STRENGTH AND DEFORMATION CHARECTERISTICS OF FIBRE REINFORCED CEMENTED SAND

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INTRODUCTION

- Due to the construction of massive structures and excessive land utilization, it sometimes becomes unavoidable to use sites with poor soil conditions for the construction of an engineering structure.
- The combined effect of adding cement and fibre in ground improvement has been found to be a useful improvement technique.
- The main object of this paper is to experimentally investigate the effect of fibre reinforcement on stiffness, yielding, failure modes and criteria of Portaway sand at high pressures.

MATERIALS

Portaway sand

- Gs = 2.65
- D50 = 0.35
- Cu= 2.2
- emax = 0.79
- emin = 0.46

Polypropylene fibre

- Length= 22mm
- Diameter = 0.023mm
- Gs = 0.9
- Elastic modulus = 8 GPa

Ordinary Portland cement

- TS EN 197-1-CEM 1
- Gs = 3.15

EXPERIMENTAL SETUP

GDS high pressure triaxial apparatus

Schematic Diagram

High pressure

TESTING PROCEDURES

- Size of specimen 50mm×100mm
- Fibres were mixed with sand prior to adding the water
- 5% of cement was added to sand for cemented samples
- Specimens were compacted in 4 layers.
- Uncemented samples were prepared on cell base.
- Sheared at a constant rate of 0.15 mm/min
- All cemented samples were cured for 14 days.

STIFFNESS

- Increasing the confining pressure increases the stiffness of fibre reinforced sand
- Addition fibre the degradation curve do not converge to at a an axial strain of 10%
- Continue to degrade with different value until the very high axial strain

YIELDING

YIELDING

- The yield point is located at starting point of the transition from a stiff to a less stiff response.
- Addition of fibre increases yield stress in both sand and cemented sand at all the different confining pressures

YIELDING

- The confining pressure has a significant effect on the yield strength qy, during triaxial compression
- Follows a curve pattern with convex shape and the yield curves expand with increasing cement

MODES OF FAILURE

(a)

(b)

(c)

MODE OF FAILURE FROM I_B

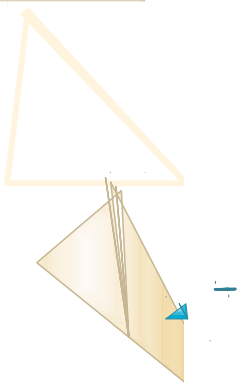
- Brittle behaviour increased with increasing cement content and decreased with addition of fibres and increase in confining stress
- The brittleness index is high at relatively lower confining pressure and with addition of cement contents; which indicates a stronger, stiffer, and more brittle material
- As the index decreases, approaching zero, the failure behaviour becomes increasingly ductile

CONCLUSIONS

- The addition of fibres and increasing confining pressures also affected the stiffness of the composites. The addition of fibre increased the stiffness of clean sand in drained triaxial tests carried out at a CP of 4MPa from 3MPa to 3.2MPa and in cemented sand increases in stiffness there was hardly any noticeable effect.
- With the increase in confining pressure the yield stress of fibre reinforced sand increased from 471kPa, 1MPa, 3.3MPa and 6.01MPa at confining pressures of 300kPa, 1MPa, 4MPa and 10MPa respectively.

CONCLUSIONS

- The values of IB increased with the addition of fibres in both cemented and uncemented sand and decreased with the increase in confining pressures. The value was as high as 2.1 for fibre reinforced cemented sand at 100kPa and reduced gradually to approximately zero at and above 4MPa. At and above 4MPa all samples showed a ductile mode of failure with IB values very close to zero.



Questions