

**Martin Herrington**

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OXOH2O Solutions

Sample Description: Concrete cores, 2" diameter**Sample Condition:** suitable for analysis**Date Sampled:** August 10, 2022**Sampled By:** R.J. Allen, Inc**Sample Location:** 4615 E 4th Street, Long Beach, California**Job Name:** Bridgeport**Job No.:****Customer:** OXOH2O Solutions, Inc.

Report No.: 01130122**Analysis Completed:****Primary Analyst:** Thomas Holzheu

INTRODUCTION

Concrete cores collected from a retaining wall were submitted for evaluating the effectiveness of externally applied "OXO H2O". The retaining wall is constructed of concrete masonry units (CMU). The cores provided are identified in Table 1 below. Exploratory work was performed to evaluate the effectiveness of the OXO H2O treatment in sealing off connected capillaries and voids.

Table 1. Submitted testing samples

Item	Sample ID	Description	OXO H2O Condition
1	A1	2" core, CMU, high	treated
2	A2	2" core, CMU, medium	treated
3	A3	2" core, CMU, low	treated
4	B1	2" core, CMU, medium	untreated
5	B2	2" core, CMU, low	untreated

SAMPLING AND TESTING METHODS

The nature of the CMU blocks used in the retaining wall limited the core diameter to 2". It is usually standard practice to drill nominal 4" diameter cores for chemical and physical evaluations of hardened concrete. Since the nominal aggregate size is smaller than 0.5", a 2" diameter core was considered acceptable to perform the C1556 testing. The treated and reference cores were subject to a phenolphthalein staining test (A3 and B2) and an evaluation of the permeability of the concrete matrix (A2 and B1). The staining test was performed on freshly cut cross-sections and the results are documented in Figure 2 and 3. Permeability of the concrete matrix was evaluated following the procedures described in ASTM C1556. Cores A2 and B1 were conditioned using saturated calcium hydroxide following the procedure described in ASTM C1220 and subsequently submerged in a saturated sodium chloride solution for 35 days.

RESULTS

The untreated reference core (B2) appears to be completely carbonated throughout the entire width of the CMU block (see Figure 2). Only the infill mortar/grout material still showed the pink indicator color (pH >12.5). For comparison, the phenolphthalein indicator turned pink on the OXO H₂O treated CMU block (Figure 3) throughout the entire 8" length of the core, indicating the range of the treatment.

The chloride diffusion coefficients of the OXO H₂O treated and reference cores were calculated from the profile data shown in Figure 1, which are 1.66E-12 m²/s for the treated core and 1.55E-12 m²/s for the reference core.

SUMMARY

The phenolphthalein indicator tests demonstrates the range to the full 8" length of the CMU block of the OXO H₂O treatment (see Figure 3). The appearance of the staining pattern would suggest a increase of the pH value (>12.5) of the pore solution in the connected capillaries and voids. The elevated pH of concrete facilitates a protective envelop of embedded rebar elements and is one factor in preventing rebar corrosion.

The diffusion coefficient as calculated with ASTM method C1556 shows a relative change of about 10% between the reference and treated cores. The observed trend confirms that the OXO H₂O treatment seals off connected capillaries and voids. It is fair to assume that repeated applications of OXO H₂O would further reduce the permeability of the investigated concrete matrix.

Please feel free to contact us regarding these findings.

TABLES AND FIGURES

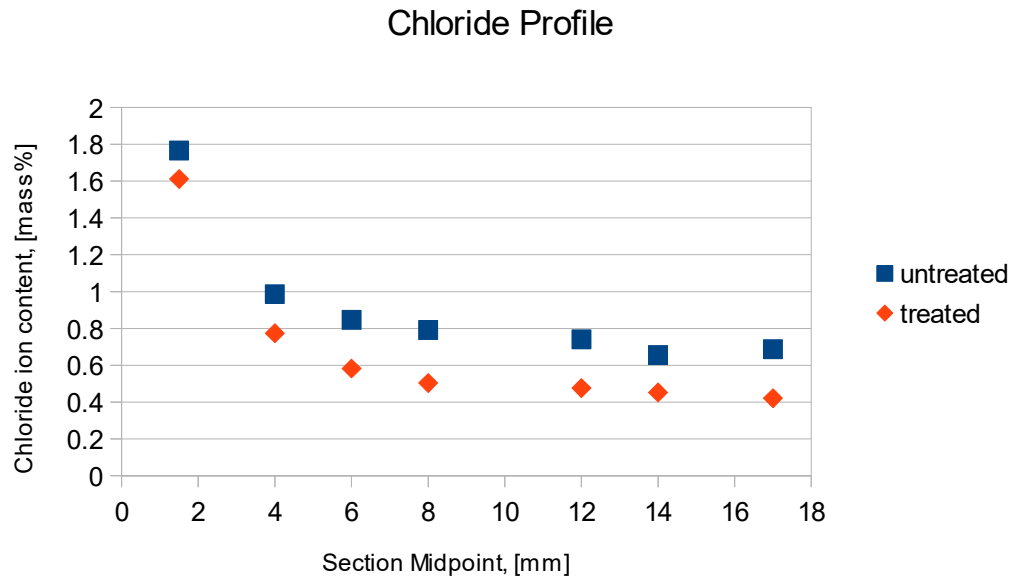


Figure 1. Chloride profile after storing the reference and treated cores in a saturated NaCl solution. The chloride profile is used to calculate an apparent diffusion coefficient for a given hardened concrete matrix. The calculated coefficient of the reference core is $1.55\text{E-}12 \text{ m}^2/\text{s}$ and $1.66\text{E-}12 \text{ m}^2/\text{s}$ for the treated core.

Table 2. Acid soluble chloride ion contents by mass of concrete

Sample ID	Section, [mm]	Analytical subsample, [g]	Chloride, [wt%]	Section Midpoint, [mm]
B1 untreated	0 – 3	5.49	1.766	1.5
	3 – 5	4.86	0.986	4.0
	5 – 7	6.24	0.846	6.0
	7 – 9	5.49	0.792	8.0
	9 – 11	5.71		10.0
	11 – 13	9.18	0.741	12.0
	13 – 15	6.29	0.656	14.0
	15 – 19	10.18	0.687	17.0
A2 treated	0 – 3	5.41	1.612	1.5
	3 – 5	4.62	0.774	4.0
	5 – 7	5.58	0.582	6.0
	7 – 9	5.02	0.504	8.0
	9 – 11	4.69		10.0
	11 – 13	4.92	0.476	12.0
	13 – 15	4.99	0.453	14.0
	15 – 19	8.89	0.421	17.0



Figure 2. CMU reference core section after application of the phenolphthalein indicator (freshly cut cross section). No color change was observed, which indicates a pH <10 and carbonation of the cementitious paste has occurred throughout the CMU block.



Figure 3. Comparison of freshly cut cross sections of the reference (top, B2) and the OXO H2O treated (bottom, A3) cores. The color change of the phenolphthalein indicator to pink is clearly visible throughout the treated CMU core (A3).