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EPIQR Software : A New Refurbishment Concept

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EPIQR SOFTWARE A NEW REFURBISHMENT CONCEPT

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ABSTRACT

The support of the EPIQR method is a multimedia computer program. Several modules help the users of the method to treat the data collected during a diagnosis survey, to set up refurbishment scenarii and calculate their cost or energy performance, and finally to visualize the results in a comprehensive way and to prepare quality reports. This article presents the structure and the main features of the software.

RÉSUMÉ

Le support de la méthode EPIQR est un programme informatique multimédia. Plusieurs modules aident l'utilisateur pour traiter les informations recueillies pendant l'enquête de diagnostic, afin d'établir plusieurs scénarios de rénovation et calculer leur coût ou encore les performances énergétiques de l'immeuble. Enfin il permet de visualiser les résultats de façon compréhensive pour établir un rapport de qualité. Cet article présente la structure et les caractéristiques principales du logiciel.

INTRODUCTION

The EPIQR method is a decision aide tool for residential building refurbishment. It helps the expert to establish a structured building diagnosis covering building deterioration, energy performance, indoor environment quality, and compliance with standards and regulations. The expert can build various refurbishment scenarii and calculate for each of them the refurbishment cost. He can calculate the energy balance of the existing situation and identify the energy saving potential for retrofit actions. A special module helps the expert to perform a cost analysis and personalize the method costs.

EPIQR is the result of a European research project in the Joule II framework. A multidisciplinary teem with research institutes and private consultants from Switzerland, Germany, France, The Netherlands, Denmark, United Kingdom and Greece participated in the project, bringing their expertise in all the domains touching refurbishment and giving a global approach to the method. Energy savings and occupant comfort got a central place in the very early stage of the decision process.

The building diagnosis and cost calculation is a continuation of the well-known Swiss method MERIP. The software of the method has been developed at the EPFL. The interface is programmed in Microsoft Visual Basic 5 and the databases in Microsoft Access 97. The program runs on a standard PC with Windows 95/NT4 or on a MAC with windows emulator. It is now available in the Swiss, French, German, Danish and Greek market. In Switzerland it exists in French, German and Italian languages.

SOFTWARE MODULES

Eight different modules allow the user to work on a project to the degree of detail he wishes according to the available budget for the study. Within four hours, an expert user can give a first rough estimate of the global refurbishment cost, allowing three hours for the visit and one hour for data handling. A complete project with a description of the current state of each element, an energy balance, a report on the indoor environment quality and two or three refurbishment scenarii may take two to four working days depending on the complexity of the project.

Building Characteristics

Only seven dimensional coefficients are absolutely necessary to calculate the refurbishment cost. These are façade areas, built area, area of foundations, lot area, number of apartments, number of stories and number of staircases. The user can give some other parameters that are more easily measured from which the program then calculates the above. For example instead of giving the façade area he can give the façade linear length and live it up to the program to calculate it. The program will adjust the refurbishment cost according to building dimensional coefficients and building complexity coefficients. The building cost index updates the cost taking into account price variation over time (every country has an institution giving the current price index). The building and owner identifications are stored in a database managed by the program in the same way as email programs manage address books.

Figure 1 : Building dimensional coefficients for the calculation of the refurbishment cost and building complexity coefficients for the adaptation of the database costs to the particular project.

Building Deterioration State

The building is decomposed into 50 elements. For example windows, façade finish, boiler, electrical installation etc [1]. For each building Element, different types may exist. The user chooses the type that corresponds to the actual building and decides which of the deterioration codes a, b, c, or d described by the method, best fits the observed state of the building element. In addition to the detailed description, one or more pictures illustrate the four possible deterioration states. A total of about 500 photos and sketches help the user to decide on the correct deterioration code (Figure 2).
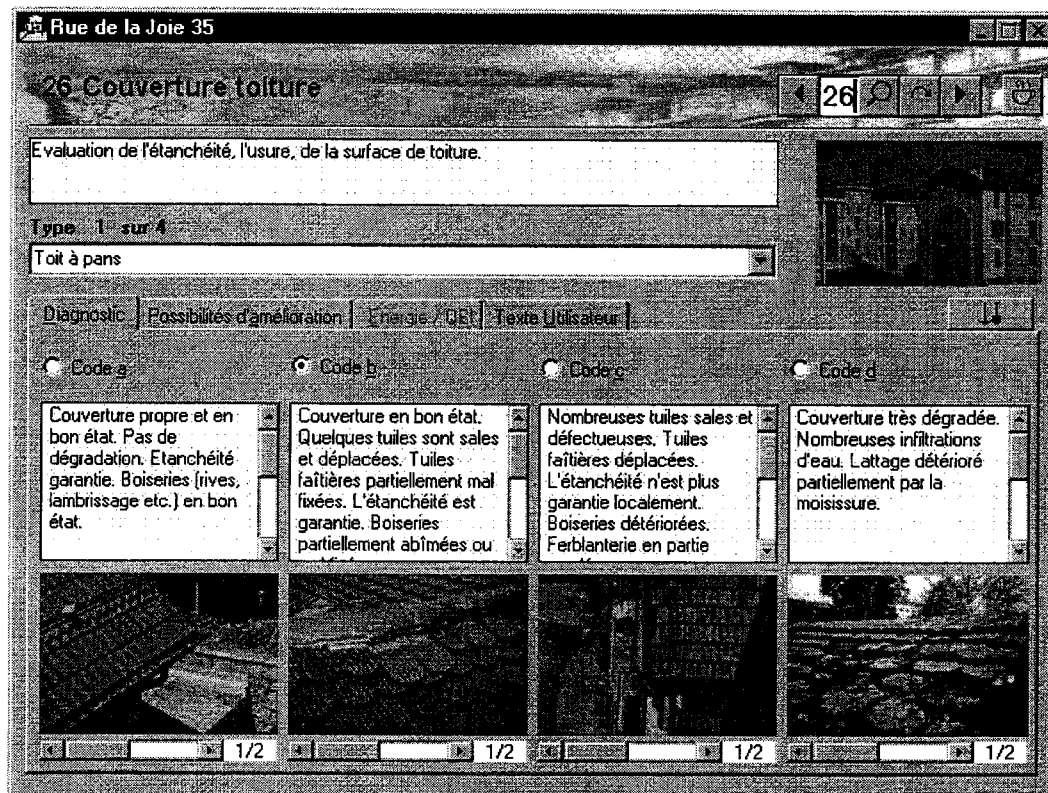
Figure 2: The users have to decide to which deterioration code the observed element corresponds. Several pictures illustrate the codes and ease the decision-making.

Upgrading retrofit work is described separately in order to distinguish work necessary to bring the building element back to current standards from work that adds value to the building.

Heating/Cooling Energy Requirement and Energy Saving Potential

Energy bills show the current state of the building energy consumption. This state is compared to the standard and best practice values of the country to illustrate the saving potential.

A simplified energy balance calculation based on EN-832 [2] shows the heat loss distribution and guides the user to retrofit measures with a higher energy saving potential.

Figure 3 : The current energy consumption indicates the global energy saving potential (left). The energy balance heating calculation (right) shows the potential of some actions separately.

Occupants and Indoor Environment Quality [3]

Before the building audit, a questionnaire is distributed to the occupants with questions on the indoor environment and apartment facilities quality. This questionnaire helps the surveyor to identify hidden problems in the building or to support his arguments in refurbishment strategy discussions with the owner. The software performs a statistical treatment of the questionnaire and relates complaints with refurbishment work and energy retrofit measures. If for example the occupants observe rusty or dirty hot water, the software will suggest replacement of the hot water distribution system and if they feel cold draughts or condensation on the windows, it will suggest replacement of element 39 (windows).

Building a Refurbishment Scenario

Decide a refurbishment strategy (Step 1)

A round graph summarizes the building deterioration state of the 50 building elements. On the same graph the user can visualize the refurbishment cost instead of the deterioration state and identify the most expensive actions. The graph is active and the user can unselect a set of actions to see the effect on the total cost. This is extremely useful in the decision making process when the investment budget for renovation is limited. Deselecting all façade elements in this example, the total cost does not change considerably. In the cost graph, we can see that for this project the kitchens and the toilets are the most expensive elements. The active energy flowchart assists the user to construct an energy coherent scenario by testing the effect of different projected actions.
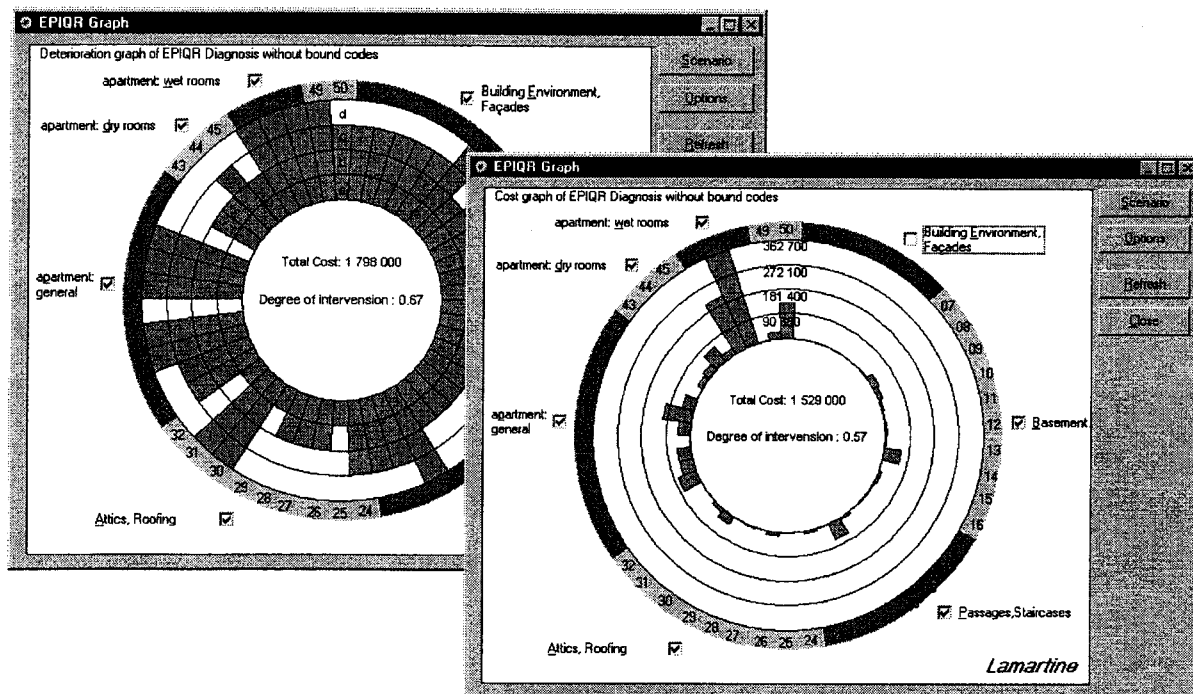
Figure 4 : The active graph shows either the element deterioration state, the bars on the left picture, or the element refurbishment cost, the bars on the right picture. The user can project different scenarios by deselecting one or several element groups (the sectors on the circle circumference). The degree of intervention is the ratio of the actual cost to the cost if all the elements where deteriorated to code d.

Elaborate a detailed scenario (Step 2)

The energy flow chart, the cooling module (only for southern countries) and the deterioration/cost graph help the user to take a global attitude towards the refurbishment of a given project. Another screen will help him to browse elements one by one and decide on the level of intervention for each. His decision will be based on the deterioration state of the element, on the occupant complaints and on the cost of bringing the element back to current standards. National standards and guidelines affect refurbishment of many building elements as well. Another important decision parameter made available by the software is the remaining life span of the building elements [4]. All this information should help the user to take a more coherent decision. The user can browse one by one through the 50 elements and by deciding on the level of intervention for each of them the total cost of the scenario is updated.

Cost Analysis

The program calculates the scenario cost element by element. This first rough estimate helps the refurbishment expert to converse with the owner to decide upon the retrofit strategy taking into account budget limitations. This interaction could be iterative until the two converge on the most convenient scenario. At this stage the user must perform a more accurate cost analysis. For each element the program gives a more detailed description of work and costs. The user can modify the calculated cost and give his own estimate. The detailed descriptions of the actions to be undertaken are such that they can be classified either according to an element classification method or a trade classification method [5, 6]. The Swiss building cost

classification method BCC is already implemented in the program and the user can, for example, group all masonry work together, carpentry in another group, sanitary in another etc. It is possible to also integrate into the software different national classification methods.

CONCLUSIONS

The EPIQR software is neither a simulation program nor an expert system. It is a support that makes decision making easier, more rational and coherent. The software does not decide for the user but gives him enough information elements to take an informed decision. It combines information from the audit, from the cost and deterioration database, from the picture database and from energy calculations, to assist the decision actors from the first moment of the project until a decision is taken on the refurbishment scenario. This combination brings forward energy and indoor environment quality issues into the first stage of the decision making process when there are still many possibilities for alternatives open. In practice these issues are usually ignored at the first stages of the project and only the physical state of the building and the cost are considered. Often energy, when considered, comes in only during the detailed project phase and then it might be too late for variations. As soon as the refurbishment budget has been decided on, the margin for modifying the initial project is too narrow.

Using computers in the decision making process allows almost immediate availability of data that would take considerable time to calculate manually. In this new environment, the expert can test several combinations and scenarii within a reasonable time, which opens new perspectives.

Since the EPIQR software does not decide for the user but assists him to decide, it is necessary that the user has some level of expertise on building refurbishment. However, it does not require any advanced computer expertise. Building experts with little experience in building physics for energy savings can also take advantage of the software.

The user-friendly interface and its multimedia features make the software an excellent pedagogical instrument to teach building refurbishment. The program is used with much success at the Department of Architecture of the Federal Institute of Technology – Lausanne.

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