2.14 Electrical conductivity and resistivity

Electrical conductivity and resistivity of concrete play an important role in those applications, where stray currents may disrupt signals (guided vehicles) or create unsafe conditions (explosion protection). Electrical resistivity is also important where reinforced concrete will be exposed to corrosive conditions, as corrosion supporting or inducing currents will flow more easily in low resistivity concrete.

Keeping the amount of cement paste low, using good quality pozzolans and avoiding the introduction of ionized inorganic salts will result in lower conductivity and higher resistivity [61]. Temperature effects are important as well, whereby higher temperatures give lower resistivity.

Adding steel fibres will change neither concrete resistivity nor conductivity. The fibres are discontinuous and are spread three-dimensionally throughout the whole concrete.

The critical concentration at which an electrically continuous three-dimensional network is formed cannot be reached with steel fibre concrete. (Note: this may be different for the very special case of Slurry Infiltrated Concrete, SIFCON, which contains 800 kg/m³ steel fibres or even more.). In a worst-case scenario for steel fibre concrete, fine concrete containing 80 kg/m³ Dramix ZC 40/0.40 was compared to the same concrete without fibres. Based on the commonly used fibre types and dosages; the chosen amount of this specific steel fibre corresponds to an extremely dense fibre network and thus countless potential contacts between steel fibres. In practical terms, this fibre concrete may certainly be seen as a very exceptional mix.

Despite these severe conditions, no significant increase in conductivity could be found when compared to the plain concrete specimen. Furthermore, investigations based on RADAR did not find higher shielding after fibres had been added.

In addition, tests have been carried out on concrete with extraordinary high dosage rates such as 400 kg/m³. The aim was to maximize conductivity, without considering economic constraints. Even though relatively high macroscopic conductivity was obtained, the value reached is still far below the conductivity of metal sheets or bars.

Thus, ordinary steel fibre concrete is not a suitable material for conductive concrete, EMP-applications or radiation shielding. For the same reason, there is no need to worry about steel fibres affecting concrete conductivity or resistivity in applications such as tunnel linings, industrial floors or other applications subject to a corrosive environment. The results of the above-described tests have been reported in [62].