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Test Report

Zemdrain®

Extract from the test report:

Comparative tests on concrete test specimens which were produced with water draining Zemdrain® formwork and conventional formwork

- Summary -

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Test Report

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6 Summary

The present test report shows the results of the comparative tests on concrete samples in the case of concrete production with water draining formwork and conventional formwork. The investigations included the production of concrete test specimens of different dimensions for the determination of the

- compressive strength (chapter 5.1),
- rebound number (chapter 5.2),
- surface tensile strength (chapter 5.3),
- initial surface absorption (chapter 5.4),
- chloride resistance (chapter 5.5),
- water penetration depth under pressure (chapter 5.6),
- freeze-thaw resistance (chapter 5.7),
- carbonation resistance (chapter 5.8) und
- sulphate resistance (chapter 5.9).

For the realisation of the concrete technological investigations, large test samples (concrete walls) and small test specimens of strength class C35/45 (with a maximum water cement value of 0.45 and a minimum cement content of 320 kg/m^3) were produced. The overview of the production dates and the scope of testing of all test specimens can be found in Tables 1 to 4.

All concrete walls were tested on all wall surfaces equipped with water draining formwork sheets. When using the conventional formwork only selected sides of the walls were subjected for reference testing.

Subsequently the main results regarding the determination of the above mentioned concrete technological investigations are shown.

With regard to the compressive strength (28 days), a mean value of approx. 63 N/mm^2 was determined for the walls Classic-24, Classic-72 and MD-1x. The mean value of the compressive strength for the wall MD-2x was approximately 61 N/mm^2. For the wall MD-3x, the mean value of the compressive strength was 56 N/mm^2, see Table 18.

Concerning the determination of the rebound number (28 days value), median values of 44 to 48 were determined for the walls which were equipped with water draining formework sheets. For the walls with conventional formwork the median values were between 35 and 37, see Table 30.

At the test age of 58, 64 and 65 days, the mean values of the surface tensile strength of the walls with water draining sheeting were between 4.1 N/mm^2 and 6.0 N/mm^2. For the walls with conventional formwork the mean values of the surface tensile strength were between 2.4 N/mm^2 and 2.9 N/mm^2, see Table 40.

Relating to the 10-minute values ot the initial surface absorption at the test age between 105 and 130 days the mean values of the water-draining sheeting samples ranged between 0.3154 ml/(m^2/s) and 0.8026 ml/(m^2/s). The mean values for the test samples with the with conventional formwork ranged from 0.7372 ml/(m^2/s) to 0.9123 ml/(m^2/s), see Table 50.

Relating to the 30-minute values ot the initial surface absorption at the test age between 105 and 130 days the mean values of the water draining sheeting samples ranged between 0.2178 ml/(m^2/s) and 0.5083 ml/(m^2/s). The mean values for the test samples with the with conventional formwork ranged from 0.4881 ml/(m^2/s) to 0.6154 ml/(m^2/s), see Table 51.

Relating to the 60-minute values ot the initial surface absorption at the test age between 105 and 130 days the mean values of the water draining sheeting samples ranged between 0.1577 ml/(m^2/s) and 0.3739 ml/(m^2/s). The mean values for the test samples the with conventional formwork ranged from 0.3484 ml/(m^2/s) to 0.4893 ml/(m^2/s), see Table 52.

Considering the chloride resistance at the test age of 128 days the mean values of the chloride diffusion coefficient of the test samples which was equipped with water draining formework sheets ranged from $2.065 \cdot 10^{-12}$ m^2/s to $5.501 \cdot 10^{-12}$ m^2/s. The mean values of the chloride diffusion coefficient with conventional formwork were between $5.238 \cdot 10^{-12}$ m^2/s and $14.775 \cdot 10^{-12}$ m^2/s, see Table 94.

With regard to the determination of the water penetration depth under pressure at the test age between 69 and 137 days the average values of the water ingress for the test samples with water draining formwork sheets ranged from 6.0 mm to 25.0 mm. In the case of samples with conventional formwork the mean values of water ingress were between 24.0 mm and 39.0 mm, see Table 96.

Relating to the determination of the frost resistance at the test age between 100 and 105 days the mean values of the 28-days freeze-thaw scaling of the water-draining sheeting samples ranged from 138.81 g/m^2 to 341.42 g/m^2. For the samples with conventional formwork the mean values the 28-days freeze-thaw scaling were between 2965.92 g/m^2 and 3817.98 g/m^2, see Table 116.

With regard to the determination of the carbonation resistance at the test age of 50 days at the concrete samples eqipped with water-draining formwork sheets no carbonation depths were found. For the conventional formwork concrete samples the average values of carbonation depth ranged from 3.3 mm to 8.6 mm, see Table 118.

Concerning the sulphate resistance at the test age of 28 days the mean values of the decisive sulfate expansion during the additional storage Δl_S of the water-draining sheeting samples were between 0.232 ‰ and 0.256 ‰. The expansion of the samples with conventional formwork was 0.289 ‰, see Tables 120 to 122. According to standard SIA 262/1:2013 [9] this test is subject to a limit value of $\Delta l_S \leq 1.2$ ‰.

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