



Discussion

Reply to the discussion by T.U. Mohammed and H. Hamada of the paper
“Relationship between the free and total chloride diffusivity in concrete”[☆]

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Thanks to Dr. Mohammed and Hamada for the discussion and comments on our paper. The relationship between free and total chloride in concrete is important in predicting the service life of the reinforced concrete. The discussion presents a good relationship between the average concentrations of free and total chloride in concrete with the age of 15 years. It indicates that the total chloride content is 1.11 to 1.16 times the free one no matter what the concrete is.

What was discussed in our paper is the relationship between the free and total chloride diffusivities. This relationship is so rough that it needs more data to validate. However, it may remind people to take caution when calculating the pregnant time of the rebar corrosion.

The chloride content and diffusivity in concrete are really correlated. Generally, the chloride diffusivity could be calculated when the concentration profile is known, and vice versa. These are influenced by the type and volume of cement, chemical composition, mineral admixtures, concrete strength, and some environmental parameters, such as temperature and water-transferring behavior. The difference between the concentration and diffusivity of chloride in concrete is shown in Fig. 1.

Fig. 1 shows the chloride concentration profiles of different chloride diffusivities with the same surface chloride concentration. From the integration of the chloride concentration profile, the relationship between the average concentrations of chloride in concrete could be deduced. The relationship between the average chloride concentrations with $D_1 = 2D_2 = 4D_3$ is $C_{1,average} \approx 1.40C_{2,average} \approx 1.93C_{3,average}$. This does not mean that the average concentration of total chloride is four times the free one when the total chloride diffusivity is four times the free chloride, and vice versa.

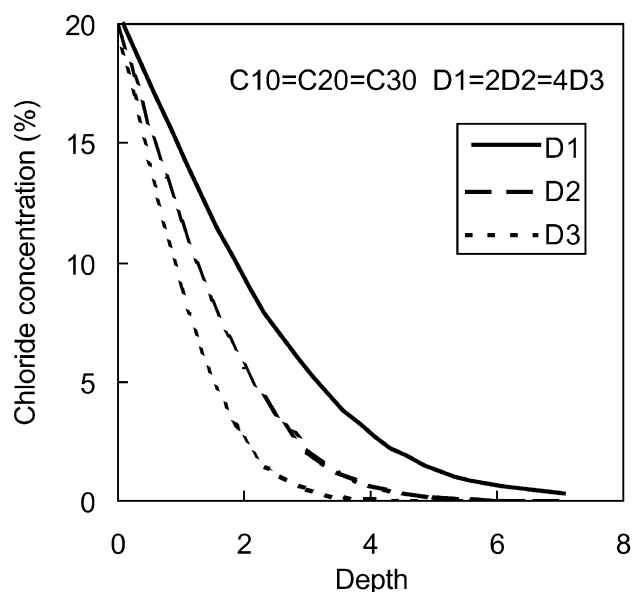


Fig. 1. The chloride concentration profile with different diffusivities.

The relationship between the average free and total chloride content is important, as well as the relationship between the free and total chloride diffusivities. The discussion of Dr. Mohammed and Hamada and our paper just showed one aspect of the relations. However, the accurate quantity of those relations could not be given by a small amount of data because of the error in sampling and testing, the difference between cements, concrete mixes, environments, construction, and history of usage of the concrete structure. Therefore, both conclusions need more research to evaluate.

Thanks again for the good discussion of Dr. Mohammed and Hamada on our research work.

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