Informatic tools for historical centres maintenance

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Abstract

Maintenance activities represent an economic investment necessary for the preservation of the environment and operational performance of building systems. The significance of the role of maintenance lies in the fact that it must satisfy the needs of current user requirements as well as preserving the existing environment heritage for future generations. In this respect a long-term view of maintenance planning is essential in order to optimise the scarce resources allocated to maintenance. The presented research aims to create an information system (“Maintenance Booklet”) to support the management of maintenance programs of homogeneous historical buildings. The proposed information system will hold both graphic and constructional data of buildings of the urban infrastructure and will provide tools for critical analysis of the building components, in terms of their behaviour when used; as well as the capability to identify. The “Maintenance Booklet” is generally defined as a systematic and organised collection of information about the management rules for the periodic control of building components and systems, and interior spaces of buildings.

The resulting informative system represents the knowledge base of the maintenance booklet. The system has to satisfy control performance at different levels; to record the technical information, to give to the building manager a methodological know-how to select data for programming interventions, to give procedures to control the technical performance of the building systems.

The tool was designed in HTML language to input data on web pages, in order to allow dissemination of building information within the net. This web-based system is supported by a database for technical and graphic identification of building systems; criteria for maintenance strategies; data entity-relationship map; control procedures for maintenance interventions (survey cards, diagnosis
cards of decay condition, clinic operative cards, monitoring cards, chronological programme for interventions).

1 Building maintenance management

The maintenance intervention is made on existing buildings and, although it is not a preserving operation, it triggers some transformations in the real estate system, eventually lengthening its useful life. In order to ensure the preservation of a building what must be respected is the logic underlying its construction and the organisation of space, the quality of materials used, the relations linking its parts (components and space); the maintenance project can thus be defined as an "implied" one since it is already drawn within the building and may be extrinsecated through an in-depth analysis of its technical constructive and functional characteristics, which against the widespread practice of recovering a building through an intervention which ends up transforming it in something which is completely different from what it was before, not so much from the formal standpoint, but from the structural one.

Nowadays designing building maintenance tools means to preserve an existing building at the same time taking into account users' needs, translating them into an innovative process of continuous intervention on that building in order to maintain the quality of services it renders at a level which is deemed as optimal; the above mentioned tools must cope the need to preserve the building with the unavoidable transformations and the pushing requests for innovation the users of the building make as a consequence of physical, technological and functional obsolescence, which cannot refrain from affecting the state of that building as time goes by. Those transformations are caused by renewals which sometimes result in an upgrading of the building's structure through the usage of elements which aim to achieve new and higher performance standards; it is in this phase that maintenance interventions must be controlled so that the needs for durability, reliability, and capability to maintain the building's structure are taken into account, making sure that the main criteria driving the intervention are the compatibility between the technologies adopted for maintenance and those used for construction, and the preservation of both the basic architectural idea and the identity of the site where the building is located.

For purposes of this a maintenance programme, which is the operating arm of the Maintenance Plan, is laid down (1); the Plan rests on the design of an Information System storing all sort of available information relating to the building, to its efficiency and to the time reliability of its composing parts. The Maintenance Plan is conceived as a prevention tool (threshold value-based or condition-based maintenance), a policy which aims to reduce emergency situations; however, a certain share of correcting interventions ("after accident" or "incidental" maintenance) may fit the framework of the applicable maintenance policies, which can be mixed in a way which is the most appropriate for purposes of the optimal technological and economic management of the building.

The numerous laws approved, during the nineties in particular, starting from L.109/1994 (Merloni) and subsequent changes, until L.415/1998, mainly to
comply with EU directives, rule among other things the issue of the "maintenance project". Those laws are flanked by the rules issued by important European institutions; among those sets of rules UNI's ones represent the national reference for purposes of complementing the existing legal requirements with voluntary technical and procedural guidelines. Through the application of those rules we obtain an orienting and informing document relating to:

- the set of data needed to develop knowledge of the buildings to be maintained of the geographical sites where they are located, and on the mutual relations among them;
- the analytical methodology and on the control parameters used to program inspections and interventions on a statistical basis;
- the intervention procedures.

1.1 Computer-aided tools supporting maintenance plan management

The realisation of Maintenance Plans, aiming at the preservation of real estate assets throughout time, raises the need to manage a large amount of heterogeneous data, describing both the urban and jurisdictional location of buildings, and their structural and functional features. Under this regard the design of Information Systems to be linked on line to specialised databases and to be run by dedicated departments looks the most feasible tool for the management of the plan itself.

About methodology, the parallel definition of a set of instruments collecting and analysing building-related data, which contribute to the completion of the Maintenance Program, has enabled to carry forward the research work (2). Therefore during the preliminary phases of the project most of attention was paid to:

a) The identification of the characteristics of the reference set of buildings,
b) The detection of the parts of the outer parts of the building suitable for programmed maintenance interventions,
c) The choice of the most appropriate way to classify and numerically encode the components of the parts of the building shell.

2 The users' profiles

The introduction of informatic technology in any process of productive activities involves at all a change of the roles of people who are engaged in these activities.

In planning the process informatisation it is necessary to define the future users profiles because there is a strong link between operators and actions, each step is set for specific competence at every level than for every action there is an operator with his own requirements.
This kind of structure is apparently strict but it is really the guarantee of the instrument, while in common process very often there is not a precise attribution of roles and it causes inefficiency.
The users profiles defining is based on the knowledge of all specific competence and, for each user, of his own activities; there is also defined how each user is allowed to access to the system.
The activity of planning roles for users of the informatic tool for building maintenance and management is an important phase in the design of the informatic structure; it comes from this that new categories of employment are recognised.
The distribution on maintenance process localises various operative levels with new activities.
The users area comes out shared into four categories:
- manager
- technique
- final user
for each category there are specific own competence and activities.
The maintenance booklet is structured to be, at the same time, both a work tool and a training tool; by this way the informatic instrument for maintenance and management of buildings is able to give to all operators the possibility of “learning by working” without any costs for public administrations.

3 New classification plan of maintenance booklet

The Information System planned for maintenance of historical buildings is based on a flow-chart of information. It considers a careful phase of analysis and check of the data that allow us to understand the building deeply. All this it’s necessary to use a tool able to decompose and to classify all the parts of the building into its sub-systems and components, based on an unified appropriate common language. The classification allow the engineers of maintenance to understand building’s performance, through an accurate knowledge of constructive, physical, geometrical characters, of typology and form and degradation conditions.
The research, developed by our group, proposes a normalized language created for the informatized maintenance booklet able to collect different information. This classification plan was born specifically for the maintenance, pointing the attention on the particular needs of this context, starting from some scientific national and international classification systems.
The systemic classification suggested by UNI (Institute for Unification Standards), Standard n° 0051, decomposes building into technological and environmental units. It was born such as a tool aimed to assure the quality of building’s components produced by industry. It allows us to understand the relations among all the technical elements. The technological system is decomposed pointing the attention on the function of the single element; while the environmental system on the activities that take place in the spaces.
The UNI classification system organizes all the building components into a hierarchy structure in order to their level of complexity. The technological
system consists of technical units that include elementary technical elements. The environmental system consists of environmental units that identify a group of activities related on the users' behaviour. This system, born for new buildings, aimed to control the building process and to assure the quality of industry products through tests of their performance. This classification system is a good reference for our study, but presents an unflexible structure to informatize the maintenance process of historical buildings.

Another classification plan, named PC/SfB, considered a good system by the international scientific community was born to use the same language during all the phases of planned and productive process. In fact, every element appear with the same code whether it is included into technical cards, or into drawings, or into quality certificates.

The PC/SfB (draw up by Sweden Committee for building problem) presents an hierarchical structure that seems like a tree: every information is divided into other information more simple. This plan is more appropriate for the new constructions that for the ancient buildings. It is an advanced step towards a classification plan that is not only a list of codified voices, but towards a more complex informative system. The new classification system for maintenance of historical buildings is based on the same hierarchical criterion from UNI classification system, but it aims to collect different information directly for the maintenance process.

A prerequisite of effective informatization of a maintenance planning is the possibility to codify and informatize every voice into an alpha-numerical system. A plan like this allows us to recognize the classified voices and to improve voices not changing the system's structure. Starting from the logical model of information process (flow-chart) we drew up tables in which we classified all the data we needed for the maintenance plan of an historical building. This tables include:

- check-lists related to the voices codified;
- glossaries whith the definition of the single voice. It was necessary to analyse all the relations among the codified voices with the aim at informatize all the maintenance process. The new classification system allows us to understand for every technical element of building envelope constructive, phisical characters, degradation conditions, maintenance designs, costs, equipment and building trades, collecting different information. We can say that all this forms an integrated system of information to support the management of maintenance programs for historical buildings.

References
