WATERPROOFING AND PAVEMENT OF BRIDGES AND VIADUCTS WITH TREATMENTS OF SYNTHETIC MORTAR

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ABSTRACT

Notoriously, constructive solutions in the design and execution of waterproofing for bridges and viaducts slabs are studied in a way to confer the work several and manifold characteristics: utmost waterproofing; fair adhesion to the underlaying concrete support and to the curb beams (as well as to the concrete foundation of eventual joints); uniformity and continuity in every point of the protective function; chemical inertia against the environment aggressiveness and, at the same time, freezing resistance; mechanical strength, enough to stand traffic and manufacturing stresses; flexibility and contained elastic modulus; fast practicability.

To these purposes, the main actual technologies, particularly interesting thanks to their innovative features and to the resulting performances, are:

a) synthetic (polymeric) membranes of limited thickness (3–3.5 mm), characterized by toughness and flexibility at the same time;

b) polymeric mortars of consistent thickness (10 mm), characterized by a low elastic modulus.

Those two technologies obtain, generally, preference against the previous solutions (epoxy and/or epoxytarred systems) or the oldest membranes (pre-formed sheathes, asphalt mastic) because of a better reliability and durability. In fact the above mentioned solutions bypass, much better than the past methods, basic problems of adhesion to the support, problems of perforation resistance (defects proper of bituminous mortar and asphalt mastic, the latter particularly unsuitable to adhesion), as well as problems of extreme stiffness (defect proper of epoxy systems, added or not with tar). The new generation of technologies grants continuity and uniformity to the protection also and overall in the curb beams area, that uses to be the weak point of waterproofing based on bituminous compounds.

With the aim of improving the new treatments, an additional solution for impermeabilization has been studied, that, through a proper mix-design, is suitable to provide for the wearing course of the road, previous absorption of selected stone aggregate. To the purpose, a polymeric binder, essentially made of an epoxy-polyurethan copolymer, tied - by chemical inertia - to an elastomeric polymer (fluid polybutadiene), is added to a particular tar obtained from hydrocarbon distillation.

The bi-component epoxy resin owns a higher capacity to adhere to the support (both concrete or iron, with or without previous application of adhesive primer), even in case of humidity; it has also good chemical and physical characteristics, resistance to stresses, but overall it keeps inert facing the various types of environmental aggressive agents and maintains unchanged at very low temperatures.
The binder, to apply in synthetic mortars suitable to centimeter-thick applications, has been completed with a quartz-aggregate grading curve, having a voids content largely minor than the binder dosage, so as to provide together waterproof and chemical-physical resistance. The system, once applied, can be open to traffic after 10 hours from laying, at ground temperatures around 20°C.

The present research has further intended to prove the contribution of such design solution to the durability of the structure, to the driving comfort and to the traffic safety. To this purpose, various applications of the material for paving and protection of orthotropic-slab viaducts have been reproduced and monitored. In the same way, the physical-mechanical characteristics of the material applied to concrete slabs have been experimentally investigated and their validity tested. For an effective check of the behaviour of bridge or viaduct slabs under stresses produced by heavy vehicular traffic, fatigue tests have been conducted over structural elements made of reinforced concrete covered by synthetic mortar, studying the reply in case of integral or cracked support (visual and microseismic analysis by ultrasonic methodology, free oscillation...).

The analysed results of the investigations made on this material about its integrity have proved the qualifying validity of this solution, its durability and suitability for waterproofing the slabs of bridges and viaducts, and its capacity to provide excellent road surfaces and wearing courses.