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VÝVOJ INTERAKCIE TECHNOLÓGIE A PATOLÓGIE STAVIEB

DEVELOPMENT OF THE RELATIONSHIP BETWEEN BUILDING TECHNOLOGY AND PATHOLOGY OF BUILDINGS

Pathology of buildings is a scientific discipline in the field of building technology concerned with finding causes of undesired pathological problems, forecasting building diseases and finding technologies for therapy, prevention and maintenance of buildings. The article analyses theoretical basics of interrelations in the fields of study. The interaction between pathology and technology is presented through the verification of the relations. The conclusion describes the possible implementation of the theoretical basics of interaction between patology and technology fields of study into practice.

INTRODUCTION

Building technology as a science discipline deals with the technology of building processes, their mechanization, labor content, choice optimization, health and safety at work, not excluding environmental protection. The theory of building process is further developed in preparation and construction-manufacturing process realization during construction site operation.

Pathology is a general term to describe the unsound, abnormal, generally undesirable phenomena. Pathology as a science discipline has a similar structure, terminology and methodology. Abroad, the pathology of buildings devotes particular attention to the action of microorganisms like algae, fungi, mosses and lichens on building structures. Study and development of this scientific discipline has interdisciplinary basics. Specialists from posts of construction engineers, microbiologists, chemists etc. look for a joint action. However in this form the term scientific discipline is more narrow and therefore known as "Building mycology". Pathology deals with the construction deviation, abnormal life processes and phenomena of buildings. Furthermore, in [2] the author states „it examines and refers to the nature of the diseases causing abnormal conditions. It also investigates the structural and functional changes as well as building usage abilities resulting from the disease process. Furthermore, based on these generalized and systematically organized findings it continues to develop diagnostic methods, technologies and materials, their alternative and objectified solutions as a way of solving therapy and prevention of pathological conditions".

The existence of an interaction between pathology buildings and building technology is undeniable. Reality of high quality designs of buildings or construction sites does not preclude the formation and development of pathological conditions. The cause is the impact of building technology, way of using and maintaining the buildings. In [1] the author introduces, „quality of theoretical knowledge allows to model construction processes, optimize and schedule them, as well as to comprehensively manage quality in construction processes on a theoretical but especially practical level".

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ANALYSIS OF INTERRELATIONS AND VERIFICATION IN PRACTICE

Basic theory of interaction

The existence of ties between pathology of buildings as a scientific discipline and building technology is undeniable. The interaction of any two elements creates prerequisites for relations that have particular common rules. However, the interaction of pathology and building technology is specific. In most cases it is not possible to describe their interactions by approximate mathematical models, dependency or dependency features. The rules are dynamic, in constant development. In many cases it is not always possible to clearly determine the direction of ties. Dependencies are usually experimentally proven by long-term case studies. We can certainly say that the pathological condition of structures occurs when taking into account all known theoretical knowledge in the process of structural design and maximum quality control in the process of building performance. This is due to the input of number of subsystems' independent variables into the process of development, realization and the use of a structure as an integrated system.

The basic idea of technology and building pathology interaction is a building structure with predetermined and expected features. These are limited by requirements arising from legislation and standardized, quality or pre-arranged contract technical specifications.

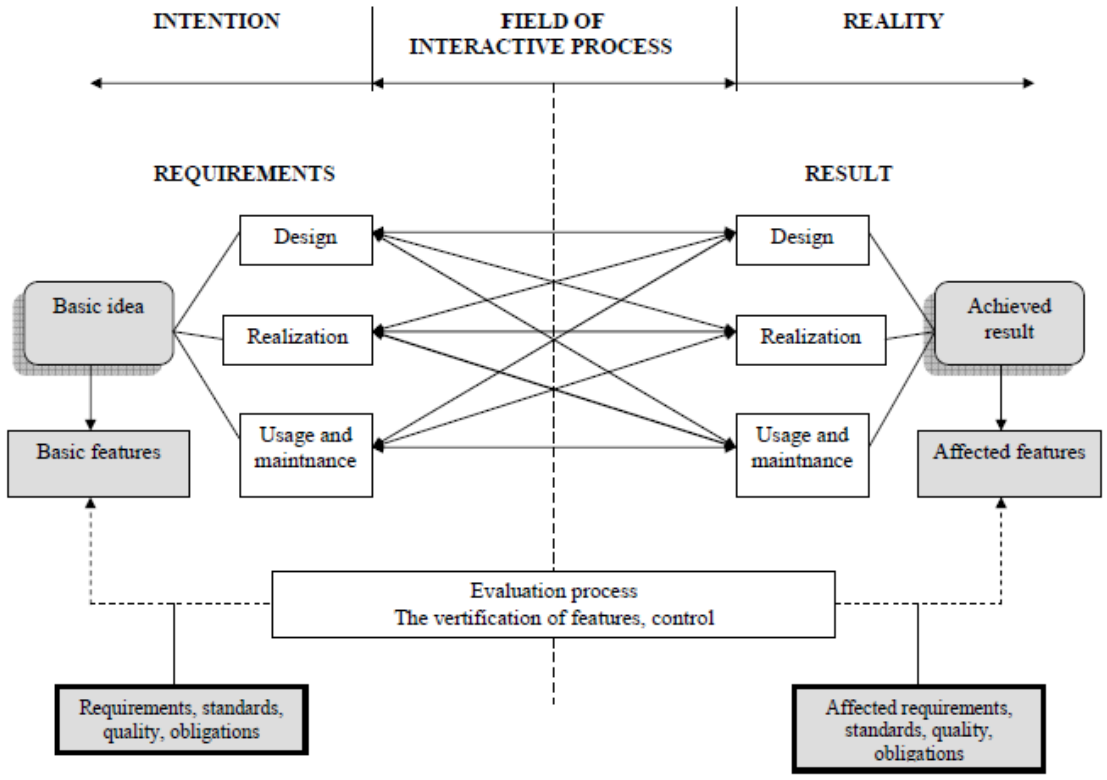

Fig. 1 The theory of interaction between the intention and resulting technical condition of a structure. The figure shows basic features in the process of planning, implementation and early stages of usage and maintenance. Despite a perfect plan and implementation of a construction, the life cycle of the construction brings changes in the characteristics. The changes are caused by interrelated influence or exclusion of various factors. It is necessary to

develop new technologies to objectify the characteristics of the construction, to achieve the original basic features.

The requirements are being transformed into the process of designing, implementation, maintenance as well as the use of a structure (according to the scheme of Fig. 1). At times, the actual result obtained shows other than expected parameters. It is influenced by a number of independent variables which affect and interact among each other. In many cases they are also mutually exclusive of each other or intensify the effects of pathological (morbid or polymorbid) conditions and construction signs.

In practice it is impossible to determine the single factor without interaction with others. The results are influenced and distorted features of a structure. In this process the field of interactive process is seen as a period of time without a closer quantification.

Structure features are in their basic idea or even in the achieved results further distorted in time. We are talking about the action of specific environmental conditions, their unpredictable changes in expected life time, changes in the terms of use, operation of construction interventions, effects of aging or random contingencies. All the listed factors are considered as the principal means of interaction.

Water and moisture effect on the structure, in combination with micro-organisms and higher organisms is one of the most frequently occurring outcomes of the interaction of technology and pathology of buildings. Under moisture, we understand water in its full range, either being built-in in a structure or as an air moisture/humidity or vapor condensation, regardless of activity in or outdoors. But there are plenty of examples where humidity does not play an important role and it is not a carrier of interactions within the existence of organisms. Moreover it eliminates their existence.

The construction work, as the product of a number of activities in building technology is therefore a carrier of required or affected features - a pathological condition. The role of pathology of buildings is to objectify these affected and undesirable features so that they meet all the essential requirements for construction in accordance with valid legislation. Objectification is mainly understood as a determination of causes, treatment design, development of technology therapies and their modifications into the design, realization, maintenance or even the usage of a structure.

Therapy literally means the treatment or suppression of symptoms. In conjunction with building terminology, this term should be understood as a combination of technological solutions for building or structure sanitation that results in:

- remediation and mitigation of the condition,
- restoration of original features of the construction works,
- elimination of any progressive pathology conditions,
- objectification and improvement of the original functions and features of construction work,
- creation of new user qualities.

Long practical experiences, new knowledge of building technologies as well as experimental solutions are being used while applying the therapy. By observing the recovery efficiency of used technology on a structure new experiences on the effect of therapy, its service life, labor content and financial costs are obtained and verified. It also develops the hypothesis of circumstances of pathological conditions and professional activities in terms of prevention.

Verification of the interaction between technology and pathology of buildings

A recent example of the interaction between technology and pathology of buildings is a defect of the external wall with additional thermal insulation - insulation by contact system (ETICS). In [3] the author introduces, „the main pathological example is plaster colonization by cyanobacterial algae in symbiosis with fungi (micromycetes) in the form of spots up to continuous coating. They can be rarely seen on false ceilings, coated with slime. Green and black colors dominate. At this time no clear identification of the causes is known".

It should be noted that in the early stages of the use of a building all the essential requirements are fulfilled (set, expected, predetermined), transformed in the process of designing, implementation, maintenance and use of the structure. During the use, however, despite the perfect design and execution of a construction there is a change of features due to the interaction and exclusion of various factors.

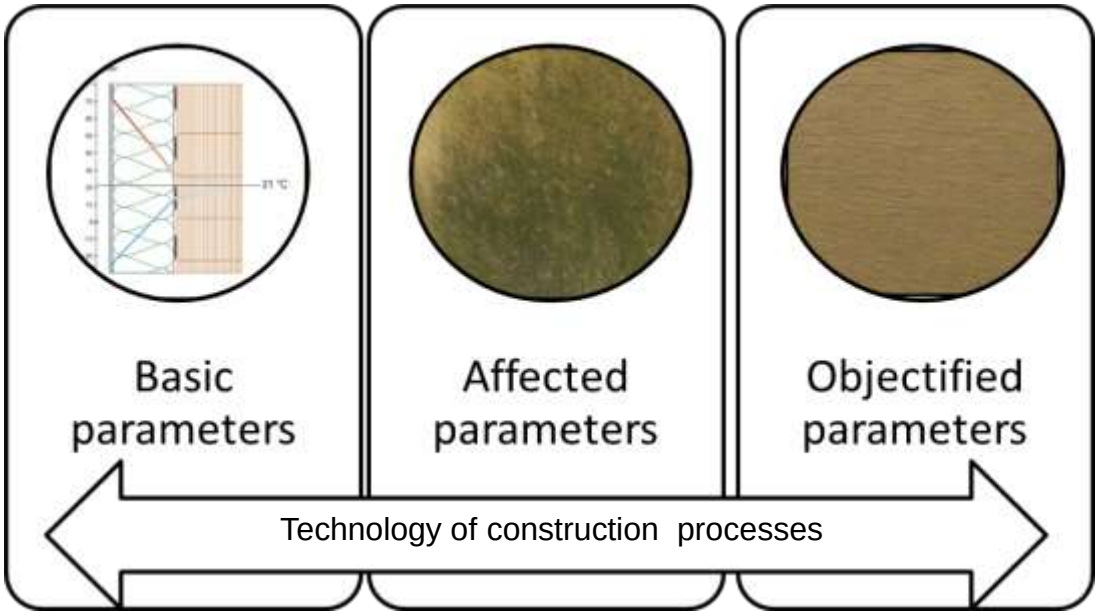

Fig.2 The theory of interaction between the intention and resulting technical condition of a structure. The figure shows basic required characteristics of ETICS in the process of planning, implementation and maintenance during the early phases of usage. Despite a perfect plan and implementation of a construction, the life cycle of the building brings changes in the characteristics of ETICS. The changes (affected parameters) are caused by interrelated influence or exclusion of various factors. It is possible to ensure and increase the durability of the required characteristics (objectified parameters) through development of new technologies.

Experts in [4] [5] [6] [7] and [10] deal with multiple hypotheses. They look for the dependence of material base in combination with condensation on surfaces, showing the connection with the color range of surfaces as well as the connection with the implementation defects. Highly specialized departments in [8] and [9] refer to the development of microorganisms in several areas, stating that the reason is overall change in environment (clean air, built-up areas, the restriction of pesticides in agricultural production, etc.). Observations and knowledge of related science disciplines show a lot of factors that determine or inhibit the vegetation of microorganisms on modern building materials. Many can be influenced by human activity in the process of design, implementation or maintenance. Many

remain unknown and beyond the control of dependence, many are mutually exclusive. The combination of several factors causes the fact that interaction becomes confusing; determination of one carrier is excluded. Interaction field as a time period for the development of the pathological condition is in [2] experimentally monitored and in this meaning it represents 4-6 years from when the structure is put into use.

Pathology of buildings, as already mentioned above, in addition to finding causes also deals with technology solutions, therapies, i.e. objectification of affected construction features. In biocorrosion of ETICS, the role of objectification of construction's characteristics is ensuring the ability to use these characteristics. Practice, managers, owners and ETICS users demand solutions. Permanent solutions which will ensure the expected durability of a structure with projected essential features of the work. However, since the causes are unknown, it is necessary to develop therapy and technology solutions towards correction and effect mitigation of the pathology condition, restoration of the original features of a structure and elimination of possible progression of pathological conditions. The objectification of parameters is achieved by technology solutions – management of decontamination (Fig. 3). For instance in the case of biocorrosion of ETICS, the remediation technology is already experimentally proven and put in use by direct mechanical intervention in combination with chemical exposure. Direct methods of treatment technologies are the simplest feasible [3]. As a complementary solution it is possible to use some of the indirect methods. These are inhibition and prevention of biocorrosion which is longer lasting, but in construction often not the easiest to accomplish.

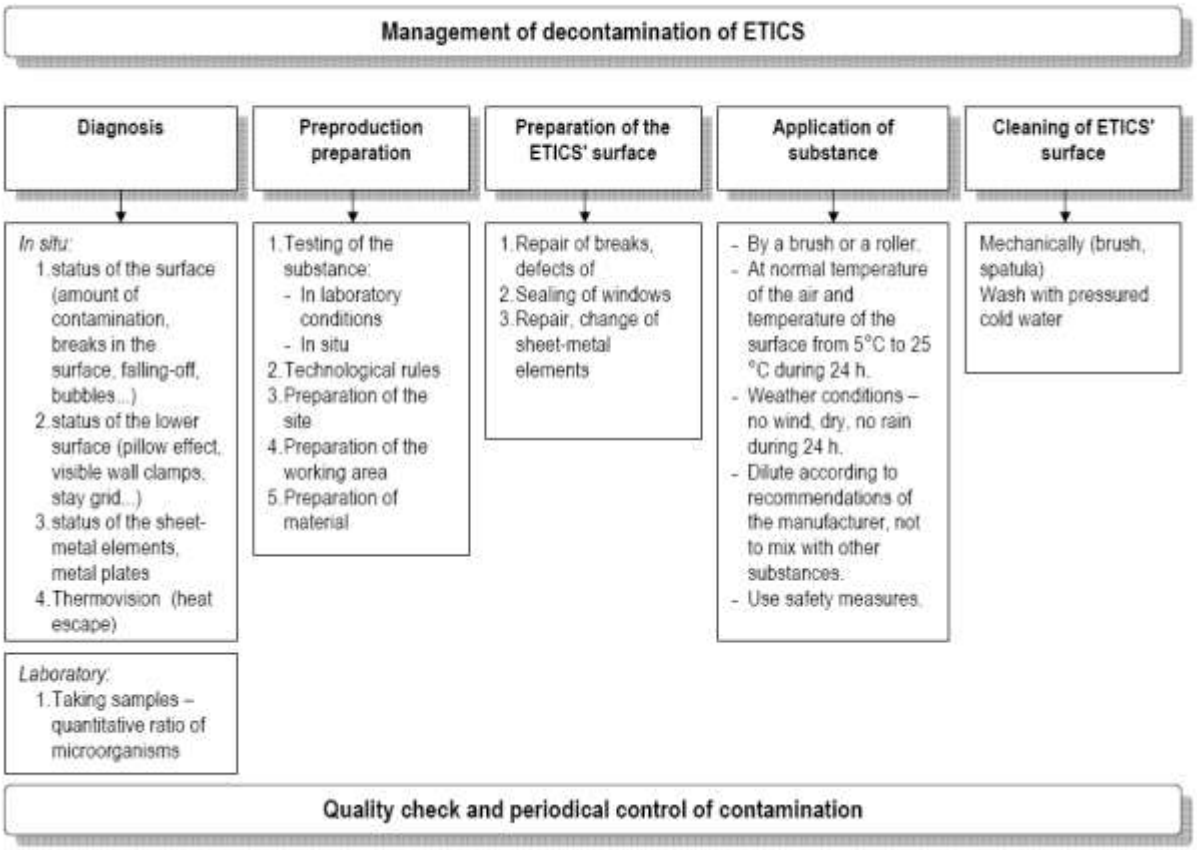

Fig.3 The study results of the interaction between technology and pathology. The figure shows management of technological processes of ETICS decontamination and provision of long-term resistance against microorganisms. The management and the development of technologies is the solution for pathological issues with ETICS in practice, without closely determining their causes.

From the example mentioned above, it is clear that the proposed technology treatment includes a wide range of construction processes. It also includes a method of mechanization, labor content determination, solution optimization, issues of health and safety at work, not excluding environmental protection. Generalization and organization of knowledge gained from dependency and cause findings and from proven treatment technology is therefore used for the design modification, realization and ETICS maintenance.

CONCLUSION

Building technology as a science discipline deals with the technology of building processes, their mechanization, labor content, choice optimization, health and safety at work, not excluding environmental protection. Pathology is a general term to describe the unsound, abnormal, generally undesirable phenomena. Pathology as a science discipline has a similar structure, terminology and methodology.

The existence of an interaction between pathology buildings and building technology is undeniable. This interaction has been presented in the examples above in relation to ETICS but this applies equally to other construction solutions. Pathology, as part of the scientific discipline of technology, is dynamic. Therefore, it has to follow newly developed technology to objectify constructions and achieve the optimal characteristics. These are ever-changing and inter-dependent disciplines which cannot be studied separately and must be used in practice together to ensure durability of constructions.

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