Second International Conference Buildings
and the Environment, June 1997, Paris

EPIQR a new refurbishment concept

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Abstract

Building refurbishment mainly concerns physical and functional building components but should also take into account various topics such as energy consumption, pollutant emission and operational waste reduction as well as air quality and spatial comfort.
Against this background, the European project EPIQR offers a new concept which should allow architects to approach the refurbishment of residential buildings with a global view of the whole process.
In any refurbishment process, the preparation phase is of utmost importance. The object exists and has to be studied to lay open all potentialities. The EPIQR method starts by establishing an overall diagnosis of the building acquired through a systematic and standardised visit.
The file drawn up in this manner constitutes the basis for the planning of the refurbishment process and for discussion with the other parties involved in the project. All relevant parameters are taken into account: the physical state of the building components, the functional state of the services, the energy balance of the building, the type and occupation of the apartments etc.
Furthermore, EPIQR constitutes an excellent financial planning tool offering the possibility of knowing the prospective evolution of the deterioration of all components in the future.

Introduction

The existing building stock increasingly requires maintenance work on one hand (preservation of quality and utilisation value) and refurbishment work on the other (repair and re-establishment of all the functions of the utilisation value).
These are the primary requirements to which will have to be added considerations regarding a voluntary reduction of the energy consumption, heat losses, pollutants, operation and utilisation wastes, air quality and space-related comfort. The satisfaction of these needs and measures that go even further, all require first of all a diagnosis of the state of the building including all relevant factors, on the basis of which a precise description of works to be done and of prospective costs can be established.

The Refurbishment Sector

In Europe, building maintenance and refurbishment have come to represent an ever increasing part of the building sector. According to a study by the institute

Euroconstruc [1] of all member countries of the EU as well as Austria and Switzerland, the total construction sector represented, in 1990, 670 Mia Ecus, 39% (261 Mia) of which came from refurbishment and refurbishment activities. And apparently, these figures are representative of the general tendency for years to come.
In Europe, the global market of maintenance and refurbishment makes up 40% of the whole building sector.
In Switzerland, this percentage is even higher (about 50%) and we have reasons to believe that this tendency is growing. Furthermore, numerous buildings constructed in a haste in the sixties and seventies, before the oil crisis, are great consumers of energy due to outdated heat production systems and/or insufficient insulation of the building envelope. Rehabilitation activities in these buildings often constitute an excellent occasion for improving the energy balance and the indoor climate. Better control of the heating along with thermally improved building envelope insulation do in fact result not only in energy savings but also in improved indoor comfort. And thermal gains scored due to passive use of solar energy can also considerably contribute to an improved energy balance and user comfort.

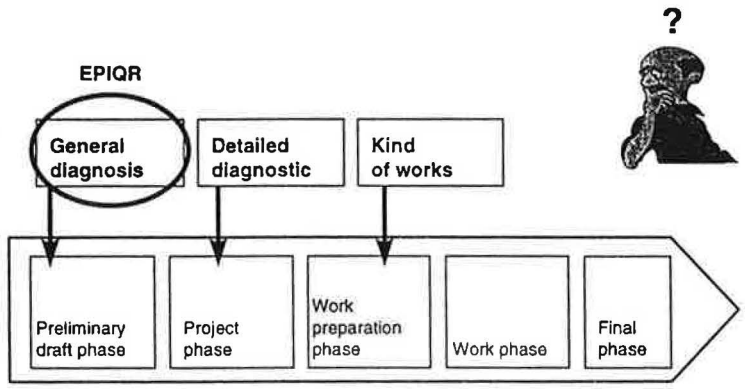
New tools required

In the context of a refurbishment, the approach chosen for the first phase is the most important. The object exists; it has to be analysed and seen as a whole for the study of potential problems and the planning of an intervention strategy [2]. This is the phase of an overall diagnosis which has to systematically include the whole building. It is the point of departure for discussions which will lead to a definition of the refurbishment project. None of the different parameters can be ignored, and there are many. First of all, the physical state of the building elements and the functional state of the building services as well as the type of housing and its occupation have to be determined. Then, rent paid before refurbishment work and financial viability of the planned operation are also important factors in the decision-making process. To help the architect in his work, there are already many tools and methods [3], [4], [5] on the market, but they are not necessarily adapted to the current situation. A new concept which approaches projects in a practical and realistic way should respond to the new requirements of the market. To be useful, it must allow rapid (and therefore low-cost) collection of all data relevant for sufficient precision of the diagnosis, compatible with known market fluctuations in the building sector. Furthermore, the developed instrument must be accessible to a large range of people working in the building sector (architects, engineers, technicians) who are not necessarily specialised in investigation or analysis methods or building pathology.

A methodology for the building sector: the EPIQR tool

In the frame of a European project [6] a new evaluation method is being developed through international collaboration (see list of participants at the end of this paper). The major characteristics of this method are the following.

In any evaluation process, the two key phases are the data collection and the presentation of the results. First, all parameters of the building must be collected systematically and stored in a standardised format. Building elements have to be assessed without probing. This evaluation must reflect the current state of the building, its level of equipment, its energy consumption, etc. (Fig.1). For an optimal and representative choice of data it is important that a common and durable basis of assessment criteria is established. The whole building must be considered, yet the investigator should not get lost in the quantity of data to be collected. The object of study must be situated in its urban context: access, proximity, scope and general conditions of work to be done must be considered.



Successive phases in the architects work
(Swiss regulation SIA 102)

Fig.1: EPIQR in the general renovation process
EPIQR takes place in the preliminary draft phase

Recent developments in the computer world make it possible to offer extremely efficient and flexible tools which in our case will serve as an invaluable help in the approach explained above [7].
The point of departure using this tool consists in a systematic visit of the building according to a standardised procedure [8]. In the course of this visit which will take a few hours (max. 4 hours according to the size and complexity of the building), data is collected following a check-list of criteria which can be seen on the screen as text and images (Fig. 2). This check-list may also consist in a booklet containing all building elements and criteria. In order to facilitate the investigator's assessment and to ensure a correct judgement of the situation, the advantages of multi-media will be used: through text and images it will be possible to fix and then to recall at will the content and the value of every situation and from there, to ensure its coherent assessment. The different data bases related to the various problems to be looked at (deterioration, energy, air quality, etc.) can be adapted to local particularities and evolve as a function of more precise and complete knowledge of the domain based on experience (Fig.3).

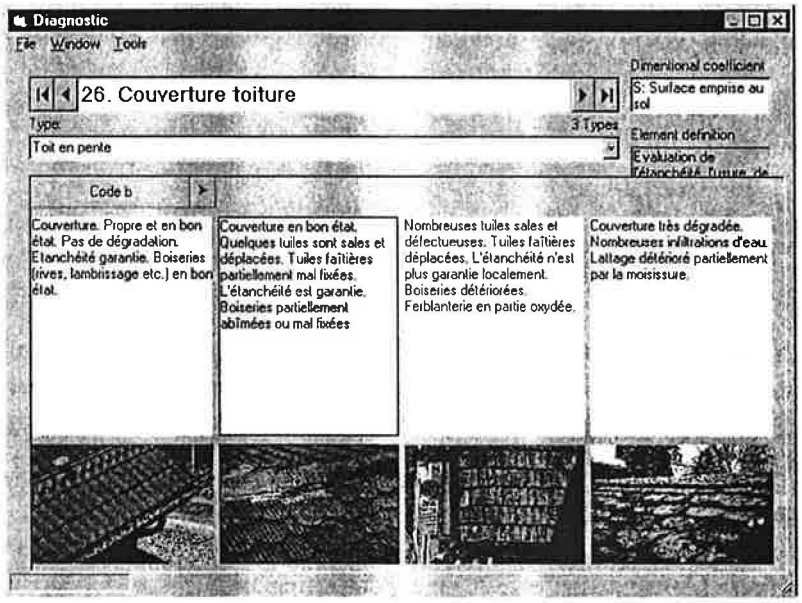


Fig. 2: Coding the degree of deterioration of the building elements
The degree of deterioration of the 50 EPIQR elements is described and coded a to d. The text is illustrated with typical examples.

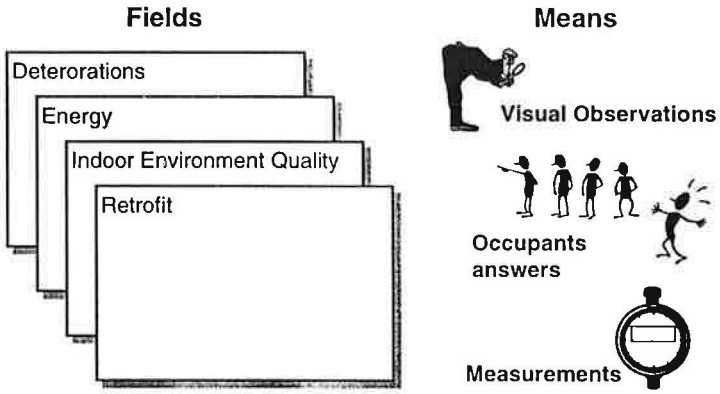


Fig. 3: EPIQR data base
The EPIQR database is composed of several fields. Data is gathered through visual observation and occupants interviews.

In order to coherently organise the project, the project manager will have to present a complete report to the building owners, including the building

diagnosis but also presenting different scenarios for the continuation of the operation. This report includes (Fig. 4)

- a diagnosis of the condition of the different building elements
- an overview of the worst deterioration problems
- energy balance of the building, possible improvements [9], [10], [11]
- possible improvement of indoor quality [12]
- the nature of refurbishment works (possible actions)
- definition of the degree of intervention
- cost of refurbishment works
- simulation of possible investments schemes.

The presentation of the results demands particular care. It aims at two goals: on one hand, the non-specialist must be informed on the state of the object (point of departure of the evaluation) in a synthetic and accessible way, on the other, the nature and scope of the proposed intervention must be quantified. Some of these data will be presented in the form of graphs in order to stress certain important points which will help the owner to decide which option to choose for the refurbishment of his property. It is clear that a graphical presentation of the results is preferable to long explanatory texts.

The indication of the global intervention costs is accompanied by a description of all the works involved. This basic information is only really useful if accompanied by a commentary indicating the probable evolution of the state of deterioration as well as the costs of refurbishment as a function of the elapsed time. This will be a really useful tool for the financial planning of building refurbishment and the choice between possible scenarios.

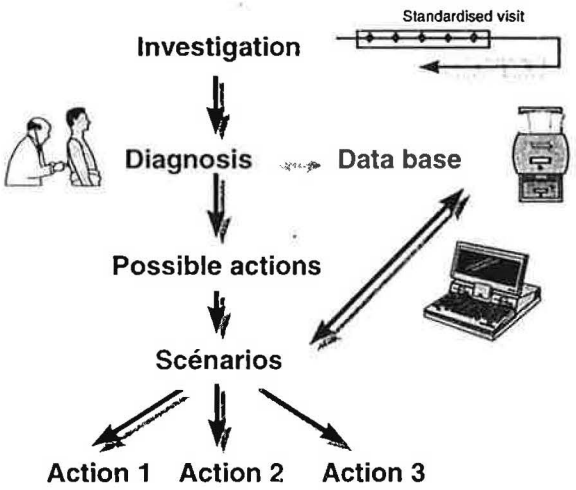


Fig.4 : The EPIQR concept
The complete catalogue of possible actions allows different refurbishment scenarios

Extension of the methodology

The general concept explained here and illustrated for the construction sector could also be applied in other sectors. Civil engineers are facing similar problems: maintenance and refurbishment requirements of structures follow the same pattern as in housing. It is therefore conceivable to apply the EPIQR methodology to an enlarged field of activities (Fig. 5).

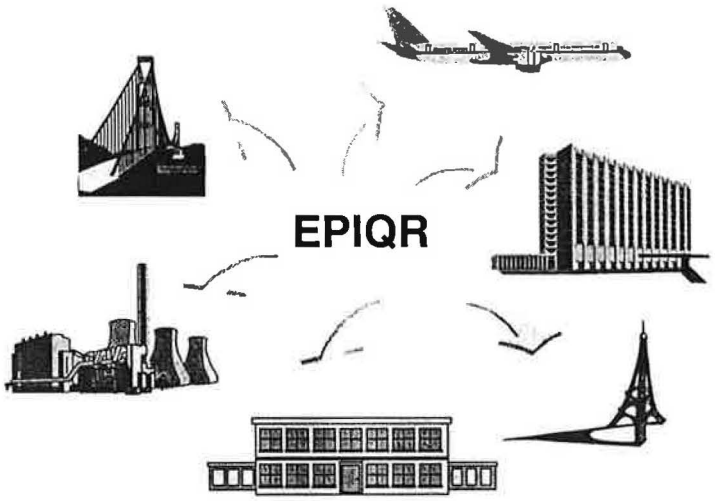


Fig.5: Possible extensions of the EPIQR concept
The EPIQR concept could be adapted to a great variety of situations

Conclusion

At the start of any refurbishment project it is of paramount importance to gather all relevant information. This information generally concerns various fields such as building and services degree deterioration energy demand, waste management, indoor environment quality etc.
The EPIQR method allows a rapid and comprehensive survey and report of this information acquired through visual observation and occupants interviews. Of the many possible refurbishment scenarios based on this information it will then be possible to choose the one that best fits to the general situation, the need of lowering the energy consumption and the financial possibilities.
Finally the EPIQR methodology could easily be adapted to a wide range of complex problems such as those encountered in the maintenance and refurbishment of civil structures.

EPIQR partners

Building Research Establishment BRE (United Kingdom) Project coordinator
Centre Scientifique et Technique du Bâtiment CSTB (France)
Danish Building Research Institute SBI (Denmark)
Fraunhofer Institut für Bauphysik IBP (Germany)
National Observatory of Athens NOA (Greece)
Building and Construction Research TNO (The Netherlands)
Ecole Polytechnique Fédérale de Lausanne EPFL (Switzerland)
G.A. Meylan (Lausanne) and GS Arkitecten AG (Münchenstein)

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