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CONDITIONS OF THE CONSTRUCTIONS SUSTAINABILITY IN NATURAL ENVIRONMENTS

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Abstract: *This paper has looked to respond to certain issues related to the sustainability of constructions in the natural environment and bringing of contributions in the understanding of the phenomenon as a whole. Natural environment influences the degradation of the concrete by action: freeze and defrosting repeatedly, temperature variations, rain, biological, wind and others.*

Key words: *durability of precast, diagnosis, humidity, dust.*

1. Introduction

This paper follows some issues related to durability of buildings in the natural environment and bring some contributions in the understanding of the phenomenon as a whole.

Natural environment influences the degradation of the concrete by action: freeze and defrosting repeatedly, temperature variations, rain, biological, dust, wind and others.

Natural environment with atmospheric humidity of 60%, can cause the corrosion of reinforcement in concrete elements under a porous or carbonated concrete until the reinforcement.

2. Freeze and defrosting repeatedly

Repeated freeze and defrosting action is a wet concrete problem located in a certain degree of saturation. Damage is manifested visibly in the form of cracks that develop along parallel construction elements by exfoliation, from the outside. Usually mass damage had had occurred in the form of rounding of edges and corners and sections are reduced items. The steps near to the collapse occurs of massive concrete dislocations.

Compromising concrete occurs due to pressure that in its mass arises because the increase in water content in freeze frame. On some points or areas can be exceeded the tensile strength of the concrete, which results in weakening progressive internal structures due to reduced cohesion between concrete components and matrix-aggregate adherence.

Concrete frost is a phenomenon that develops gradually due to the heat transfer rate through the concrete from the progressive increase in the concentration of alkali dissolved in water still unfrozen. Water does not freezes in all pores simultaneously, first freezes in the large pores and continuous at decrease of

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temperature with water freezes in a finer structural defects. When thaw occurs under conditions of high humidity, water gets in micro and macro cracks occurred by during previous frosts and goes the surfaces of the aggregate matrix adhesion where is weaker or has suffered. The next frost amplifies state of efforts, as well as effects, emphasizing the cumulative nature of freeze defrost cycles.

Under these conditions should be avoided as water to come in contact with the concrete by isolation measures waterproof. Rain water mixed with ice can drain concrete, or water and dissolved aggressive agents, such as chlorides, can penetrate into the concrete and thereby jeopardizing the concrete and even armature. In angular zones or at joints between elements, water can stagnate and therefore long term impermeability is not guaranteed. In these areas, it is necessary to use drainage slopes disposed on the upper surface of the elements or have special protection against water. Where defrost salts are used for example on bridges, in parking areas or on balconies, leaks on the joints can cause corrosion of supporting elements, which although they are usually really protected, can lead to a local degradation with serious consequences both economic and even of general stability.

3. Temperature variations

Temperature variations may cause in reinforced concrete elements of a structure, additional internal tension by compression or stretching when growth occurs respectively decreasing temperature. If concrete element is prevented thermally expand, there is an increase in the stress with temperature difference. Internal tension is influenced by the thermal expansion coefficient and elastic modulus of the material.

For linear elements, temperature variations are important only if they are part of static structures undetermined, lengthening or shortening the bars, leading to the appearance of tensions in other elements of the structure. Effects of temperature variation are not negligible, either plate type elements where deformations occur between the two sides.

The behaviour of reinforced concrete elements to decreasing temperature has an adverse effect, especially when combined with the phenomenon of contraction. Thus, before applying load exploitation, construction executed in the autumn, crack, when the temperature is decreasing. Internal deformations which develop state of crazing increases the concrete structure. The effects are even more important, as the internal efforts are higher and temperature variations occur frequently. Repeated heating and cooling lead to alternating concrete efforts thus weakening more pronounced the structure and cracks in concrete, a phenomenon that will favour further deterioration processes through chemical corrosion.

Concrete structure degradation worsens when there are sudden temperature changes and when, between matrix and aggregate is not thermal compatibility.

If in the concrete structure are differences between the coefficients of thermal produces contraction uneven expansion may affect the internal continuity of the material.

Thermal expansion cracks produce well defined and rare, unlike those due to thermal contraction, which are more dense and fine. These differences can be explained by opposite trends of mechanical actions arising and the difference between the resistances of concrete in tension and compression.

4. Action of rain

The water especially rainfalls can influence both directly and indirectly degradation of concrete elements.

Direct action occurs over time with the abrasion phenomenon and depends on: tilt raindrops hitting the surface, the density drops, the speed of fall and others.

Indirect action is manifested by the appearance of blackish spots on the surface elements. These spots are present on most high building facades occur because of the moisture and the effects of pollution. Contribution of the rain is transport of dust, in areas where it becomes increasingly more concentrated and darker. Horizontal or lightly inclined surfaces retain more water and thus even more dust. The areas most exposed to the smearing effect are facades oriented N, N-E and where rain is moderate or low.

In areas with accumulations of dust usually develops and biological elements. A torrential rain is not enough to wash the dust and clean the wall.

5. Biological action and dust

Surfaces of concrete often provide proper conditions for the development of biological elements such as algae and lichens.

Algae green or dark colours grow on wet concrete. There are certain algae that can live alkali surfaces, causing reduction of the pH of the surface of the concrete and finally, the onset of corrosion.

Environmental factors that depend on biological elements for growth on building materials are still little known, for example some areas that seem dry may be more biologically contaminated than others permanently wet.

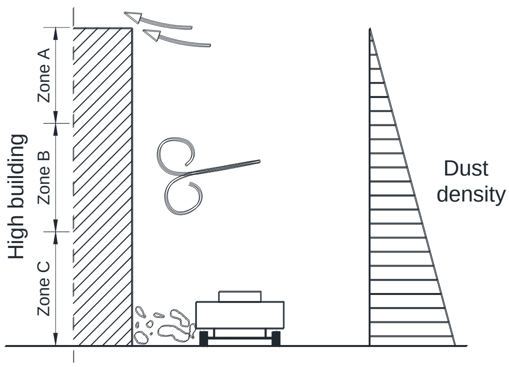

Fig. 1. *Areas dust deposition on the height of buildings*

Dust in the air is transported and deposited by wind. Dust deposits on high facades can be represented as in fig. 1. In zone A wind speed is high and dust deposits are insignificant, even no existent, depending on the roof of that building. In region B of dust deposition is accelerated by the effect of turbulence or wind gusts, and the C deposition is greatest due to the increased density of dust especially from traffic.

Dust according to particle size may be divided into:

- fine powder (0.01 μm to 1μm) can remain suspended in the air and adheres to rough surfaces. It has a high capacity for coverage due to a large surface area relative to mass;
- Coarse dust (1 μm to 1 mm) is of mineral origin and has a small capacity to

cover. The dust will not stick to dry surfaces and easier to surfaces that are wet for long periods (facades oriented N-E).

Dust deposition is influenced by air movement in two ways:

- Speed of movement of air masses increases with height, so that dust deposition will be higher the lower parts of the buildings. This effect is intensified by the dust from the street or from traffic;
- An obstacle near the air flow is deflected outwards, forming the air current, which in turn depends on the wind speed.

6. Conclusions

Durability of reinforced concrete buildings is not a problem only in aggressive environments but also in the current environment. In some constructions, which are found in common environments, there were also worrying phenomena of degradation.

Study of degradation of reinforced concrete is essential in addressing sustainability. Sustainability of reinforced concrete depends decisively the quality of execution and especially the compactness of concrete coatings.

Behaviour of materials, elements and concrete structures over time under certain environmental conditions can be established only in-situ research. Laboratory investigation cannot give a complete picture of the behaviour in time of construction.

In this regard should be given particular attention to assessing condition buildings, both in terms of means of investigation and evaluation criteria. For execution of sustainable construction must be taken measures protect the exposed reinforced concrete elements of the natural environment, which takes into account: freeze defrosting repeatedly, variations in temperature, rainfall, biological action and dust, wind and others.

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