Investigation of optimum state for strength of cement-mixed sand

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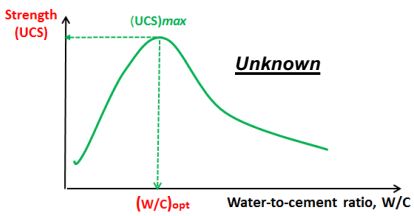
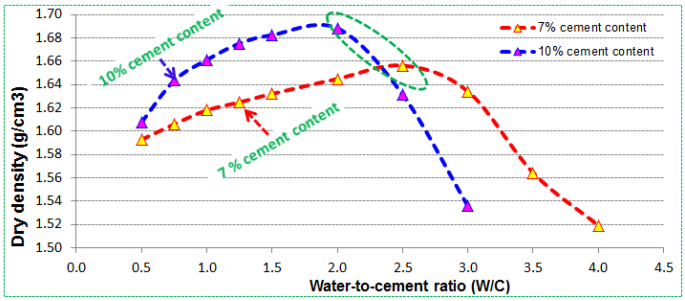
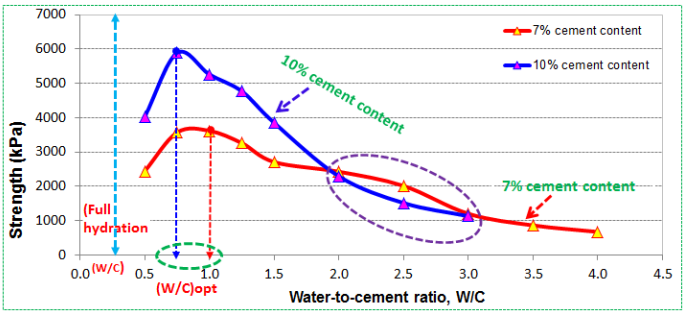
Introduction

The main aim of this study is to investigate the **optimum state** for **strength** of cement-mixed sand (CMS). The experimental program with unconfined and tri-axial compression tests were approached. A wide range of mechanical factors such as cement content, porosity, water-to-cement ratio, curing time are changed to consider the behavior of cement-mixed sand.



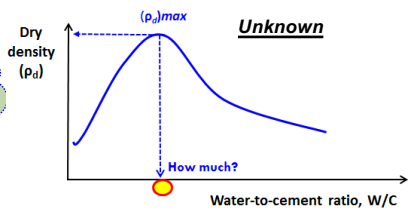
Optimum water-to-cement ratio $(W/C)_{opt}$



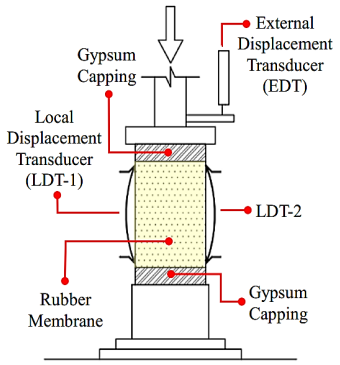


Remarks and conclusions

1. Maximum dry density depends on cement content
2. Range of $(W/C)_{opt}$ is 0.75-1.0, & stable with cement content
3. Maximum strength not occurs at maximum dry density
4. Adding cement is not sufficient for large W/C ratio



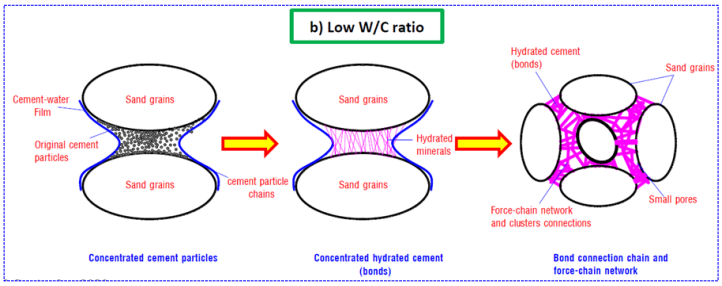
Relationship Strength-W/C-density

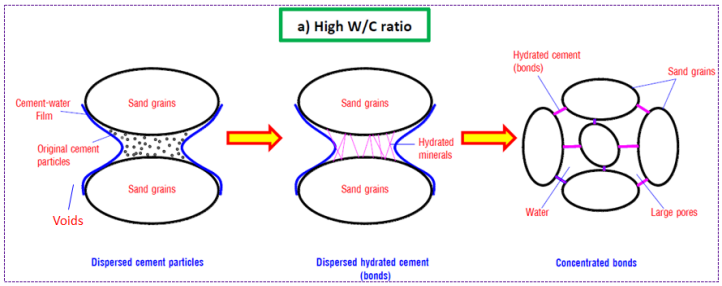


Schematic illustration of apparatus

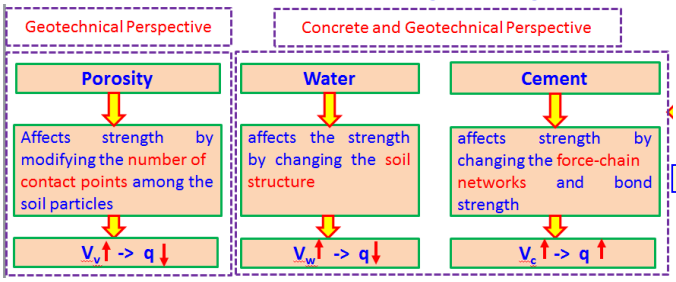
Bond formation model with W/C ratio

A bond formation model is proposed to explain the relationship between strength and water-to-cement ratio of cement-mixed sand. The proposed model is based on concept of **presence of bonding cluster and force-chain network.** For low W/C ratio, **bonds are network, and small pores.** For large W/C ratio, **bonds are single and large pores.** 3 main reactions of bond strength are: hydration, ion exchange, & pozzolanic reaction.

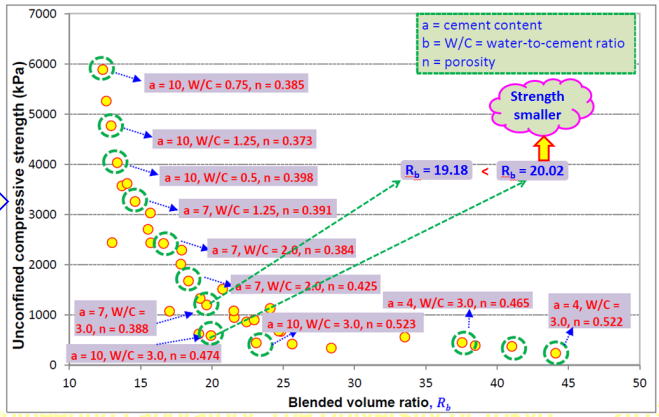




A proper index for controlling strength of CMS



Validation



Proper index, namely, the ***blended volume ratio*** (R_b) *is proposed*

$$R_b = \frac{Volume\ of\ voids + Volume\ of\ waters}{Volume\ of\ cements} = \frac{V_v + V_w}{V_c}$$