

## Testing of hydrophobic impregnation for the protection of concrete structures – Prevention of chloride ingress

(2 appendices)

### 1 Assignment

Testing of *BCS Byggver* hydrophobic impregnation product on concrete with respect to prevention of chloride ingress and infrared analysis. The tests were carried out in accordance with the directions of NT BUILD 515, Edition 1, *Hydrophobic impregnations for Concrete – Prevention of chloride ingress – Filter effect*.

These test results have been published in report 6P00354 A 2016-10-28 for the same product, under another product name.

### 2 Test schedule

The test objects and scope of the test are shown in table 1. The tests were carried out between May and October 2016.

*Tabel.1. Test schedule for treated and untreated concrete samples*

| Property                                       | Method       | Test object                        |             |
|--|--------------|------------------------------------|-------------|
|  |              | Measurements<br>Dimensions<br>(mm) | Number      |
| Prevention of chloride ingress – filter effect | NT BUILD 515 | 100x100x50                         | 3 treated   |
|  |              |                                    | 3 untreated |

The concrete and the test specimens were produced and stored at RISE CBI Swedish Cement and Concrete Research Institute in Borås in accordance with the directions of EN 1766. Tests were carried out on “Type MC(0.45)”.

*BCS Byggver* batch nr EB 25448, which arrived at RISE CBI on 26 April 2016, was applied by RISE CBI in accordance with the manufacturer’s recommendations. An amount equivalent to approximately 400 g/m<sup>2</sup> was applied to the test surface of each test specimens.

The amount of impregnation product applied was checked by weighing. RISE CBI has no other information relating to the substance and its sampling.

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### 3 Results

The chloride profiles of the test specimens were then determined as the  $Cl^-$  level in % of the weight of the concrete in six steps down to a depth of 25 mm in accordance with EN 14629:2007 *Products and systems for the protection and repair of concrete structures – Test methods – Determination of chloride content in hardened concrete*.

The results of the determination of the chloride profile is shown in diagram 1 as the mean of results from three specimens. The measurement data is reported in Appendix 1.

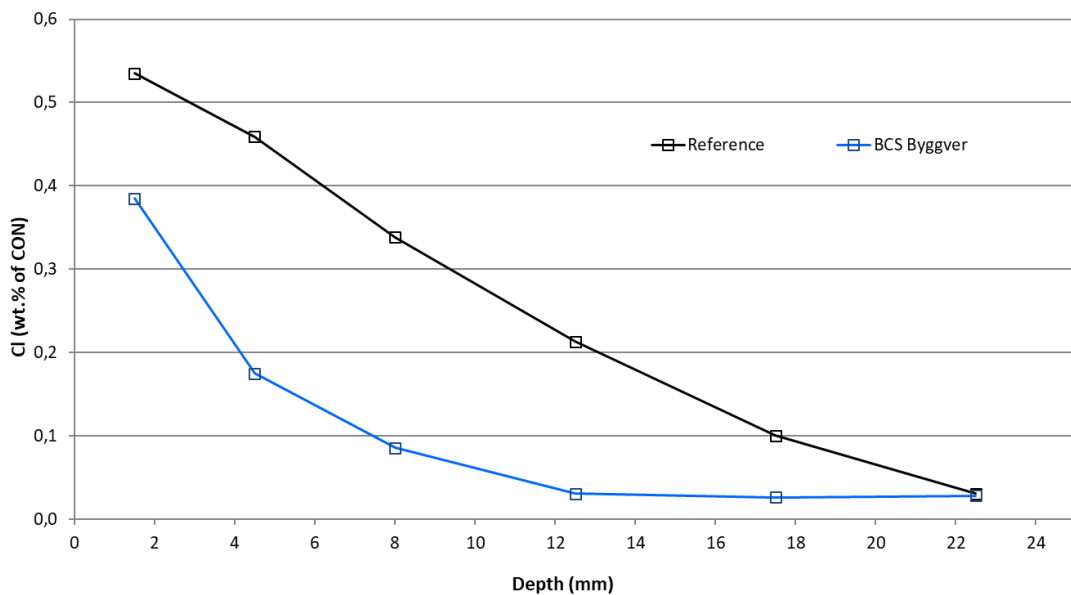


Diagram 1. Chloride content

### 4 Comments

The tested hydrophobic impregnation product, *BCS Byggver*, meets the requirement of AMA Anläggning 17, LFB.311. The calculated filter effect ( $FE_{25}$ ) is 0.68 which is higher than the requirement on minimum value, which is 0.60.

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### Appendices

1. Test schedule.
2. Test results of the determination of the chloride content.

Appendix 1

| NT-Build 515                                   |            |          |             |
|--|------------|----------|-------------|
| MC(0,45) 100x100x100                           | Datum      | Referens | BCS Byggver |
| Tillverkning                                   | 2016-05-23 | R        | EB 25448    |
| Vattenlagring                                  | 2016-05-24 |          |             |
| 20±2C  |            |          |             |
| Sågning, 100x100x50                            | 2016-06-20 | 3        | 3           |
| Vinkelrätt överytan<br>inga håligheter ≥ Ø5 mm |            |          |             |
| Försegling med epoxi                           | 2016-06-20 | R1       | CC1         |
| 20±2C, 65±5 RF                                 |            | R2       | CC2         |
| ca 2-3 h efter sågning<br>2 st appliceringar   |            | R3       | CC3         |
| Limning av gummiduk                            | 2016-06-22 |          | CC1         |
| 20±2C, 65±5 RF                                 |            |          | CC2         |
|  |            |          | CC3         |
| Applicering                                    | 2016-06-27 |          | CC1         |
| 20±2C, 65±5 RF                                 | 10:15      |          | 1111,30     |
|  |            |          | 1115,38     |
|  |            |          | 4,08        |
|  |            |          | CC2         |
|  |            |          | 1220,18     |
|  |            |          | 1224,23     |
|  |            |          | 4,05        |
|  |            |          | CC3         |
|  |            |          | 1197,32     |
|  |            |          | 1201,40     |
|  |            |          | 4,08        |
| Start exp i 15% NaCl-lösning                   | 2016-07-25 | R1       | CC1         |
| 20±2C  |            | R2       | CC2         |
| Separata behållare                             |            | R3       | CC3         |
| Kontroll efter 14 resp 28 dygn                 |            |          |             |
| Avslut exponering                              | 2016-09-19 | R1       | CC1         |
| Provkroppar torkas                             |            | R2       | CC2         |
| Placeras i plastpåsar                          |            | R3       | CC3         |
| Sedan i 5±2C                                   |            |          |             |
| Svarning start tidigast                        | 2016-09-19 | R1       | CC1         |
| avslutas senast                                | 2016-09-26 | R2       | CC2         |
| Dock inom max två dagar efter start            |            | R3       | CC3         |
| Beh/obeh svarvas parallellt                    |            |          |             |
| Torkning                                       | 2016-09-19 | R1       | CC1         |
| 105±5C   |            | R2       | CC2         |
|  |            | R3       | CC3         |
| Förvaring av betongpulver                      |            | R1       | CC1         |
| skyddas mot CO2 och fukt                       |            | R2       | CC2         |
| fram till kloridanalys                         |            | R3       | CC3         |

Appendix 2

|  |        |           | Reference |       |       |       |        |       |         |         | BCS Byggver  |       |       |       |        |       |         |             |  |              |
|--|--------|-----------|-----------|-------|-------|-------|--------|-------|---------|---------|--------------|-------|-------|-------|--------|-------|---------|-------------|--|--------------|
| Max depth                              | Middle | Thickness | REF1      | REF2  | REF3  | Avg   | Avg-bg | Std   | COV (%) | CI/step | CC1          | CC2   | CC3   | Avg   | Avg-bg | Std   | COV (%) | CI/step     |  |              |
| step [mm]                              | [mm]   | [mm]      | (fig)     |       |       |       |        |       |         |         | (fig)        |       |       |       |        |       |         |             |  |              |
| 3                                      | 1,50   | 3,00      | 0,518     | 0,538 | 0,549 | 0,535 | 0,506  | 0,016 | 3       | 0,061   | 0,315        | 0,396 | 0,443 | 0,385 | 0,355  | 0,065 | 17      | 0,043       |  |              |
| 6                                      | 4,50   | 3,00      | 0,439     | 0,466 | 0,472 | 0,459 | 0,430  | 0,018 | 4       | 0,052   | 0,158        | 0,220 | 0,146 | 0,175 | 0,145  | 0,040 | 23      | 0,017       |  |              |
| 10                                     | 8,00   | 4,00      | 0,323     | 0,355 | 0,337 | 0,338 | 0,309  | 0,016 | 5       | 0,049   | 0,067        | 0,105 | 0,084 | 0,085 | 0,056  | 0,019 | 22      | 0,009       |  |              |
| 15                                     | 12,50  | 5,00      | 0,208     | 0,205 | 0,227 | 0,213 | 0,184  | 0,012 | 6       | 0,037   | 0,026        | 0,040 | 0,026 | 0,031 | 0,001  | 0,008 | 26      | 0,000       |  |              |
| 20                                     | 17,50  | 5,00      | 0,092     | 0,091 | 0,118 | 0,100 | 0,071  | 0,015 | 15      | 0,014   | 0,019        | 0,033 | 0,026 | 0,026 | -0,003 | 0,007 | 27      | -0,001      |  |              |
| 25                                     | 22,50  | 5,00      | 0,020     | 0,033 | 0,039 | 0,031 | 0,001  | 0,010 | 32      | 0,000   | 0,021        | 0,035 | 0,028 | 0,028 | -0,001 | 0,007 | 25      | 0,000       |  |              |
| <b>Total</b>                           |        | <b>25</b> |           |       |       |       |        |       |         |         | <b>0,213</b> |       |       |       |        |       |         |             |  | <b>0,068</b> |
| <b>Filter effect (FE<sub>25</sub>)</b> |        |           |           |       |       |       |        |       |         |         |              |       |       |       |        |       |         | <b>0,68</b> |  |              |