

## SOUTH BELGIUM REPORT ON CAAD.

Michel RENSON, ir. architecte, assistant  
Laboratoire de Physique du Bâtiment  
Université de Liège  
Avenue des Tilleuls, 15  
B-4000 Liège.

This communication presents the actual situation of CAAD concerning the South of Belgium (Walloon part) and Luxembourg.

After having contacted different universities and schools of architecture, it seems that research and teaching in CAAD are not yet in the same stage of development in most of these establishments.

Concerning the schools of architecture, the main reason of this is that the majority of them only begin to be fitted up with computer equipment, and so they have not yet got the time to use it efficiently.

In the case of universities, progresses are more important, and this for two reasons :

- on the one hand, the possibility to use more performant computer equipment;
- on the other hand, the constantly increasing impulse of research departments attached to universities and entrusted to develop computer programs in many scientific fields.

Particularly, the University of Liège includes a research department attached to the Faculty of Applied Sciences, the Building Physics Laboratory, which is concerned with the development and perfecting of programs relating to the building and its environment.

Unfortunately, if research in CAAD is constantly increasing, the teaching of this topic is developing slower and is not yet well integrated in the curricula of the consulted schools. Most of them only present a general computer course. So the aim of this report is to present the work developed in our region, even if it is not yet integrated in CAAD teaching. Anyhow, it has been developed in schools and not by commercial companies.

I. FACULTE POLYTECHNIQUE DE MONS - Département d'architecture

As long as we are concerned, the only work developed in this establishment is a program elaborated for architectural perspective drawings on digital plotters or graphic printers.

Moreover, this program has been presented in detail by its author at the International ECAADE Conference organized in Brussels in October 1983.

II. INSTITUT SUPERIEUR D'ARCHITECTURE SAINT-LUC DE TOURNAI

The second establishment where computer programs are developed is the Architecture School of Tournai. The option chosen here is to let the students develop their own programs, so that the school is now in possession of many little modules practically covering all the aspects of the architects profession: financial, administrative, technique, operational research, building visualization, etc.

III. UNIVERSITE DE LIEGE - Laboratoire de Physique du Bâtiment

The programs developed in this service are numerous and cover different aspects of the architectural design.

1. Programs for building energy analysis: LPB-1, LPB-2, LPB-3, LPB-4

Four different programs are presently available in the laboratory. Calculation methods used are based on different points of view and therefore the results give information at different levels.

The simplest program (LPB-3) is a static evaluation of the solar heat gains of a building considered as a unique thermal zone. Another one (LPB-4) performs nearly the same calculation but room by room. Both of them allow a good estimation of energy consumption (in term of heating demand) and provide a valuable help for the choice of main characteristics such as insulation or glazing area.

The other programs perform dynamic calculations. The first one (LPB-1) is a complete dynamic description of a building and is based on the notion of response factors of a wall. The second one (LPB-2) provides a dynamic study of a single room and is based on a finite differences calculation. Both of these two dynamic programs allow to compute the inside temperature and the energy consumption.

Meanwhile, those sophisticated programs require precise and numerous data so that they are only applicable to buildings the design of which has been completed, that is to say exactly when important modifications are not possible anymore. That is the reason why other programs have been developed in order to help the architect on an earlier stage of the design.

## 2. Program of feasibility study of the architectural project : FEASIBILITY

The first stage of the design process generally consists in a feasibility study of the project. With this program, no solution is outlined : the whole architect's attention is only focused on the research of acceptable values of main global parameters (solar recuperating factor, shape factor, heated floor area, volume, global heat loss coefficient). These parameters characterize a projected dwelling which must be acceptable from multiple points of view: technique, energy, costs. The feasibility study allows the architect to see if an architectural solution exists or not: he manages the main global parameters in order to obtain satisfactory results. The final product of the feasibility study consists in a set of global parameters representing a lot of solutions which potentially reach the objectives defined by the client at the inception stage. The shape factor, the global heat loss coefficient, the glazing factors, etc, have been silhouetted, in order to become a basis of the outlines to be proposed by the architectural team.

### 3. Program for building modelisation and manipulation : VOLUME

The program VOLUME is an interactive tool for 3D modeling of building which can be used in many problems (heat losses calculations, architectural evaluations, ...) where a geometric representation is required. The program is more than a tool to input a geometry : it is also a tool for design; manipulations are very easy and many design solutions can be tried.

A building is seen as a collection of polyhedrons. Computer-user communication is made by a powerful but simple command language. Volumes or polyhedrons are defined with different primitive commands, each of them corresponding to a simple geometric type (prism, pyramid, cylinder, ...). Volumes are manipulated or copied with expressions and variables: expressions consist of geometric operators (translation, rotation, symmetry, and sets of operators applied to sets of volumes. Results of expressions are sets of volumes which can be stored in variables.

Any geometric item (point, line, angle, ...) can be input graphically. Recent developments of the program allow now to define openings (doors and windows) of any shape in faces of volumes with the same flexibility and facility than for volumes in space.

At any time, the user can ask for perspectives or other types of projections with or without hidden lines removed. The program is able to detect adjacency or contact between faces of volumes. So it is possible to produce files describing precisely and completely the building created (external and internal walls areas, glazing areas, ..). Those files can be used for various types of evaluation programs, such as heat loss calculation programs (for instance, the program ESP of ABACUS).

So VOLUME claims to be a real design tool for architects : not only a program producing geometric data files for peculiar representation or evaluation of completed designs. It is intended to be used throughout the architect's work and particularly in the first stages of the design process when major decisions, influencing the final performances, are taken very often on irrational basis. Using VOLUME would be a process of gradual enrichment for the design through which the architect would organize his ideas, clarify his concepts, discover and explore his own way of thinking.

#### 4. Program for typological analysis of the existing building park: TYPOLOGIE

This program, until now still under development, is intended to provide a methodological help for the programming of the energetical renovation of the existing residential building park.

The main tasks of the program is the development of a Building Data Bank, and of different peripheral modules. Among them, the five most important perform:

1. Data management;
2. Data and results normalization;
3. Performances evaluation;
4. Sorting and selection;
5. Typological analysis.

Using these modules, the final purpose of the research work "TYPOLOGIE" is the determination of a breakdown of the national residential building park by classes to which the best measures of energy economy will be applied.

So this completes a brief presentation of the main works undertaken in CAAD in the South part of Belgium.

**Order a complete set of  
eCAADe Proceedings (1983 - 2000)  
on CD-Rom!**

**Further information:  
<http://www.ecaade.org>**