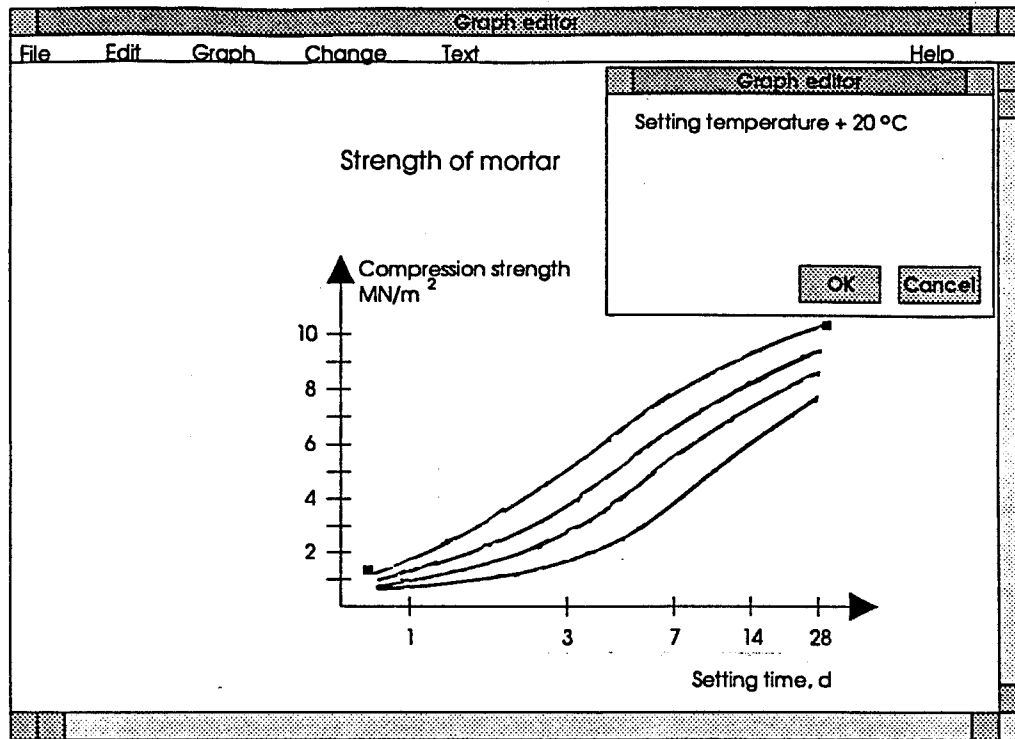


Figure 3 Tool for the preparation of diagrams for a computer based building regulation and code system

## CONCLUSIONS

The proposed system for delivering building regulations and codes as a part of a larger computer based building information system is a practical solution, but, though it is rather simple it takes into account some important characteristics of typical building regulations and codes. The simplicity of the system is considered as a positive feature since it makes the system cost-effective in the terms of the final implementation, inputting and updating of regulations and codes data.

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