

THE DESIGN OF AN INFORMATION SYSTEM FOR THE RESTORATION AND MANAGEMENT OF AN HISTORICAL BUILDING

by Giancarlo CARRAI – SVALTEC Srl

The Monumental Complex Mozzi Bardini, in the centre of Florence, is the result of an aggregation of buildings born in different historical periods. Internally a variety of architectural and decorative features developed over an area of 5.000 square metres, and about 130 rooms. The idea to create a three-dimensional Information System for an historic building due to become the headquarter of the offices of the Ministry of Culture and the Performing Arts and a Museum, appeared an interesting challenge. In fact people are not used to think the real world as a sandwich of two-dimensional information layers and appreciate the dynamics obtained through the elaboration of interrelated layers. Examples of partial three-dimensional views are being developed; software to visualise prospective views or cross sections of a building already exist; instruments to navigate inside museums such as the Louvre also exist. However few references can be found of instruments allowing access to information related to the study, the development of projects, or their management. The system should support decision makers with queries such as “select rooms of first floor having specified characteristics (i.e. in the range of 20 m. far from the entrance) and rooms of second and third floors whose horizontal structures have such characteristics (poor or good state, material, dimensions, etc.) to allow the construction of an elevator shaft with minimum damaging to ...”.

PLANNING THE INFORMATION SYSTEM

Planning

The first steps were the preparation of the documents necessary to the planning, development and test of the work to be done. Specifically:

- a) the Logical Framework with general and specific objectives, results, activities, inputs, means of verification and pre-conditions;
- b) the Software Requirement Specification (SRS) indicating the context, the analysis of requisites, the data conceptual model, the list of specific requisites expressed in an atomic form to allow testing the traceability within the application;
- c) the Software Design Document (SDD) where the data conceptual model is exploded in the physical model and where all entities and attributes are normalised;
- d) the Validation & Verification Plan (V&VP) containing the modalities of the different execution phases, the reaction to variations of the database, evaluation criteria etc.

The project context is the software employed by the *Soprintendenza ai Beni Ambientali e Architettonici* (the Italian government agency for the protection of historical buildings and landmarks) - i.e., ArcView 3.0 and Office97. Consequently, the software application has been developed in Access97 and ArcView with topological structure in ArcCad of DXF files giving a *wire-frame* output of the three-dimensional model.

The objective is also to create a pilot Information System model that can easily be replicated for other buildings having different forms and characteristics in order, for example, to respond to queries such as “*Select all external architectural elements of all buildings in a given area and belonging to a given historical period, where the structure, the materials and other data correspond to given values. Produce a report on the state of conservation of selected buildings, as a function of the nature and date of the restoration, in order to identify procedures that can be used for work on other buildings*” or “*Show the combined museum itineraries that a tourist can cover in less than 150 km, in which he or she can see works of art of a given historical period, or of a specific artist*” etc.

The Surveying

The entire building has been surveyed with precise topographic instruments: closed compensated traverses for 2.000 metres with 85 stations were measured; 850 detailed points were determined; 8 specialised operators have recorded 800 tables with direct measures of details; 30 digital imagery rectifications done. The entire survey has been re-elaborated with ALLPLANFT and FORMZ to build the three-dimensional, general model and all details with an accuracy position of 2 cm tolerance.

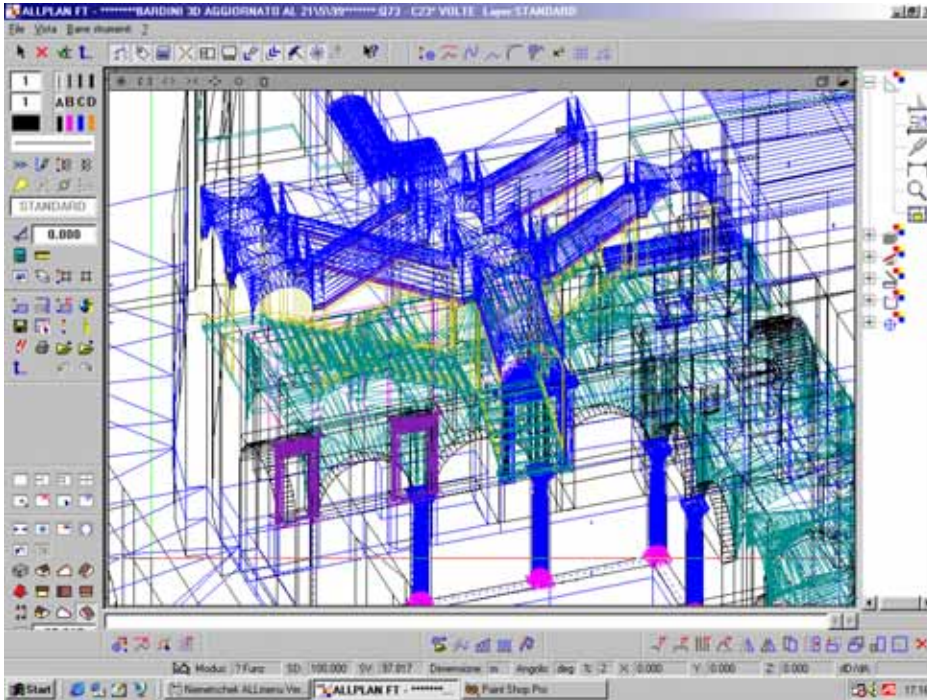


Fig. 1 wire-frame three-dimensional model

The Data Model

The novelty of the proposed model is that the system is based on a minimal unity conception represented by the “*space*” that by means of links (using the concept of topological adjacency) represents the entire building in its forms and content as well as the whole room (understood as a *tile* or a *minimum cell unit*). In this way any opening allows to go from one *room* to another, exploiting the topological relations rather than the geometric position which would make spatial analysis extremely complex.

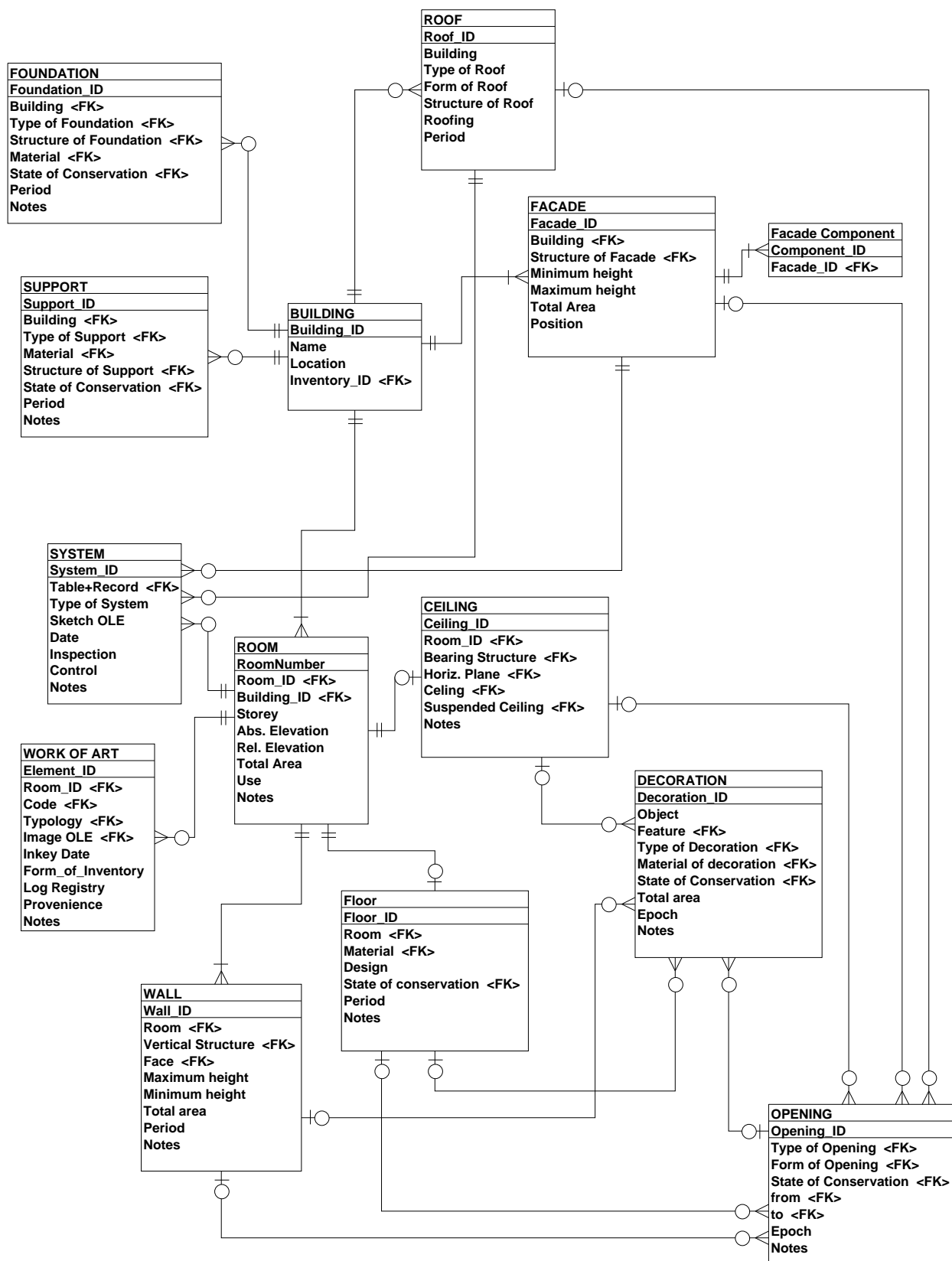


Fig. 2 Scheme of the conceptual data model

Within each space it is also possible to define all floor plans, systems and mobile objects, such as works of art. It has also been possible to manage relations of the type *many to many*, such as openings involving two connected walls, but also a wall with an external front, a roof with a floor etc. The model has then been developed and normalised by defining all attributes and relations among the entities; based on the data

physical model, an Access97 database has been adapted to allow update and modification of existing data by inserting different masks.

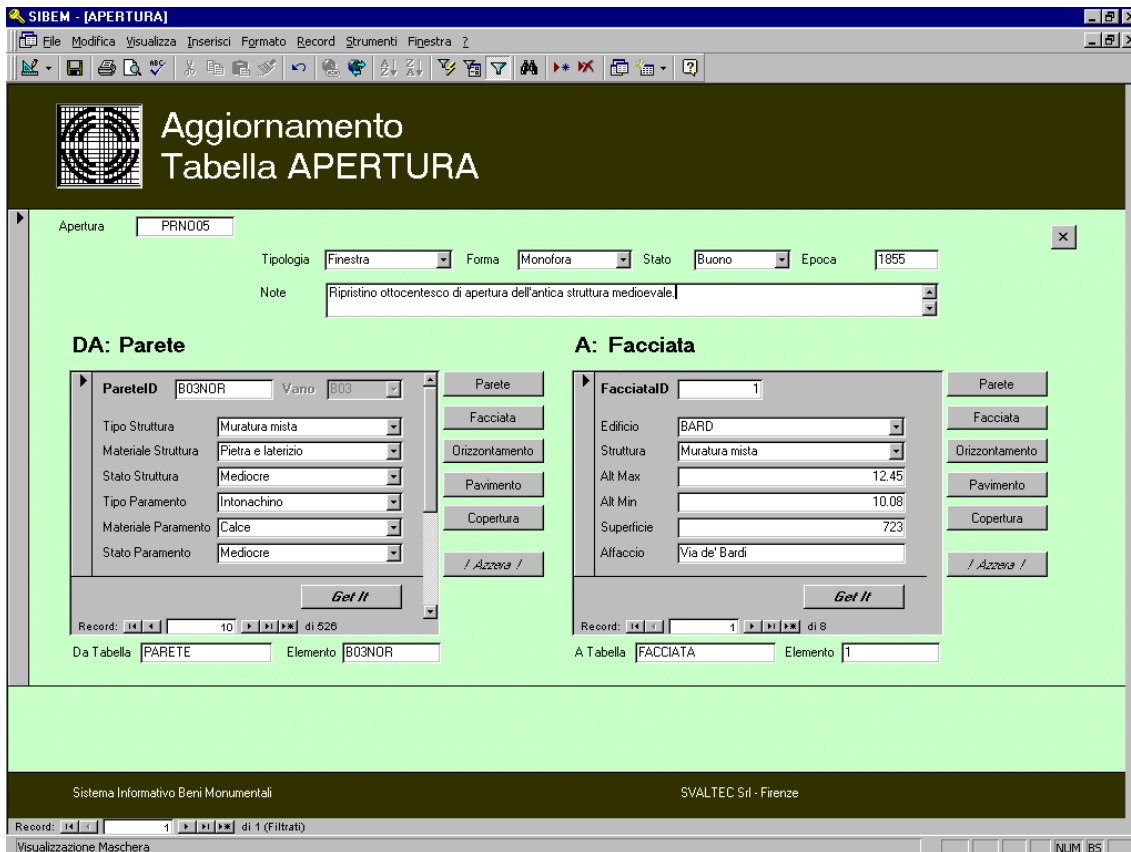


Fig. 3 Management mask of the opening entity

In order to keep records of the historical memory of the manipulation of data, modules were developed in which all operations are recorded from the moment of the installation memorising the date, the code of the operator, the field that was modified. The database is the key element containing all features and its relative attributes, and allows to manage all available fields through the Access masks.

ArcView is used as *browser* of the geometrical part to visualise the graphic response of the object linked to the table in which the query has been formulated, or as a navigation instrument to be localised on pre-defined views. For example, through mouse sensitive links it is possible to navigate by pointing the mouse on the prospect view and entering the door, then enter the next room, click on a window and enter the internal court, etc.

At the present, the application is used to organise all collected data, and to support to the planning and the recording of restoration and rehabilitation activities. The next phase will be mainly oriented towards supporting the management and planning of the activities to be undertaken.

Biography of the Author

Dr. Giancarlo Carrai graduated at the University of Florence in 1976, is managing director of SVALTEC, an Italian private firm specialised in mapping and GIS for multidisciplinary fields; he is involved as consultant in EU projects for the application of GIS in different sectors ranging from Land Information Systems to Environmental and Architectural studies.