

Construction innovation:

- 1. Biological insitu reinforcement of sand***
- 2. Geothermal heat-pump systems***

***Or any research topic in soil mechanics,
geotechnical engineering, geo-environmental
engineering***

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Biological insitu reinforcement of sand

- BioGrout, process by which bacteria control precipitation of calcium carbonate while consuming supplied reagents. By controlling amount of reagents, the amount of calcium carbonate and thus the strength of the reinforced sand mass can be engineered.
- By controlling reagent concentration, amount of calcium carbonate precipitate, and hence stiffness and bearing capacity of reinforced sand body, can be engineered without significantly interfering with permeability of treated soil, and without excavation or replacement

Process:

Grow bacteria in the lab or insitu

Injection: pump reagents, nutrients and/or bacteria in the soil

Chemical reaction catalysed by the bacteria Precipitation of minerals

.... Change of contact properties between individual grains at micro level Change of soil properties at macro level.

Geothermal heat-pump systems

- Geothermal heat pump systems use the fairly constant temperature of the shallow ground or groundwater (typically between 10 and 14°C in Ireland) as a means of heating ***and*** cooling buildings. -> typically use about one third of energy consumed by traditional heating/cooling systems.
- In closed heat-pump systems, closed pipe loops are installed in ground in dedicated vertical boreholes or horizontal trenches, or more recently are included as part of the structural piles of a building (energy piles), foundation slab or retaining wall (energy walls).

