

# CE394M: Advanced Analysis in Geotechnical Engineering

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- 1 Geotechnical modeling
  - Complexity in Geotechnical modeling
- 2 Numerical methods for differential equations
  - Direct method

# Geotechnical modeling of the complex world



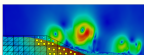
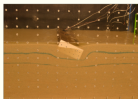
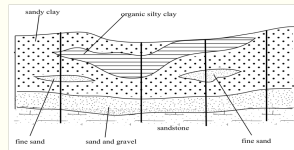
Fig. London Bridge Station, London, UK

# Geotechnical modeling of the complex world



Fig. London Victoria station upgrade, London, UK

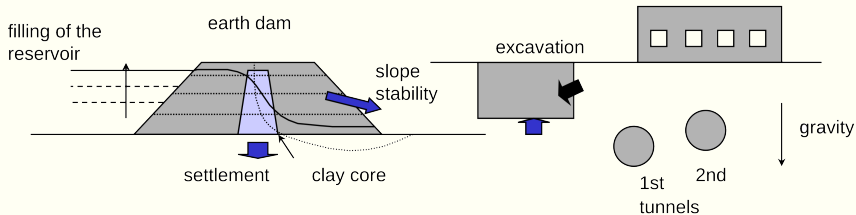
# Geotechnical modeling



- nonhomogeneous,
- anisotropic,
- non-linear,
- initial stress conditions,
- stress history
- Geometry - very complex

**Soil Mechanics in practice - largely empirical**

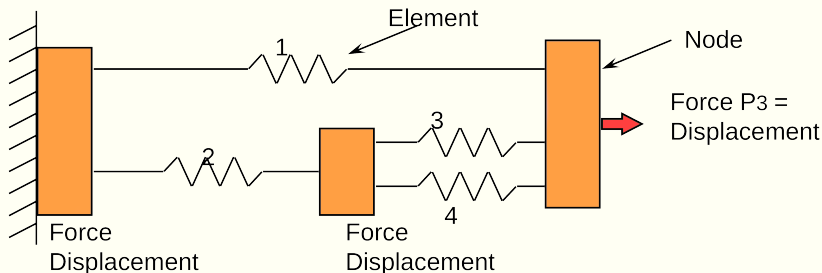
# Geotechnical modeling: What should be modeled?



# Analysis of engineering problems



# Matrix analysis of structures



- What are the known variables?
- What are the unknowns?
- What do we know?

# Matrix analysis of structures: Equilibrium

- $P_1 =$
- What are the unknowns?
- What do we know?