THEORETICAL FACTORS AND ASPECTS OF A RELIABLE WATERPROOFING DEVICE

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Abstract: *The most common and aggressive factors affecting engineering structures is water. It contributes to a decrease in the strength properties of most materials, the development of corrosion processes in metals and concrete, decay of wood, the appearance of cracks, mold and dampness, and the collapse of the protective layers of structures. When waterproofing, operational, technological and economic factors are taken into account. The considered main aspects of the reliable waterproofing device.*

Key words: *Waterproofing, corrosion, aggressive environment, foundation, dielectric properties.*

Introduction. One of the most common and aggressive factors affecting engineering structures is water. It contributes to a decrease in the strength properties of most materials, the development of corrosion processes in metals and concrete, decay of wood, the appearance of cracks, mold and dampness, and the collapse of the protective layers of structures [1].

Therefore, it is necessary to provide for waterproofing, i.e., protection of structures. Other measures are also used that contribute to the rapid removal of water or protection from its penetration, for example, grinding and polishing the surface of structures, giving products certain shapes and outlines, increasing the density of the materials used, and others [2].

Of all the possible types of waterproofing, gluing, mounted and mastic are the most durable, require a minimum of labor, material consumption and can be mechanized. Therefore, in lectures, laboratory workshops and practical classes, the materials used for the installation of these types of waterproofing are primarily studied.

At present, a significant amount of information has been accumulated on the theory, technology and practice of using waterproofing materials and a regulatory and technical base has been created for protecting the structures of buildings and structures. The use of this information in the methodological manual will significantly improve the quality of training students in the specialty "Bridges, Transport Tunnels and Subways".

When installing waterproofing, operational, technological and economic factors are taken into account, the main of which are the following [3]:

- degree of admissible moistening of enclosing structures (SNiP 11-3-79);
- crack resistance of the insulated structure (SNiP 2.03.01–84);
- the height of the capillary rise of water depending on the density of the soil;
- the magnitude of the hydrostatic head;

- mechanical impact on waterproofing (compression due to the mass of overlying structures, backfill soil and groundwater pressure, tension due to relative displacements of adjacent structural elements, backfill soil settlement, foundation, foundation, etc.);
- effect on waterproofing of aggressive environments (SNiP 2.03.11–85); temperature effects on waterproofing (maximum allowable temperature during operation of waterproofing, depending on its type and material);
- Natural impacts (solar radiation, ice, waves, biological pests, precipitation: rain, hail, snow, etc.);
- conditions for the production of work (the possibility of complex mechanization, the possibility of applying a waterproofing coating on wet grounds, the possibility of performing work in winter), the scarcity of materials and the cost of waterproofing;
- Seismicity of the construction area; special properties of soils and foundations: subsidence, bulk, swelling, water-saturated, biogenic, eluvial, saline soils and foundations of structures erected in undermined areas (SNiP 2.02.01–83).

Taking into account a priori information, the main aspects of reliable waterproofing are proposed:

1) poor water wet ability of the surface of the material used;
2) exclusion of free movement of water through the capillaries and pores of the insulating material;
3) minimizing diffuse water penetration;
4) Ensuring the specified strength, deformability and durability of the installed waterproofing.

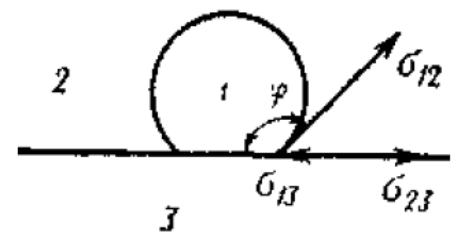
To fulfill the first aspect, the waterproofing material must be hydrophobic, i.e. poorly wetted with water. Creating a non-wet table or poorly wetted surface of the waterproofing layer is a difficult task. The wetting ability of the surface depends on the polarity of the applied liquid. From the condition of equilibrium of forces acting on the surface of the wetted body (Figure 1), it can be written as the formula:

$$\cos\varphi = \frac{\sigma_{23} - \sigma_{13}}{\sigma_{12}},$$

where σ23, σ13, σ12 are surface tensions at the interfaces of the corresponding phases – 1; 2; 3.

Reducing the wettability of the material with water can be achieved provided that the contact angle φ>90°, and cosφ-value is negative and as large as possible.

The smaller the difference in their surface tension, the more complete and easier wetting occurs. The intensity of molecular forces at the phase boundary decreases, and mutual solubility increases with increasing temperature. Reducing the surface tension at the interface between waterproofing and air practically means choosing a material that has the lowest polarity at the interface with the air.



1 - Liquid; 2 - gas; 3 - the surface of the waterproofing material

Figure 1. The condition for the equilibrium of surface tension forces during wetting

As a measure of polarity, it is convenient to take the dielectric properties, primarily the permittivity. The dielectric constant of polymers, on which the modern production of waterproofing materials is mainly based, is small. These substances belong to dielectrics. Their dielectric constant is higher in the presence of polar groups in the molecules; is 4–8 and decreases to 2–3 or less if the molecules do not contain polar groups.

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