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Modern Technologies and Materials for Cement Concrete Pavement's Repair

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Abstract

Modern aerodrome pavements should be provides year-round, intense and safe operation of aircraft. The circumstances require conducting emergency repairs, which is performed without obstacle of plane's movement, during the process window. World experience of using repair mixtures showed that for the repair of airfield pavements are suitable dry one-component, quick-hardening mixtures, which are called structural.

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Airdrome pavements fundamentally differ from most of other buildings in structural sense. Modern airfield pavements should be strong, durable, smooth, wear-resistant, have sufficient surface roughness, resistance to mechanical thermal influence of exhaust gas of jet engines, the impact of aggressive liquids and oils, provides year-round, intense and safe operation of aircraft. Therefore, the state of a coat should be such that the movement of aircraft will be possible under all conditions.

Runways are linear structures, which are characterized by small length, an approximation to the terrain, small massiveness of the upper layer. The coating made of concrete or asphalt concrete and contact with the two different environments – natural, which is the sub-base and artificial base (Дашевский, Парфенов).

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In this case load capacity and traffic intensity of modern aircraft, technology of work and materials are not coinciding with loads to cover. Thus, in most cases the runways are not withstanding the load. As a consequence, the deformation and fracture of the surface take place. There is a need to repair after small term of exploitation.

To combat these phenomena is necessary to introduce new materials and technologies which exist in the building market of Ukraine.

For repair of concrete and reinforced concrete surfaces runways from the devastation caused by the action of mechanical loads and corrosion processes using traditional waterproof and freezeproof remedial mixture type Ceresit, Siltek R-5, CPC S88 and others. However, these materials have significant disadvantages that should be considered in the repair of airfield pavements.

Necessary to consider that often the circumstances require conducting, so-called “emergency repairs”, which is performed without obstacle of plane’s movement, during the “process window”. Thus, the material for the repair should be fast setting and durable.

World experience of using repair mixtures (Солодкий, Русин) showed that for the repair of airfield pavements are suitable dry one-component, quick-hardening mixtures, which are called “structural”.

Structural concrete – this material of new generation, which has low shrinkage, retains corrosion inhibitors. It is during repair work contributes to a stable connection with the existing concrete surface and provides a low chloride ionic penetration. This increases the corrosion protection of steel and concrete structures and their frost resistance.

After application of the repair material structural integrity of the surface is restored after a few hours (no more than three hours). Due to this it is possible to use for making thin layers (6 mm) and layers of large thickness (30 mm) in one application.

At the Department of reconstruction of airports and roads were investigated properties of structural concrete and identified requirements for physical and mechanical characteristics in accordance with the climatic conditions of Ukraine.

It should be noted that when using any type of structural concrete for applying a thin layer of a thickness not exceeding 6 mm, the mixture used in its pure form, and for applying a layer thickness of 30 mm or more with the addition of crushed granite, fraction from 1.25 mm to 0.63 mm in an amount of 55–60% by weight of the dry mixture. The amount of water is determined by calculation based on the weight of dry mix and about 10–20%.

Requirements for physical and mechanical properties of structural concrete were developed based on research that was carried out in accordance with the approved program. The research program shows in Table 1.

Table 1. Program of research.

Controlled parameter	Size of sample, mm	Number of series	Number of sample in series
Compression strength	20×20×20		
	100×100×100	3	9
Adhesion strength with concrete	20×20×20		
	100×100×100	3	9
Tensile strength at bend (corrosive resistance)	100×100×400	3	6

Technology which was used for the preparation of concrete structural based on the blending of water and components (by weight of the dosage) for 3–4 minutes. Formation of the sample begins immediately after preparation the mixture at 20 °C. Samples gained strength in normal humidity conditions. The corrosion resistance was determined by accelerated method DIN 52 III (Коваль et al.) to change the tensile strength in bending and compression of the sample, which were kept in solutions of Na_2SO_4 (59.5%) – sulphate corrosion and NaCl (35%) – the technical salt – chloride ionic corrosion.

Requirements for physical and mechanical properties and corrosion resistance of the structural concrete are given in Table 2.

The requirement for corrosion resistance of structural concrete is general for Na_2SO_4 and NaCl solutions are given in Table 3.