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Reply

Author Response to Comment on: Laboratory Measurement and Analysis of the Deteriorated Layer Permeability Coefficient of Soil-Cement Deteriorated in a Saline Environment

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Abstract: The authors thank Rui Neves for his discussions related to our work. Errors in the formula have been corrected as suggested by the discusser and data in the article have also been revised.

Keywords: deteriorated layer; permeability coefficient; formulates; correction

1. Introduction

The authors thank Rui Neves for his discussions related to our work on the deteriorated layer permeability coefficient of soil–cement deteriorated in a saline environment. Based on the discussions with Prof. Neves, some formulates in the paper have been corrected [1]. We have responded in the following aspects.

2. Reply

The first response is regarding the lapse in the development of the formula to compute the permeability coefficient in a specimen with different media. We found that Equations (7)–(10) in original paper were wrong due to some errors in the calculation procedure. In the original paper, Equation (7) in original paper is achieved after substituting Equation (6) in original paper in Equation (4) in original paper, which are shown below.

$$k_{\mathrm{d}} = \frac{2k_{\mathrm{c}}k_{\mathrm{m}}d}{k_{\mathrm{m}}H - k_{\mathrm{c}}H_{\mathrm{m}}} \tag{1}$$

$$k_{\mathrm{m}} = k_0(1 - R_{\mathrm{a}}) + k_d R_{\mathrm{a}} \tag{2}$$

where k_d is the permeability coefficient of deteriorated layer; k_c is the equivalent permeability coefficient of the entire deteriorated specimen; k_m is the equivalent permeability coefficient of the middle section of the specimen; H is the total height of the specimen; H_m is the height of the middle section; k_0 is the permeability coefficient of the internal non-deteriorated region of the soil-cement; d is the deterioration depth of the cement–soil; and R_a is the cross-sectional area deterioration rate of the soil–cement specimen.

The relationship between H, H_m, and d is

$$H = H_m + 2\,d \tag{3}$$

The mistakes occurred when we, in our paper, after substituting Equation (6) in Equation (4), divided the resulting expression by H, to introduce the R_{h} term. In our paper, we defined $R_{\mathrm{h}} = d/H$.

However, the ratio H_m/H was amiss and also taken as R_h in the calculation, causing errors in our original results. We are grateful to Prof. Neves for pointing out these problems. As the second response is also about this formula, the correct formula is shown below.

Second, the discusser points out that our paper adopted an approach where the mass flow in a homogeneous layer is homogeneous, regardless of the eventual heterogeneities in other layers previously crossed by mass. We have checked our paper and believe that the inaccurate equation might refer to Equation (5) in original paper, which is

$$Q_m = k_m i_m A = k_0 i_m (A - A_d) + k_d i_m A_d \tag{4}$$

According to the suggestions made by Prof. Neves, the k_0 in Equation (4) is supposed to be replaced by $k_{m,SA}$, which is the equivalent permeability coefficient of the materials in SA. $k_{m,SA}$ is calculated as

$$k_{m,SA} = \frac{d + H_m + d}{\frac{d}{k_d} + \frac{H_m}{k_0} + \frac{d}{k_d}} \tag{5}$$

Equation (5) in origin paper should be

$$Q_m = k_m i_m A = k_{m,SA} i_m (A - A_d) + k_d i_m A_d \tag{6}$$

Equation (4) in origin paper is calculated as

$$k_d = \frac{2k_c k_m d}{k_m H - k_c H_m} \tag{7}$$

By substituting Equations (5) and (6) into Equation (7), an equation equivalent to Equation (10) in the comment can be achieved. Equations (8)–(10) in original text is supposed to be replaced as

$$K_d = \frac{A + \sqrt{B}}{2R_a(1 - 2R_h)} \tag{8}$$

$$A = K_c + K_0 R_a - K_0 - 2K_c R_h - 2K_0 R_a R_h \tag{9}$$

$$B = K_0^2(1 - R_a + 2R_a R_h)^2 + 2K_0 K_C (R_a - 1 + 2R_a R_h)(1 - 2R_h) + K_c^2 (1 - 2R_h)^2 \tag{10}$$

In Figure 1, the values of k_d calculated by Equations (8)–(10) are shown.

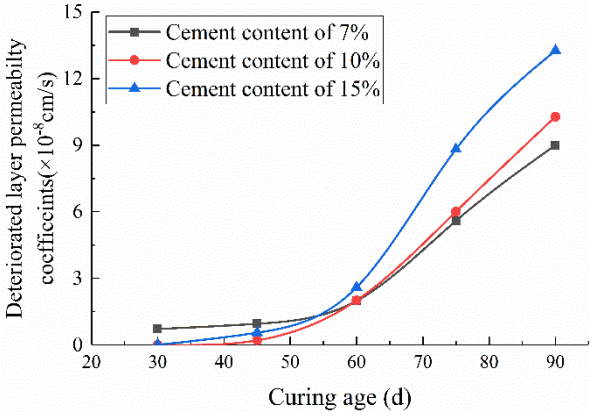

Figure 1. Development of the deteriorated layer permeability coefficients.

Finally, as Equations (8)–(10) in origin paper have been revised, the function to model the evolution of the permeability coefficient of a deteriorated part of soil–cement also needs to be revised. According to Equations (8)–(10) the parameters presented in Table 1 can be obtained.

Table 1. Fitting parameters.

Cement Content	k_i ($\times 10^{-8}$ cm/s)	k_u ($\times 10^{-8}$ cm/s)	t_c (d)	p
7%	0.69	12.66	78.90	7.31
10%	0.04	13.81	75.92	7.42
15%	0.03	14.16	75.54	8.97

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Reference

1. Comment on "Laboratory Measurement and Analysis of the Deteriorated Layer Permeability Coefficient of Soil-Cement Deteriorated in a Saline Environment". *Materials* **2019**, *12*, 2245. [CrossRef] [PubMed]