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# Obtaining parameters for numerical analysis

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  - Available constitutive models
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- **Soil-structure interaction**

## Analysis uncertainties

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### General analysis

- Engineering knowledge and competence
- Engineering judgement
- Ground model
- Parameters
- Groundwater
- Method of calculation

### Computer analysis

- Software
- Appropriate soil model
- Boundaries
- Discretisation
- Soil-structure interaction

## Appropriate soil models

“Useful numerical analysis can be performed only if one fully understands both the numerical tool and the real soil behaviour” (Zdravkovic and Carter, 2008)

In the use of computers “there is a danger that limitations of accuracy in measuring soils and other properties will be forgotten” (Little and Price, 1958).

“In many cases of daily geotechnical engineering one has good data on strength parameters but little or no data on stiffness parameters. ...it is no help to employ complex stress-strain models ...” (Shanz, Vermeer and Bonnier, 1999)

## Field or laboratory testing?

- Unable to sample most granular materials “undisturbed”
  - loss of effective stress
  - empirical derivation of parameters for “sand” soils
- Unable to sample (or lab test) coarse soils
  - representative volume too large
- Unable to sample fractured weak rocks

## Summary

- Analysis
  - only part of design
- Limited constitutive models in commercial code
  - but parameters numerous, and difficult to obtain
- Results of analysis affected by more than just parameters
  - boundaries and discretisation
  - simplification of the geological model
  - judgement as to what needs to be modelled
- Field testing does not provide the perfect answer
  - More challenging and pressured test environment
  - Primitive relations between results and (simple) soil parameters
- Only a small range of materials can be sampled and tested in the laboratory
  - The laboratory generally offers more sophisticated testing
  - Engineers may fail to understand or correctly use test methods
  - Samples will be disturbed – destructuring. effective stress changes
  - Need to integrate lab and field data
- Soil-structure interaction
  - At the interface, do we really know the loads?

How are these factors allowed for in Eurocode 7?