

STUDY ON ENVIRONMENTALLY FRIENDLY CONSTRUCTION

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Abstract: *Health, safety and environmental protection should be an part of each building designed or executed. Contractors, builders, designers, employees and all who controls the work are directly responsible for ensuring the safety and protection work both in terms of materials that are used and the way in terms of execution. Health and safety in construction is a way of life, where attention to comfort, safety and esthetics blend with the environment.*

Key words: *construction, building materials, environmentally friendly materials.*

1. Introduction

The construction sector is one of the most important economic sectors worldwide. Improving safety and health is not only important in human terms, to reduce beneficiaries' problems, but also as a way to ensure the success and sustainability of buildings, their development through a longer and better term. When we design or execute a construction project we should keep in mind a high interest for nature conservation, to respect conversion circuit matter and energy, which become mandatory only viable if we fully endorse and respect environmental legislation on the dynamic nature conservation.

In an economy that tends to a total globalization, taking into account the need for Romania's integration, as required by the National Program for European Union Accession, definitely check follow European directives developing and

promoting an environmental policy based on the principles and obligations in environmental protection.

This article presents a summary of some works ([2], [3], [4]) based on the relationship between buildings and the environment and a few of the author observations, on these issues. The impact of construction on the environment is manifested mainly by high energy consumption and CO₂ emissions, causing global warming and air pollution - because of the burning of fossil fuels, water pollution - because of the use water for washing equipment, production of solid waste - resulting from demolished concrete, noise and dust - caused by the mixture of constituent materials. [5]

While the traditional approach (quality factors, cost, time) is based on the principle of maximizing economic efficiency, without considering the environmental impact, the new approach "sustainable construction" emphasize the

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importance of reducing the environmental impact of construction. [5]

This paper aims to develop a few of this theme, trying to address some of the issues organizing discussion around the following topics, which currently constitute real challenges for engineers:

- Building Materials. Friendly materials for construction;
- Protect the environment and ensure a greater comfort using this material as friendly;
- Reduced energy consumption both in execution and operation;

2. Discussion

Building activity in our country has grown and diversified greatly in recent years. Given to the financial potential, experience and technical equipment of our country, but also to the legislation problems and design procedures for construction and operation of buildings, all in time favored the appearance of the buildings behavior problems in relation to the environment.

In general the fundamental objective of the design and execution in construction, civil or engineering constructions, should be explicit and implicit satisfaction of the beneficiaries, health and safety of builders at the work place, but also protection of the environment both during construction and during the its exploitation. The environment is the space where the natural elements interfere with man-made one.

The main component of the environment in which we build, belongs to the geological environment, and is represented by the earth's crust, that is accessible to direct investigations, for various human activities, among which buildings occupy a special place, because there are directly related to it, most buildings are made on ground. So the value of such construction projects must be evaluated according to

how they can ensure the compatibility with the geological environment.

2.1. Current State of the Environment in Romania Relateded With Construction Works

Analyzing their relationship with the environment and the impact they have on it, we can say that, constructions can play different roles: partner, victim or aggressor. In the vast majority of cases, the civil engineering buildings should be designed and shaped, to successfully realize the condition of partner they are in with the environment. However sometimes buildings become victims of destroy natural phenomena like: earthquakes, landslides, eruptions, avalanches, subsidence in underground because of natural or artificial holes).

At the same time, we should be given most importance to aggressive influences that construction have on the environment.

Often, even the civil engineering, because of some inappropriate projects or design solutions, or due to improper or negligent executions, are those that trigger many hazards, having bad influences on the environment. Execution costs, reliability and impact of these constructions on the environment depends on accuracy the solutions that civil engineering adopted.

3. Building Material. Friendly Materials for Constructions

We can say that in general how buildings look reflects how they are made. The traditional architectures derived much of their form, from the limits of local materials to the vagaries of local climate. A modern environmental architecture will have to respond to the modern context, which is far more complicated than the one within which traditional builders worked.

Design decisions today contribute not only to local environmental problems, but to regional and global ones, and to health problems as well.

A very important decision, for a construction designer is to choose the materials for the future construction. The choices can be difficult, ranging from the traditional (sun-dried mud bricks), to the modern like vinyl. For example, there are many variations of materials from which a engineer designer can choose:

- natural materials, those obtained from compounds found in nature (organic and inorganic);
- environmental materials, which have a low environmental impact in the production, use or recycling (whose processing requires low power consumption and are biodegradable);
- healthy materials, that does not harm the health of the individual (which can be natural or synthetic, organic or not).

Keeping this in mind each designer will use the available material in according to a large set of criteria like: in addition to being easy to work with, they should be resistant to both compression and tension, have high resistance to heat, high humidity but also to biodegradation, to present a pleasant aspect and not cost too much.

From ecological view, designers have many aspects that must be consider.

Behind every material is a manufacturing history often quite long and with environmental impact. Each step taken to move or make the material carries an environmental or health cost. For almost every material used in industrial countries, the price is high, and apparent alternatives are few. The building industry can use materials much more sustainably than it

does. The guidelines for doing this are well known:

- look for substances that entail a minimum of transportation and processing;
- use local, natural materials and avoid as much as possible materials that emit toxins;
- use materials efficiently and ones that are renewable, recyclable, or both.

NOTE: Even with advantages like smaller tonnages involved, using metals and plastics has far more environmental impact than using quarried materials because it entails either purification from low-grade ores or heavy chemical processing. For example, of the copper employed in U.S. buildings (nearly half of the total used in the country), some is recycled material, but 80 percent is extracted from irreplaceable virgin ores and purified through a process that is one of the largest sources of air pollution in the country. Polyvinyl chloride, better known as vinyl or PVC--a chlorinated plastic that is widely used in piping, siding, and windows. It is difficult to recycle, and its production and incineration generate carcinogenic dioxins, vinyl chloride monomers, and other pollutants. Germany's Health Ministry and the American Public Health Association, among other institutions, have called for phasing out PVC where viable substitutes exist. In the industrial countries of North America, Scandinavia, and the Pacific, wood remains the material of choice for houses. [6]

4. Protect the Environment and Ensure a Greater Comfort Using Friendly Materials

Humanity is currently looking for building materials that are environmentally friendly, both in terms of production process and in use. Environmental problems and natural resources crisis, led

to an increased interest in finding solutions to remedy the damage done so far, but also to avoid further degradation of nature. This is how the concept of sustainable development, as it was defined in the '80s by the World Commission on Environment and Development in report called "Our Common Future" as "development that follows the needs of the present, without compromising the ability of future generations to meet their own needs ". In this regard, worldwide experts recommend to use more fully organic materials, because their production does not affect any nature, are fully recyclable, but that does not mean you have to compromise to comfort, the contrary, these materials will keep a pleasant house atmosphere.

Modern buildings, like other artifacts of industrial civilization, represent an extraordinary achievement with a hidden cost. They make life easier for many today, but their construction and operation inflict grievous harm upon the environment, threatening to degrade the future habitability of the planet. Quality is one of the keys to ecological design. Environmentally sustainable buildings need to excel in many ways, from indoor air quality and energy efficiency to durability and flexibility. [6]

Civil engineers designers who have started to change their design from the classic one into a environmentally friendly, found that the design, construction and execution of such buildings encounter many obstacles. A Los Angeles-based consultant in environmental design John Picard says "Before you design a building, you have to redesign the building process". [7]

For example, in 1978, the directors of what it now known as the International Nederland (ING) Bank decided to build a new headquarters in Amsterdam. They chose to make it an "organic" building that was efficient in its use of energy and other

natural resources, that was healthy for its users, and that integrated natural shapes, green plants, and art into a space that celebrated the human spirit. Early in the design process, the bank brought engineers, an architect, interior and designers, scientists, and future occupants together into a working group. [8]

Since so many of the problems arise from disconnections between all factors involved (environment, beneficiaries and all other participants in the construction process), it is logical that the entire series of operations to be evaluated by a specialist engineer in these matters, which by its contribution must achieve the necessary links and help those involved to communicate better with the surrounding nature.

5. Reduced Energy Consumptions Both in Executions or Exploitation

Normally we put our energy problem only during services of a building, but energy consume is a problem also during the execution of a building. Making buildings also consumes energy, from mine to foundry to construction site. Production of construction materials (brick, glass, steel) takes a large consumption of fossil fuels for reaching high-temperature production.

Taking into account the energy and oil consume worldwide, we can say that almost 40% of it, is used in construction area. They thus account for about a third of the emissions of heat-trapping carbon dioxide from fossil fuel burning, and two-fifths of acid-rain-causing sulfur dioxide and nitrogen oxides.

- automatically appears the question: how can we build better?

Currently there are many ways to build better, we can find in the past some of the options, in an era of apparent plenty, it's

easy to forget that the deficit was often the mother of invention, stimulating many cultures over thousands of years to perfect ways to do more with less. Other answers will come from the research laboratories.

Increasingly, successful buildings will recover some ancient techniques recently thrown by designers and combine them with new technologies to create a synthetic, environmentally friendly and better for humanity.

6. Perspectives on Environmental Protection in the Future

Evaluating the Environmental Protection in the construction, requires the development of special studies on specific fields of construction activities that interact with the environment.

The object of this study should represent highlighting the way that buildings execution have cohabited with the environment they are in. In cases that, there are found cohabitation contradictions, it should be examined causes, and provide special solutions that could eliminate these incompatibilities. Establishing these elements would be extremely useful for future work in construction.

All natural phenomena tend to steady state and we must learn to design, for and not against nature. Often, building design and execute are generating hazards and after we subsequently seek solutions to halt or minimize the risks we caused.

At these the environment is abused further, by:

- woods deforestation, a phenomenon that is associated with lack works to combat soil erosion and protection of water courses beds;
- high energy consumption and CO₂ emissions - that cause global warming and air pollution;

- water pollution - because of the use of water for washing equipment, production of solid;

To avoid such situations it is necessary to elaborate a national plan, for medium and long term and to develop strategy for environmental protection works. The principal deficiency in environmental protection activity in Romania, is due to concerns from authorized institutions for population education: family, school, media but equally ineffective is the way we apply and respect environmental laws and regulations.

7. Final Discussions

Risk assessment involves identifying existing hazards in any construction work, but also to determine the extent of existing risks, considering existing precautions methods that we use today. Establishing the most appropriate practices and measures to prevent environmental problems, we should always consider the results of a comprehensive assessment of all appropriate and factors imply in work. Risk assessment plays an important role in protecting workers from the construction field, the beneficiaries and the environment.

Through good design and business planning, can avoided environmental contamination, even before the commencement of works on site. The correct choice of equipment, materials, construction site, even through the planning of the work, can reduce to a minimum all the problems that can may occur.

In a world with a constant expansion, a clean environment is necessary not only as a necessity but as a duty of all. This is materialized by making high quality works, without harming limited natural

resources, protecting ecological system from the construction zone and the neighboring areas, respecting the protection and conservation measures that are required for environment, assess potential ecological threats to all categories of works, prevent and reduce the impact environmental pollution and finally proposing new directions for future environmental projects.

Reference

1. Antonov A., *Ghid de securitate si sanatate in munca privind sectorul de constructii*, 2013, (*Occupational health and safety guide to construction sector*), developed by the National Institute for Research and Development Labour Protection "Alexandru Darabont", http://www.saint-gobain.ro/strategia_de_habitat/;
2. *Revista constructiilor*, (Constructions magazine) nr. 94, iuly 2013.
3. Stematiu, D., Hortopan L., Marchidanu E., *Raport de expertiza preliminara privind haldele de steril de la exploatarea miniera Rosia Poieni, judetul Alba*, (Preliminary expert report on the waste dumps from mining exploitation Rosia Poieni) *SC ENERGO MINERAL ABRUD – ROSIA POIENI*, 2008, (Constructions magazine) sept 2015.
4. Marchidanu E., *Geologie pentru ingineri constructori, cu elemente de protectie a mediului geologic si geologie turistica, (Geology for civil engeneering, on matters of geological and geology environmental protection)*, Technical Publishing House, Bucharest (2005);
5. Georgescu D., Apostu A., *Impactul constructiilor din beton armat asupra mediului*, (The impact of reinforced concrete constructions on the environment) Technical University of Civil Engineering, <http://civile.utcb.ro/metex/etapa33.pdf>
6. Roodman D. M., Lenssen N., *A building revolution: How ecology and health concerns are transforming construction*, SOURCE: Worldwatch Institute, Mar. 1995, Copyright(c) 2002 Congressional Information Service, Inc.
7. Picard J., Environmental Enterprises, Inc., Marina del Rey, Calif., private communication, July 26, 1994.
8. Brenda V., Robert V., *Green Architecture: Design for an Energy-conscious Future* (Boston: Bulfinch Press, 1991); William B., "NMB Bank Headquarters," Urban Land, June 1992; Rob V., ING Bank, Amsterdam, private communication, March 25, 1994.