TALLINN UNIVERSITY OF TECHNOLOGY

Department of Civil Engineering and Architecture
RESEARCH AND TESTING LABORATORY OF BUILDING MATERIALS
Accredited by the Estonian Accreditation Centre reg nr L004

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19.03.2020

**Experimental Report N° 207/20** 

| | |
|---|---|
| Assignment: | Testing of frost resistance of concrete specimens for 56 cycles with distilled water. |
| Product designation: | Concrete cubes 15x15x15 cm, 3 samples, marked as **Vertical Jointing Concrete VVB 50, 09.12.19**. |
| | Forwarded to the laboratory by customer on 08.01.2020. |
| Test method: | EVS 814:2003 Frost resistance of normal-weight concrete. Definitions, specifications and test method |

From concrete cubes the test specimens with measures 50x150x150 mm were cut on 08.01.2020.

Test specimens were cut out perpendicular to upper suface of cube so that the upper surface of specimen during testing was cut from the centre of initial concrete cube. The specimens were numbered, weighed and measured. The results of measures and density of specimens are presented in Table 1.

Up to the beginning of freeze-thaw test the specimens were cured at temperature +(20±2)°C and relative humidity (65±5) %. On the 3...5th day of curing, rubber was glued around the specimens so that its edge overlapped the edge of specimen and enabled to hold the cooling substance on the surface of specimens. Also the sides and bottom were isolated with thermal insulating material. On the 7th day of curing 3 mm layer of distilled water with temperature (20±2) °C was poured to the test surface and remained for (72±2) h at temperature (20±2) °C.

15 min before the beginning of freeze-thaw test the distilled water was replaced with cooling substance - 3 mm distilled water layer with temperature (20±2) °C. To avoid the escape of cooling substance by evaporation, the specimens were covered with polyethylene foil. Freezing and thawing of concrete specimens took place in freezer in air according the regime required by standard. Hence the duration of one freezing-thawing cycle was 24 h.

After 7, 14, 28, 42 and 56 freeze-thaw cycles the quantity of crumbling material from the surface of the test specimen was determined. For that the crumbling material with cooling substance was poured to the vessel and the surface of specimen was cleaned with water. The crumbling material was separated from liquid by filtration, dried and weighed. Then the new quantity of cooling substance was poured on the surface for the next cycles.

After above mentioned cycles the mass loss of specimens was determined and the total mass of crumbled material Σ M (g) and total mass loss from square unit – Σ S (kg/m²) were calculated.

The test results of mass loss during freeze-thaw resistance test up to 56 cycles are presented in Table 2.

Test results:

Table 1: Dimensions and density of test specimens cut from concrete cubes marked as **Vertical Jointing Concrete VVB 50, 09.12.19** before freeze-thaw testing

| Specimen designation | Dimensions of specimen, mm | | | | | | | Mass, g | Density, kg/m$^3$ | |
|---|---|---|---|---|---|---|---|---|---|---|
| | a | b | $h_1$ | $h_2$ | $h_3$ | $h_4$ | $h_{aver.}$ | | | |
| | | | | | | | | | | |
| VVB50 09.12.19-1 | 151.0 | 149.5 | 49.2 | 50.1 | 50.2 | 49.1 | 49.7 | 2441 | 2180 | |
| VVB50 09.12.19-2 | 150.0 | 149.5 | 50.1 | 51.0 | 50.7 | 51.3 | 50.8 | 2497 | 2190 | 2180 |
| VVB50 09.12.19-3 | 149.5 | 149.5 | 46.4 | 49.3 | 49.2 | 46.3 | 47.8 | 2322 | 2170 | |

Table 2: Mass loss of concrete specimens marked as **Vertical Jointing Concrete VVB 50, 09.12.19** during the freeze-thaw testing

Freeze-thawing test was started on 20.01.2020.

| Specimen designation | Dimensions. mm | | A, cm² | Mass loss unit | Mass loss of specimens after | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | 7 | 14 | 28 | 42 | 56 |
| | a | b | | | freeze-thaw cycles | | | | |
| | | | | | | | | | |
| VVB50 09.12.19-1 | 151.0 | 149.5 | 225.7 | Σ M, g | 0.3 | 0.6 | 0.7 | 0.9 | 0.9 |
| | | | | Σ S, kg/m² | 0.01 | 0.03 | 0.03 | 0.04 | 0.04 |
| VVB50 09.12.19-2 | 150.0 | 149.5 | 224.3 | Σ M, g | 0.3 | 0.5 | 0.7 | 0.8 | 0.8 |
| | | | | Σ S, kg/m² | 0.01 | 0.02 | 0.03 | 0.04 | 0.04 |
| VVB50 09.12.19-3 | 149.5 | 149.5 | 223.5 | Σ M, g | 0.4 | 0.7 | 1.1 | 1.2 | 1.2 |
| | | | | Σ S, kg/m² | 0.02 | 0.03 | 0.05 | 0.05 | 0.05 |
| | | | | | | | | | |
| Average | | | | Σ M, g | 0.3 | 0.6 | 0.8 | 1.0 | 1.0 |
| | | | | Σ S, kg/m² | 0.01 | 0.03 | 0.04 | 0.04 | 0.04 |

The mass loss of concrete specimens, cut from concrete cubes, marked as **Vertical Jointing Concrete VVB 50, 09.12.19**, forwarded to the laboratory on 08.01.20 and tested according to standard EVS 813:2003 with distilled water, was after 28 and 56 freeze-thawing cycles 0.04 kg/m².

Test results are valid to the described test sample only.

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