Water Repellent Treatment of Building Materials
Proceedings of Hydrophobe II
Zürich, September 1998, Aedificatio Publishers pp.197-202

Concrete Safety Barriers with Internal Hydrophobic Treatment

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Abstract

Concrete safety barriers are made from air-entrained concrete and usually are impregnated after hardening to provide additional protection against the attack of frost and de-icing chemicals. Instead, on a motorway section near Salzburg the concrete was made with a cement containing a hydrophobic agent. The water-repellent properties of the hydrophobic agent were imparted to the hardened concrete. Workability and strength were the same as with normal concrete, but the amount of air-entraining agent needed was much less. Performance has been very satisfactory and the same technique was used for building the concrete barrier on another motorway site in 1998.

Keywords: safety barrier, air entraining agents, internal hydrophobic treatment

1 The problem

Concrete safety barriers are made from air-entrained concrete but frequently are impregnated to provide additional protection against the attack of frost and de-icing chemicals. Since this can be done only after sufficient hardening (self-desiccation), one lane has to be closed to traffic to enable the barrier to be impregnated. The motorway authority wanted a method to avoid this without increasing the total cost.

2 Concrete made from a cement containing a hydrophobic agent

In autumn 1997, on a reconstruction site of a motorway near Salzburg a cement containing a hydrophobic agent was used for making the concrete. Mix-design (Tab. 1) and strength (minimum requirement 30 N/mm^2 at 28 days) were as usual, but the hardened concrete absorbed only half the amount of water absorbed by concrete made with normal cement (Fig. 1).

Table 1: Mix-design

Cement	370 kg/m^3
aggregate (0/4, 4/8, 8/16, 16/32)	1 880 kg/m^3
water (w/c = 0.41)	150 kg/m^3
air-entraining agent, plasticizer	

The amount of air-entraining agent required for an air content (total) of 5 % was unusually low (interaction with the hydrophobic agent?), but the diameter of the artificial air-voids was very small, giving a very satisfactory air void system (Table 2).

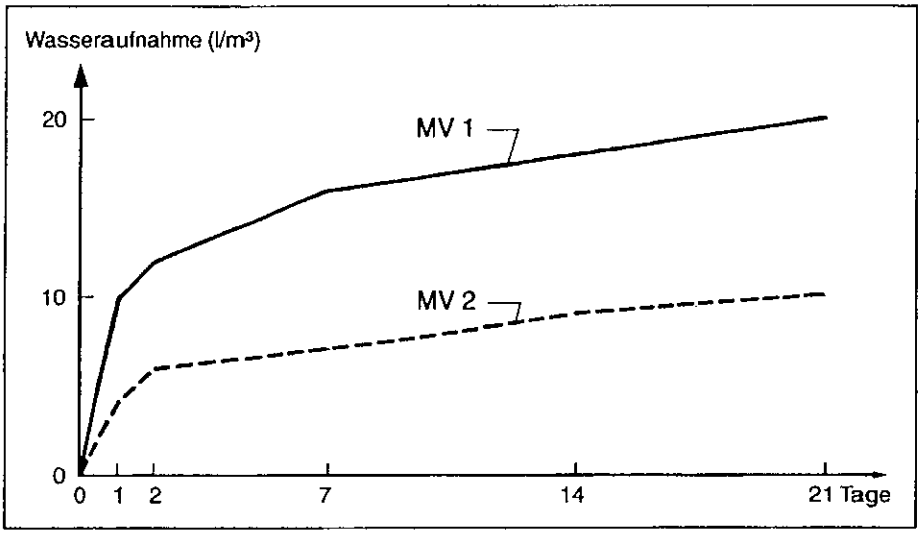

Figure 1: Water absorbed by concrete with normal Portland cement (MV 1) and Portland cement containing a hydrophobic agent (MV 2). Specimens 12 x 12 x 36 cm, demolded when aged 24 hours and stored in water + 20 °C

Table 2: Slip-forming of the safety barrier

Total air-content	5.3 %
Content of spherical air-voids	4.1 %
Distance factor of spherical air-voids	0.06 mm
Average diameter of spherical air-voids	0.07 mm

3 Practical experience

The barrier was slip-formed (Fig. 2) in autumn 1997. The concrete surface was (and still is) water-repellent (Fig. 3) and dries more quickly than normal concrete.

· Performance has been very satisfactory and the Salzburg motorway authority used the same technique for building the concrete barrier of another motorway section in summer 1998.

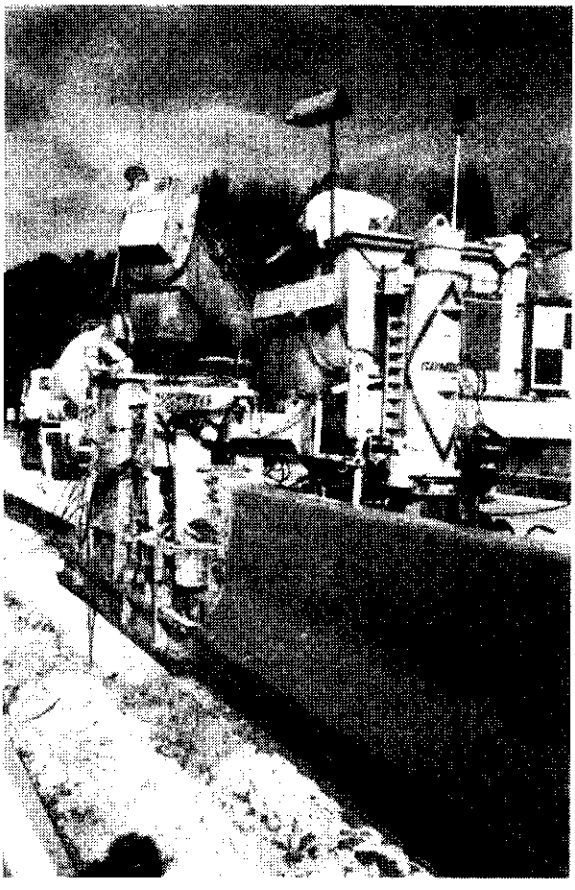

Figure 2: Slip-forming the safty barrier

Figure 3: Concrete safety barrier after rain