CONTRIBUTIONS TO THE IR STUDY OF DEGRADATION PROBLEMS OF THE BUILT HERITAGE FROM THE BEGINING OF 20- TH CENTURY

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Abstract. The paper presents a study of the transformations that took place in the urban area under the current circumstances with many financial emergencies and a property market continuously changing, due to the cultural homogenization and social- economical transformation at the global level. The maintenance and preservation programs are most of the times incomplete or shortened and this situation exposes the ensembles to an increased risk, leading to complex degradation process. The degradations that appear in time as a result of normal aging process and the action of climate factors can't be treated independently. The problems concerning the building's physics can't be solved separately from the biological and damp expertise that can significantly influence the behavior in time of the construction elements. Many of the public utility buildings such as hospitals, universities, schools, etc., unlisted on Heritage Protection List are now exposed to severe degradation.

Keywords: cultural heritage, preservation, protection, degradation factors, infrared detection of irregularities.

INTRODUCTION

The 20-th century began as a celebration of the Age of Industry and Technology with significant results in all economical branches. This rapidly changed into a response of a new Age of Information and Ecology that emphasized the most problematic and complex issues facing humanity over the next century, that is how to intervene and construct a human habitat in harmony with nature.

Many debates took place regarding a "sustainable development" as an alternative to the industrialized societies, however without preservation the whole idea of sustainability fails because communities will never want to keep nontraditional, aesthetically inferior, or of "foreign origin" buildings, no matter how well insulated, thermal glass, photovoltaic cells, or zero emission carpeting they have.

In 1923 the promoter of Modernism, Le Corbusier, referred to the" new epoch" as to a" new spirit, and" Industry overwhelming us like a flood" and the houses as" a machine for living in".

Today, almost 100 years later, this concept has been replaced by a radically modified tendency that regards the Earth itself. More and more an earth centered trend has influenced the built environment design as well as the revised thinking about the relationship between construction and environment.

As a result, the conservation, restoration and rehabilitation have become one of the primary targets of a global magnitude reform.

Reported to the age of other universities from Europe that started their activity centuries ago, University of Agricultural sciences and Veterinary Medicine from Cluj-

Napoca is relatively young. During time many monographic works were published referring especially to the academic structure, number of students, research facilities or scientific aspects. Many renovations took place during the last decade but some of the problems regarding the degradation evolution could not be resolved.

A new approach of this 145 old education ensemble is timely due to the new nondestructive infrared methods of surveillance.

MATERIAL AND METHOD

In cold climates, poorly installed insulation and vapor barriers can lead to condensation problems and the degradation of the building itself.

This situation combined with leaking of rain water during the warm period conduct to a rapid degradation of constructions and installation of biological organisms that can continue the decay process.

Badly designed, poorly constructed, poorly maintained, leaky buildings are not energy efficient and often have moisture and mold problems. In some cases, damage to the building is caused by insufficient ventilation and/or an under-designed or over-designed insulation system. Preventive maintenance in buildings of all types is very uncommon.

Moisture in building materials can destroy structural integrity and nurture mold and insect infestations.

Infrared cameras distinguish between wet and dry materials by exploiting the thermal characteristics of wet materials. These characteristics include the ability to store heat very well and to warm up or cool down more slowly than dry materials.

IR cameras can instantly take an image of an entire room, inspect places that can't be physically reached with moisture meters, reveal wet conditions behind surfaces such as enameled walls and wallpaper that don't readily water stain, track leaks to their source, monitor the drying process, and confirm when a structure is dry.

From the analysis of the exigencies referring to comfort, security and sustainability, result their dynamic character, into a continuous evolving transformation (Fig.1.).

Irregularities in the thermal properties of the components constituting a building envelope result in temperature variations over the surfaces of the structure [11]. The energy emitted by a surface at a given temperature is the spectral radiance and is defined by Planck's Law. Surface temperature distribution can thus be used to detect thermal anomalies. A thermal anomaly represents a thermal pattern of a surface that varies from a uniform color or tone when viewed with an infrared imaging system. Infrared thermography is a process in which an infrared imaging system (an infrared camera) converts the spatial variations in infrared radiance from a surface into a two-dimensional image, in which variations in radiance are displayed as a range of colors or tones. So the objects in the image that are lighter in color are warmer and darker objects are cooler.

Infrared thermography locates moisture anomalies in building envelopes by exploiting the thermal properties of water. The greater the specific heat (the amount of heat required to raise the unit mass of material one unit of temperature), the more energy is required to heat or cool a particular material. The difference in temperature can be imaged and measured using an infrared camera. The recorded visual image is a thermogram or thermal scan. The most accurate thermographic images usually occur when there is a large temperature difference (at least 10°C) between inside and outside air temperatures. In northern regions, thermographic scans are generally done in the winter.

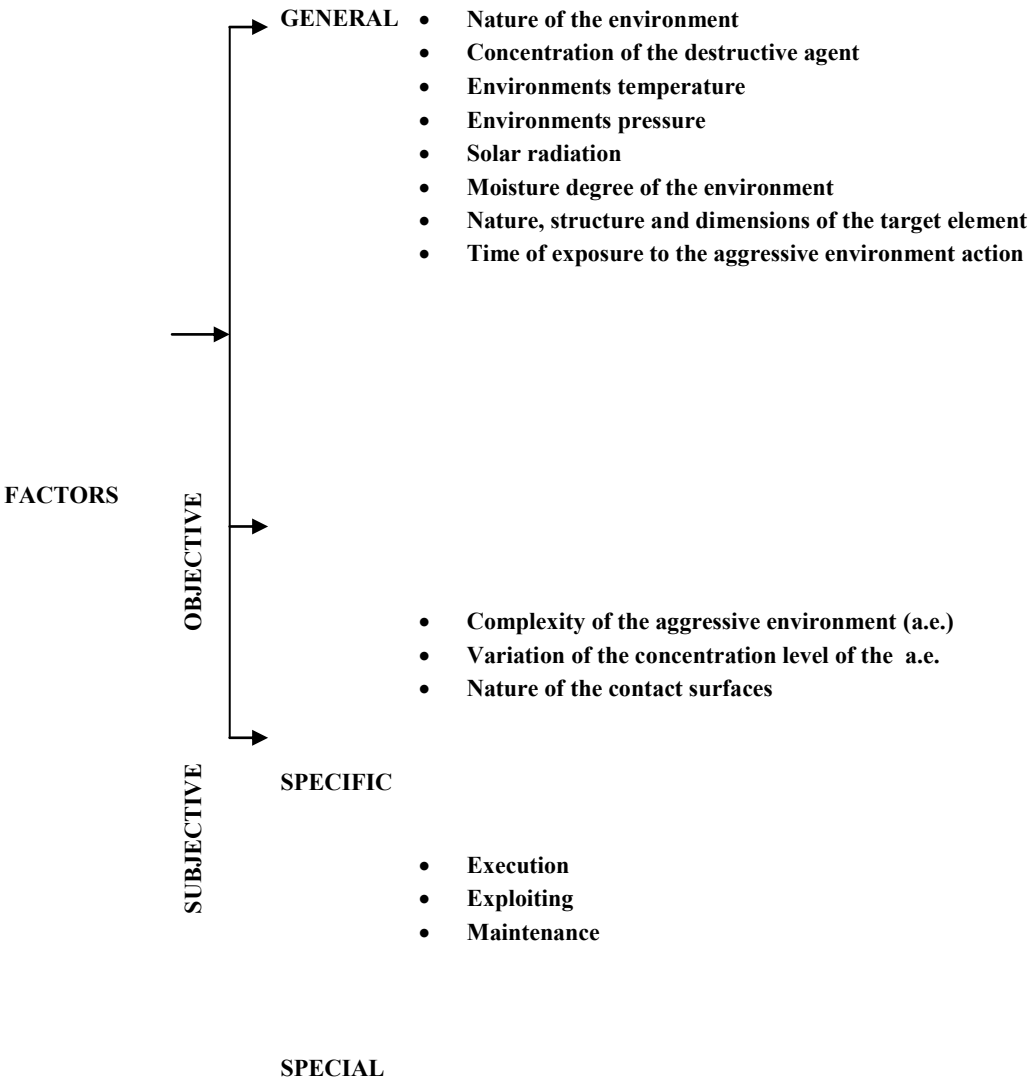

Fig.1. Factors that contribute to buildings elements degradation.

Our study took place in March 2013 when outdoor temperatures were exceptionally low between – 2 *C and + 4*C and were focused on the Rectorat building.

Heat loss detected in one area of the outside wall might originate at some other location on the inside of the wall. Also, it is harder to detect temperature differences on the outside surface of the building during windy weather. Because of this difficulty, interior surveys are generally more accurate because they benefit from reduced air movement. Thermographic scans are also commonly used with an open door test running. The method helps exaggerate air leaking through defects in the building envelope. Such air leaks appear as black streaks in the infrared camera's viewfinder.

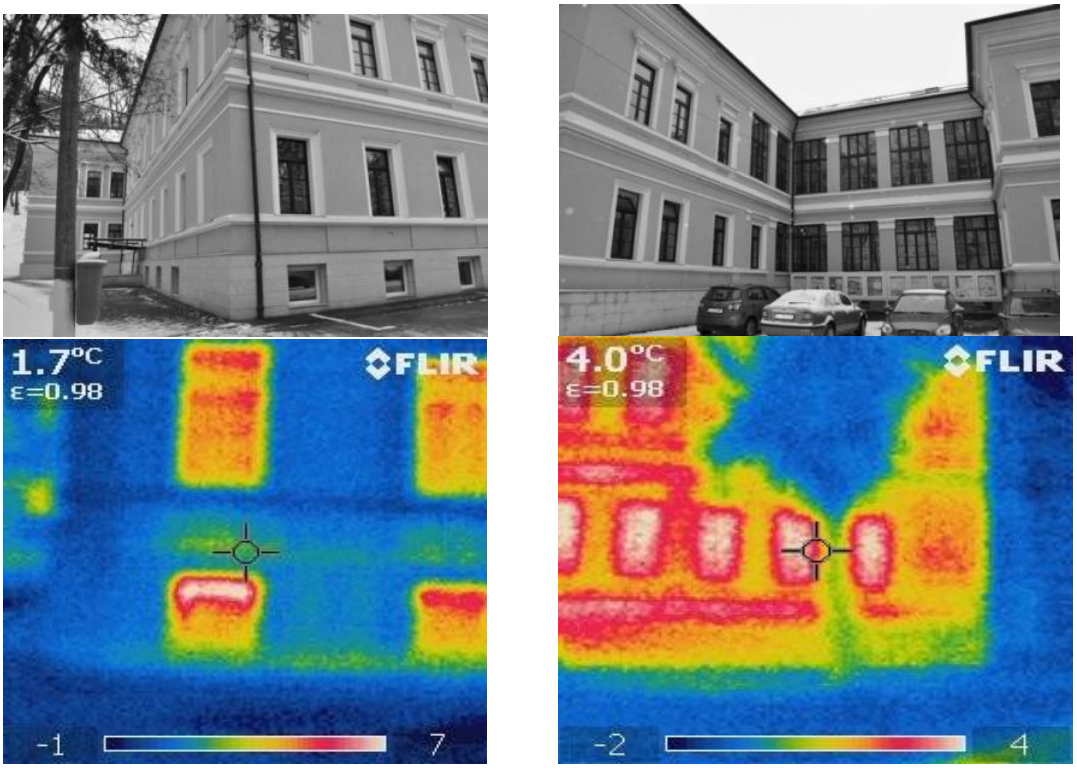

Fig.2. Defects in the building envelope.

In general, thermography uses specially designed infrared video or still cameras to make images (called thermograms) that show surface heat variations. This technology has a number of applications. The most accurate thermographic inspection device is a thermal imaging camera, which produces a 2-dimensional thermal picture of an area showing heat leakage. By visually seeing heat with the use of an infrared imaging camera it is possible to avert problems before they become problems and make the necessary repairs or changes.

RESULTS AND DISCUSSION

The suspected wet areas are relatively warm and clearly visible in this thermogram as red, yellow and white areas. Cooler, dry areas are blue, green, and black.

Moisture in building materials can destroy structural integrity and create proper conditions for mold and insect infestations. Infrared cameras distinguish between wet and dry materials by exploiting the thermal characteristics of wet materials. These characteristics include the ability to store heat very well and to warm up or cool down more slowly than dry materials. Mold in particular is a growing concern for specialists, developers, and farmers because of the growing number of filings of health-related claims. Certain molds can cause a variety of adverse animal and human health effects.

CONCLUSIONS

Infrared thermography is a useful and effective tool for the detection of moisture anomalies in building envelope systems; because of the complexities of building construction and performance of infrared detection and measurement, however, considerable care must be exercised in both collection and interpretation of thermographic data.

These investigations demonstrate that qualitative infrared thermography coupled with an informed visual inspection and quantitative substantiation using moisture meters is an effective protocol to detect moisture anomalies in building envelopes.

For cold spaces (were no additional heat sources exist) or intermittent heated (like laboratories or course halls) it has to be taken into consideration the balance between heat, produced by central heating, human metabolism and the buildings' capacity to assure the inside conditions required by the comfort Norms .

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