Lecture 3

NPTEL Course

GROUND IMPROVEMENT

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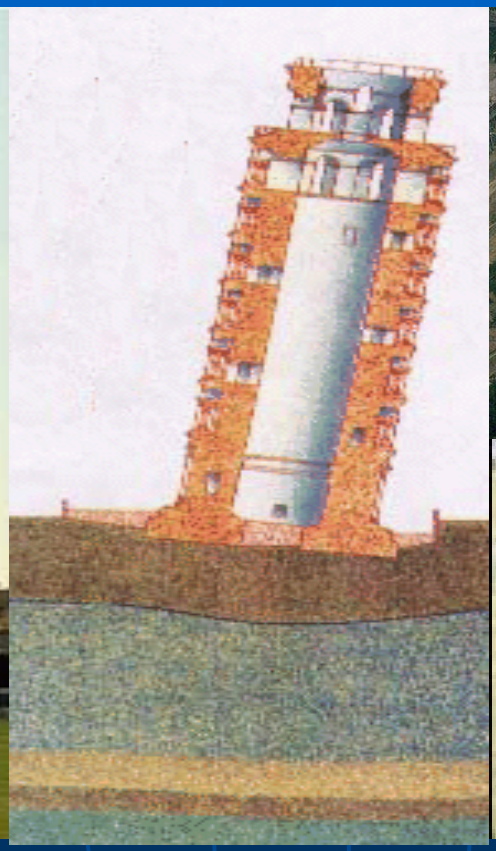
Module I

- Need for Ground Improvement
- Classification of ground modification techniques
- Emerging trends in ground Improvement

Recap:
Classification of Ground Improvement techniques
Methods and techniques of Ground Improvement
Factors affecting the selection of techniques

Need for Soil Improvement



Soft Clay

Liquefaction and sinkhole formation

Methods for Soil Improvement

Ground Reinforcement

- Stone Columns
- Soil Nails
- Micropiles
- Jet Grouting
- Ground Anchors
- Geosynthetics
- Fibers
- Lime Columns
- Vibro-Concrete Column
- Mechanically Stabilized Earth
- Biotechnical

Ground Improvement

- Surface Compaction
- Drainage/Surcharge
- Electro-osmosis
- Compaction grouting
- Blasting
- Dynamic Compaction

Ground Treatment

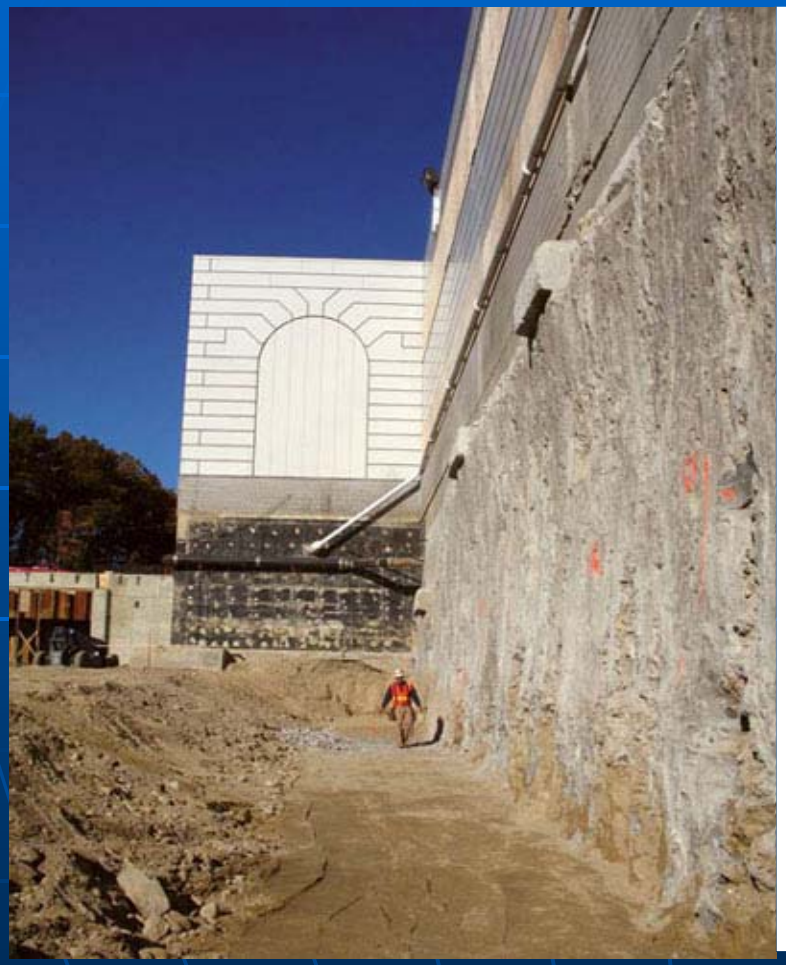
- Soil Cement
- Lime Admixtures
- Flyash
- Dewatering
- Heating/Freezing
- Vitrification

Benefits/Objectives of ground improvement techniques

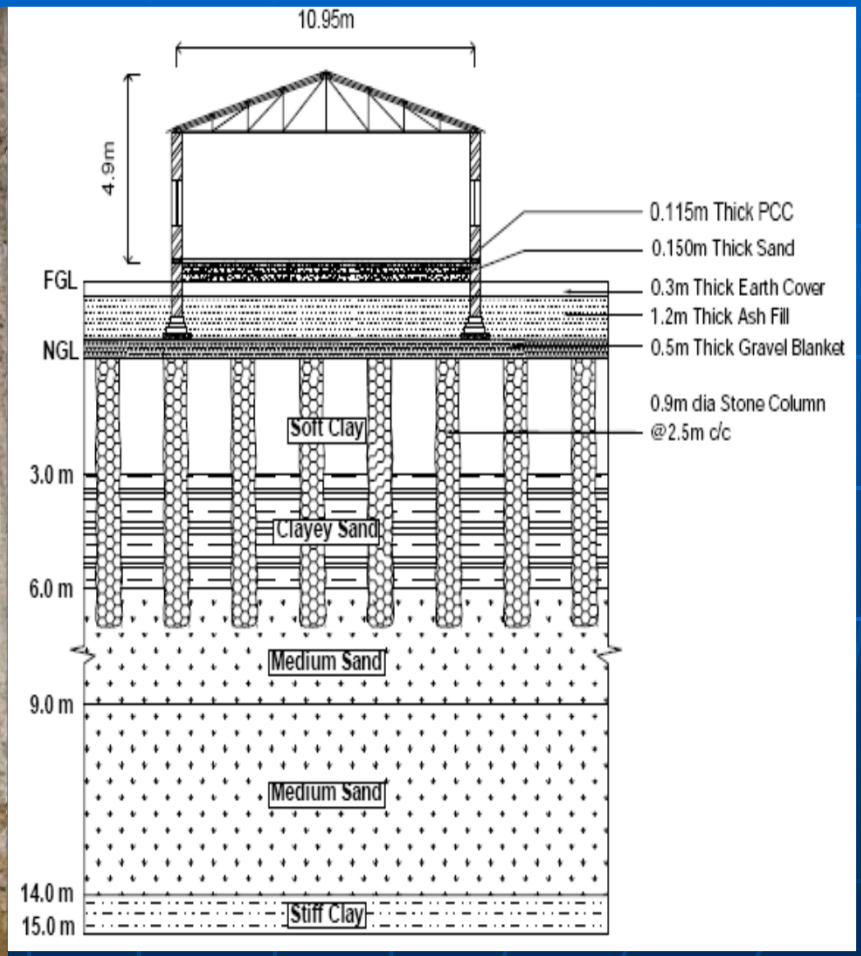
- Increase of strength
- Reduce distortion under stress (Increases stress-strain modulus)
- Reduce compressibility (volume decreases due to a reduction in air voids or water content under loads)

Continued :

- Prevent detrimental physical or chemical changes due to environmental conditions (freezing / thawing, wetting / drying)
- Reduce susceptibility to liquefaction
- Reduce natural variability of borrow materials and foundation soils

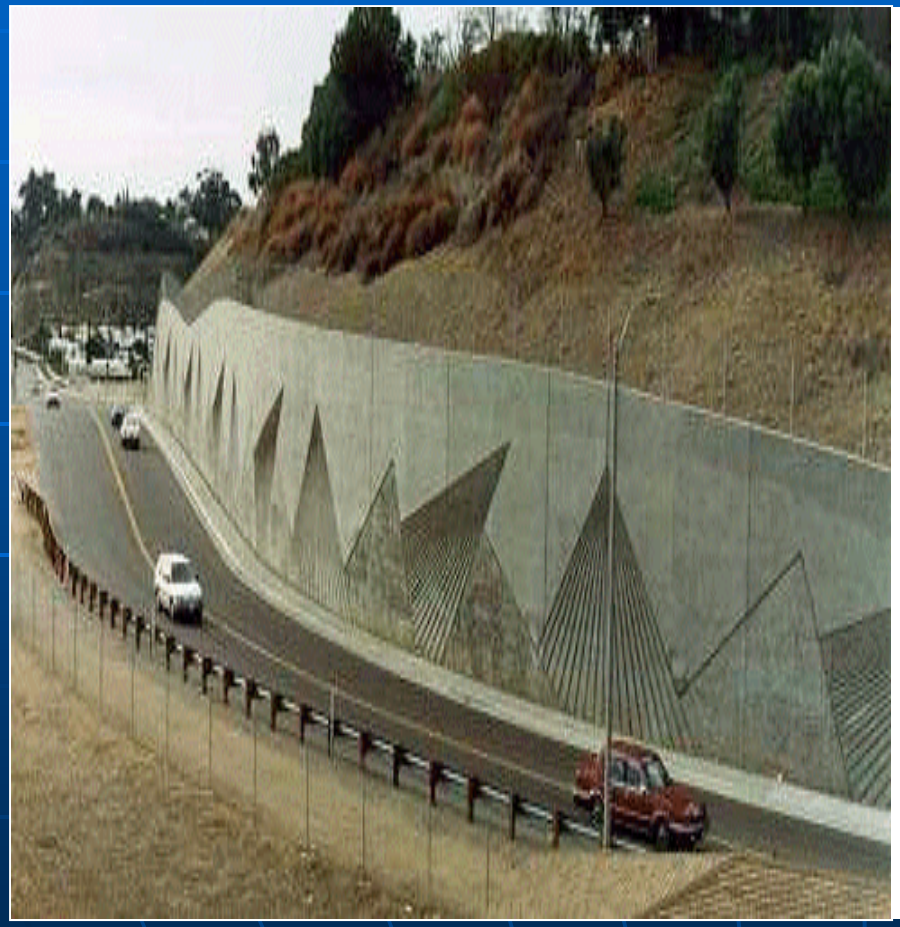


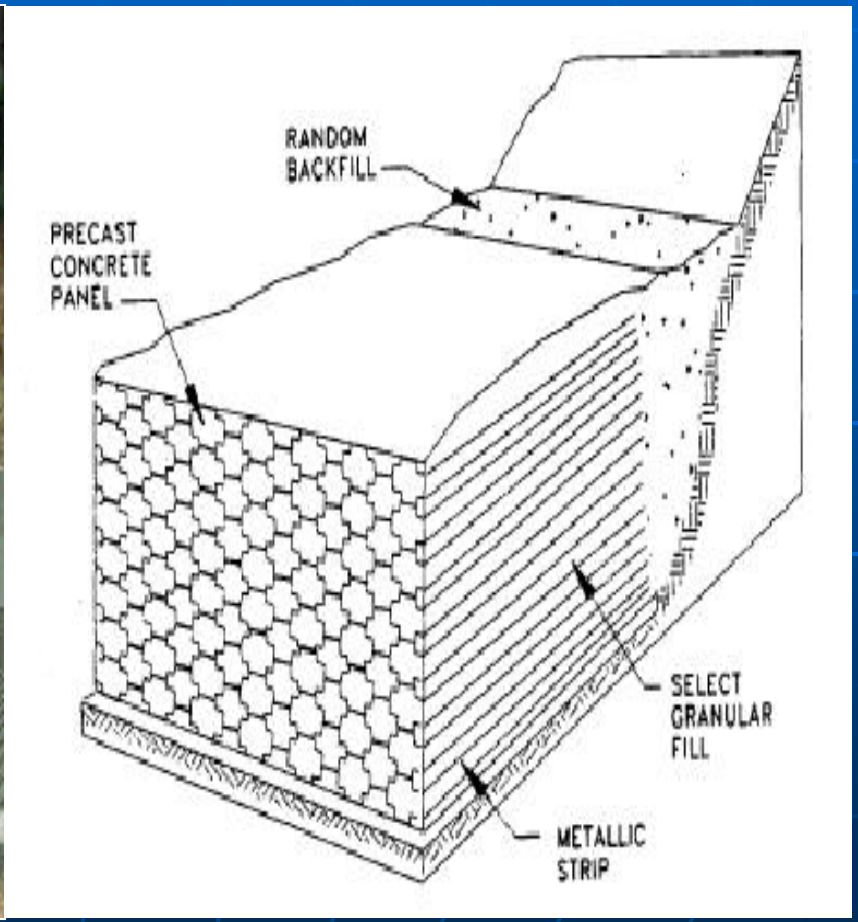
Jet grouted soilcrete columns



Stone columns

Nailing and Reinforced soil

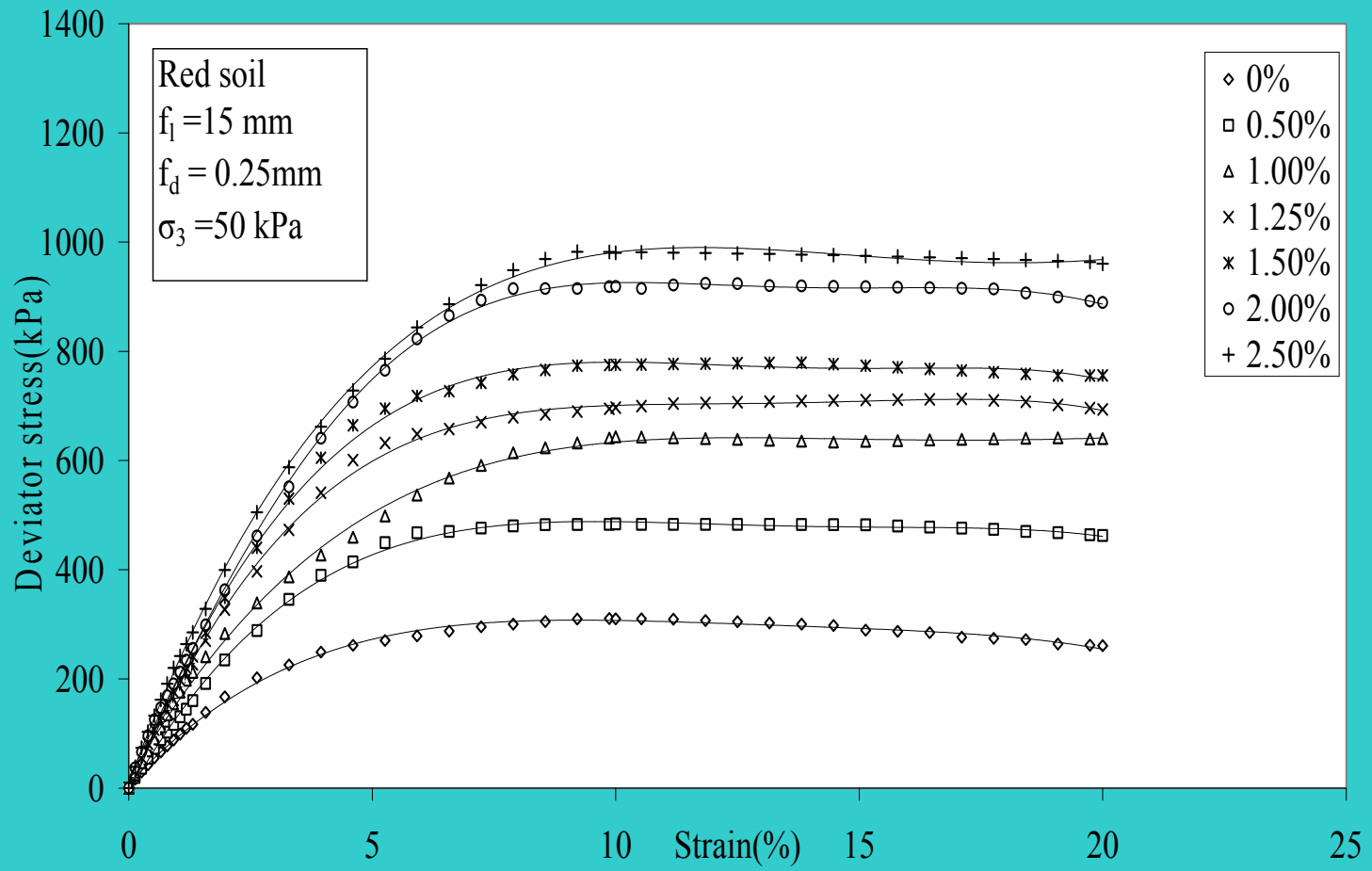




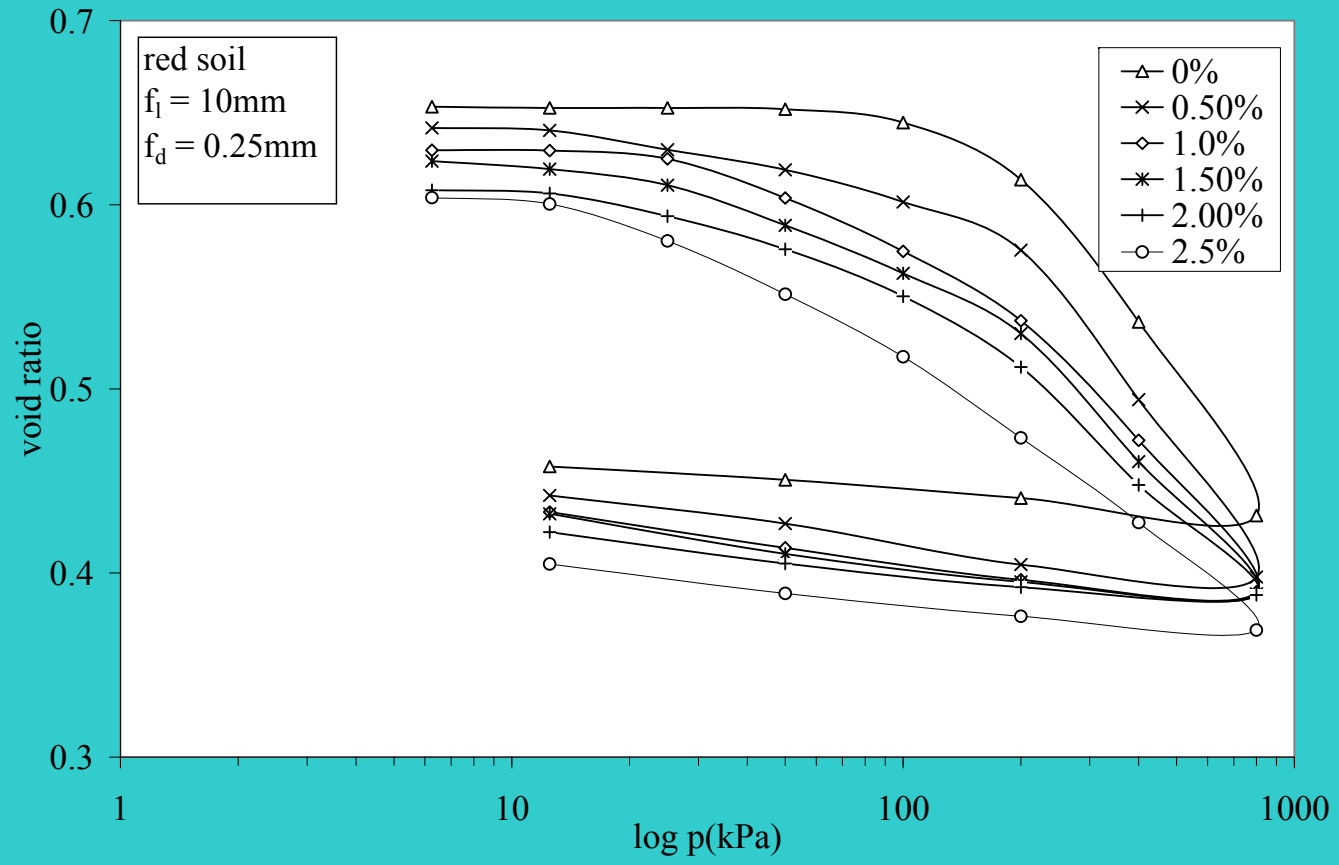
Geosynthetic products

Fibers and reinforced earth

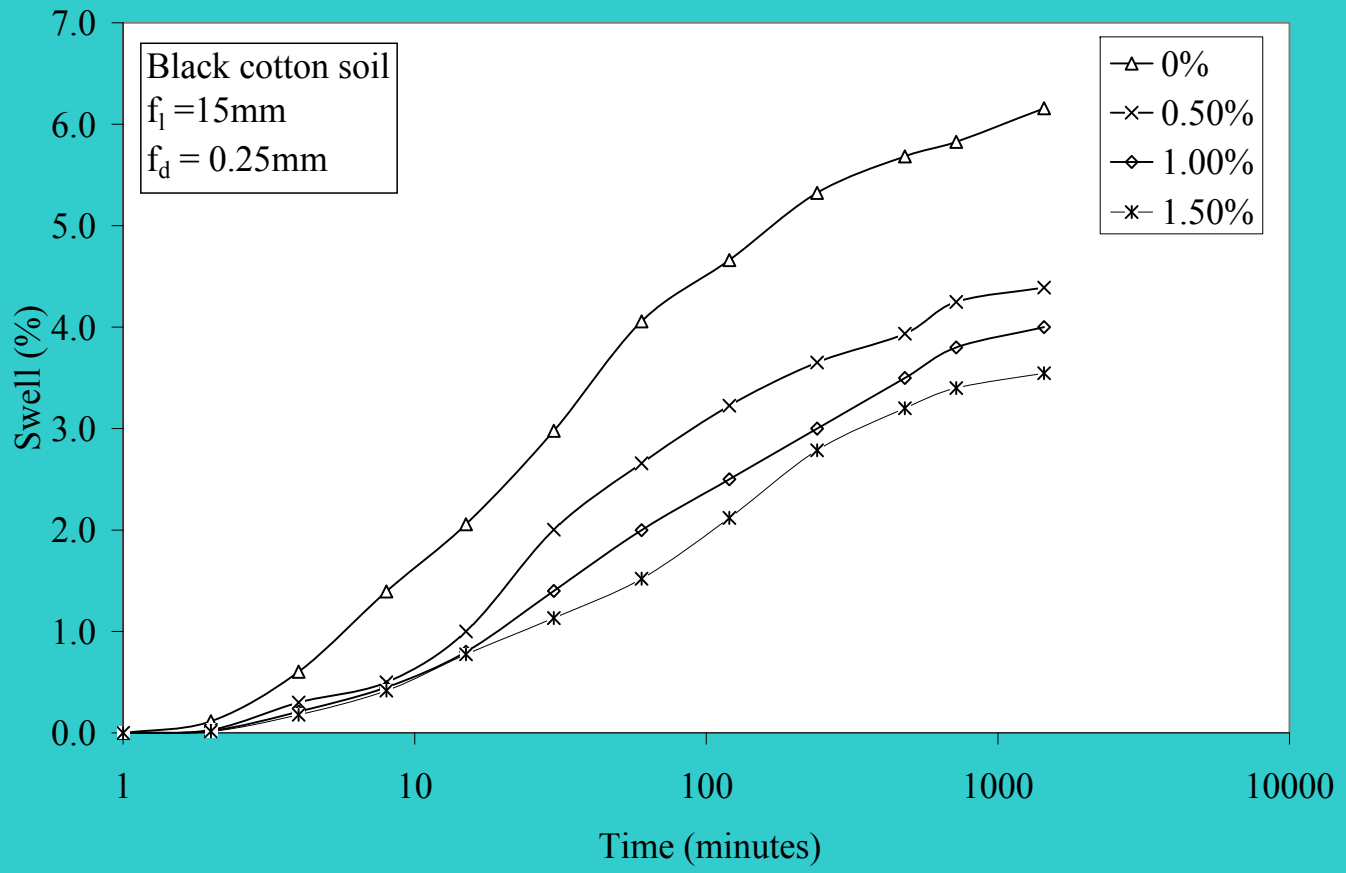
Effect of fibers on strength response



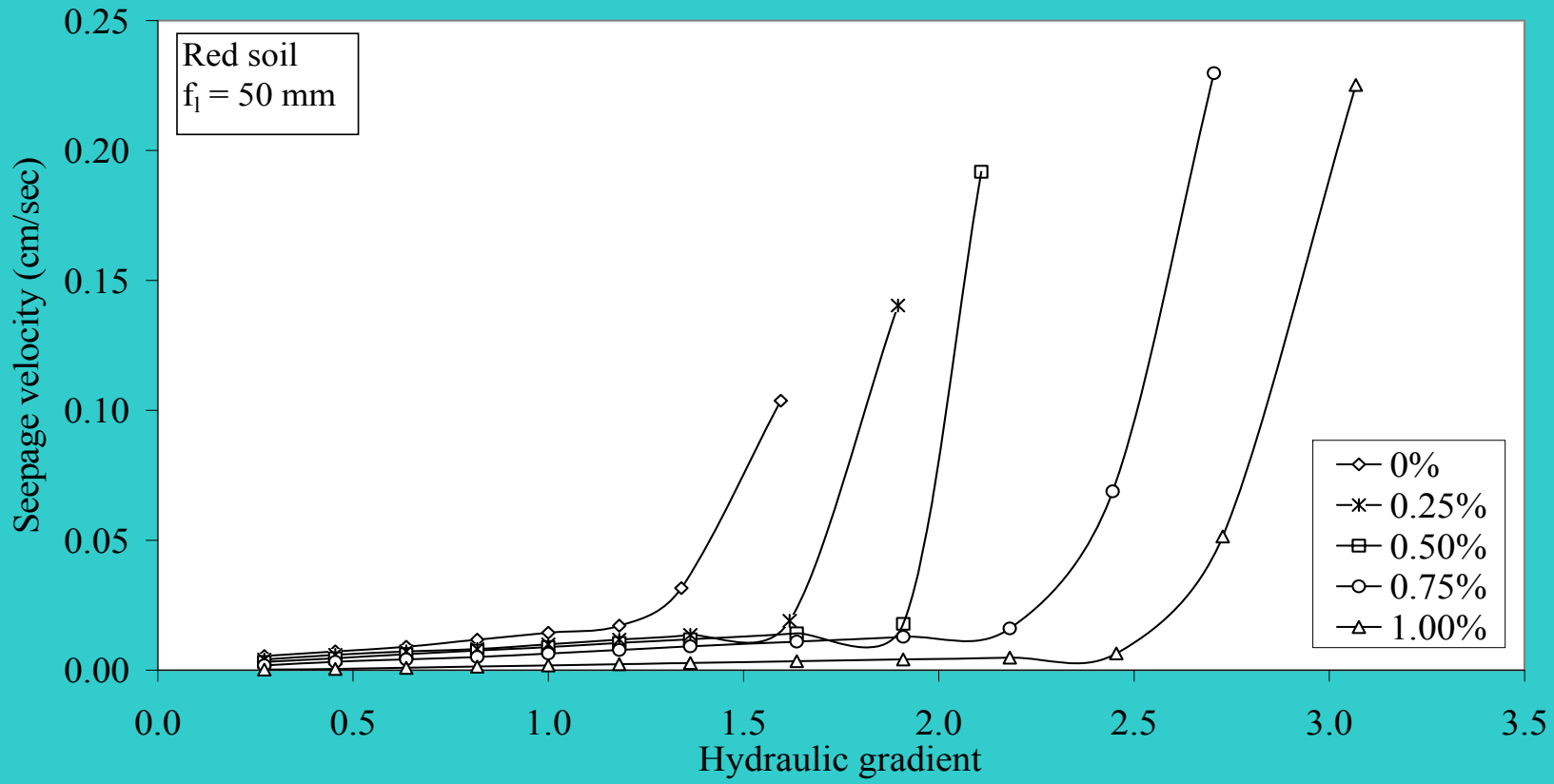
Effect of fibers on compressibility



Effect of fibers on swell response



Effect of fibers on piping resistance



Trends Today

- Environmental Geotechnics and solid waste management using ground improvement techniques
- Containment and constructive use of waste materials
- Low-cost technologies with soil and additives
- Geosynthetics
- Biotechnical stabilization

Catalysts and accelerators

- Development of new machinery, particularly for deep compaction
- Availability of new construction materials such as geofoams, geocomposites
- Emergence of better guidelines for determining the suitability of specific techniques for certain types of soils and site conditions.
- Better understanding of the geotechnical processes involved and appreciation of the significance of the construction sequence.
- Refinement of methods of analysis and computer modeling techniques

Likely Trends Tomorrow

- Microbes to stabilize or remediate soils,
- Nanotechnology to modify the behavior of clay,
- Nano-sensors and MEMS to characterize and monitor the behavior of geomaterials and geosystems,
- Remote sensing and noninvasive ground-based sensing techniques, and
- Next-generation geologic data models to bridge sensing, computation, and real-time simulation of behavior for adaptive management purposes and geophysics for urban infrastructure detection.