Experimental Study on Loading Rate Dependent Mechanical Behavior of Artificially Bounded Geomaterials

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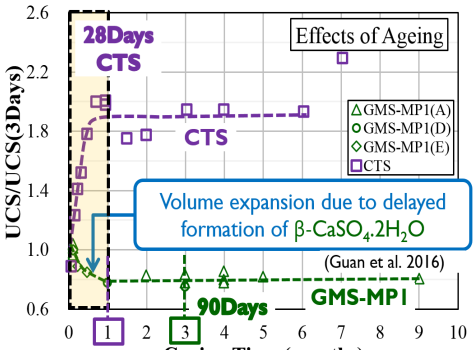
Introduction

In the present study, an arduous attempt has been made to unveil the salient aspects of time dependent mechanical behavior of two different types of laboratory produced geomaterials, viz. **Gypsum Mixed Sand (GMS)** and **Cement Treated Sand (CTS)**; by performing a wide range of laboratory tests including monotonic, creep and cyclic loading tests under unconfined and confined conditions.

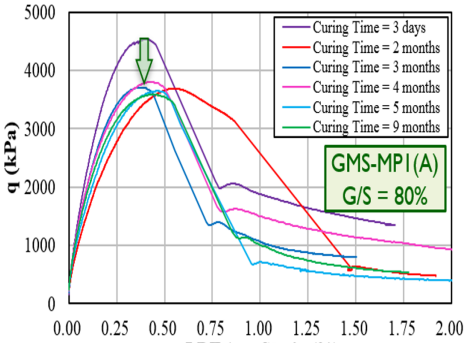
Different stages of specimen preparation

Effects of ageing on the mechanical behavior

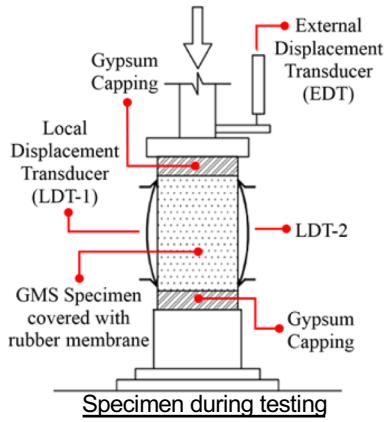
A noticeable reduction in peak strength of GMS-MP1 was observed during the first month of curing. However, continuous increase in the peak strength values of CTS was observed in the first month of curing. No further effects of ageing on the UCS of GMS and CTS were witnessed after first month.



Effects of ageing on the normalized peak strength of GMS and CTS



Effects of ageing on the stress-strain responses of GMS

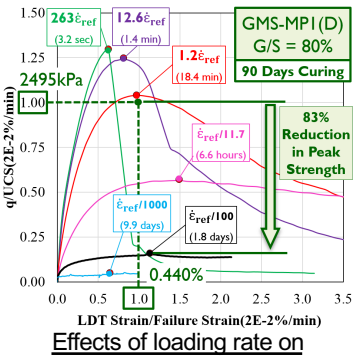


Specimen during testing

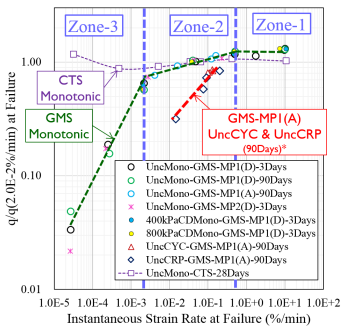
Loading rate dependency of GMS and CTS

Significant effects of loading rate on UCS and stress-strain responses of GMS were witnessed for GMS. An increasing trend of UCS and pre-peak stiffness was observed with the increase in loading rate, and the effects of loading rate on the mechanical behaviour of GMS were divided into three distinct zones of strain rates, viz. Zones 1, 2 and 3.

The effects of loading rate on the peak strength values and stress-strain response of CTS are relatively limited compared with GMS. In comparison with GMS, the post-peak strain softening in CTS specimens is also not greatly affected by the loading rates.



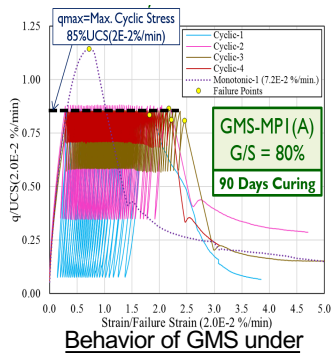
Effects of loading rate on normalized stress-strain of GMS



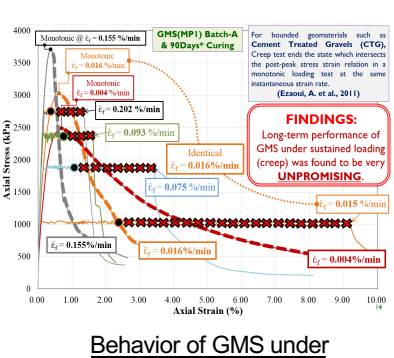
Effects of loading rate on normalized strength of GMS

Behavior of GMS under creep and cyclic loading

The behavior of GMS under unconfined creep loading is very unpromising, as a small normalized creep load is sufficient enough to cause a creep failure within a relatively shorter duration of time, viz. about 9 days. A unique relationship between the normalized failure stress and instantaneous failure strain rate of GMS specimens tested under unconfined creep and cyclic loading, and the behavior of GMS under unconfined creep and cyclic loading conditions are similar to each other and distinctively different than unconfined monotonic tests.



Behavior of GMS under unconfined cyclic loading



Behavior of GMS under unconfined creep loading