
LUSAS
Engineering analysis and design software

LUSAS for Ground Engineering and Soil-Structure Interaction Modelling

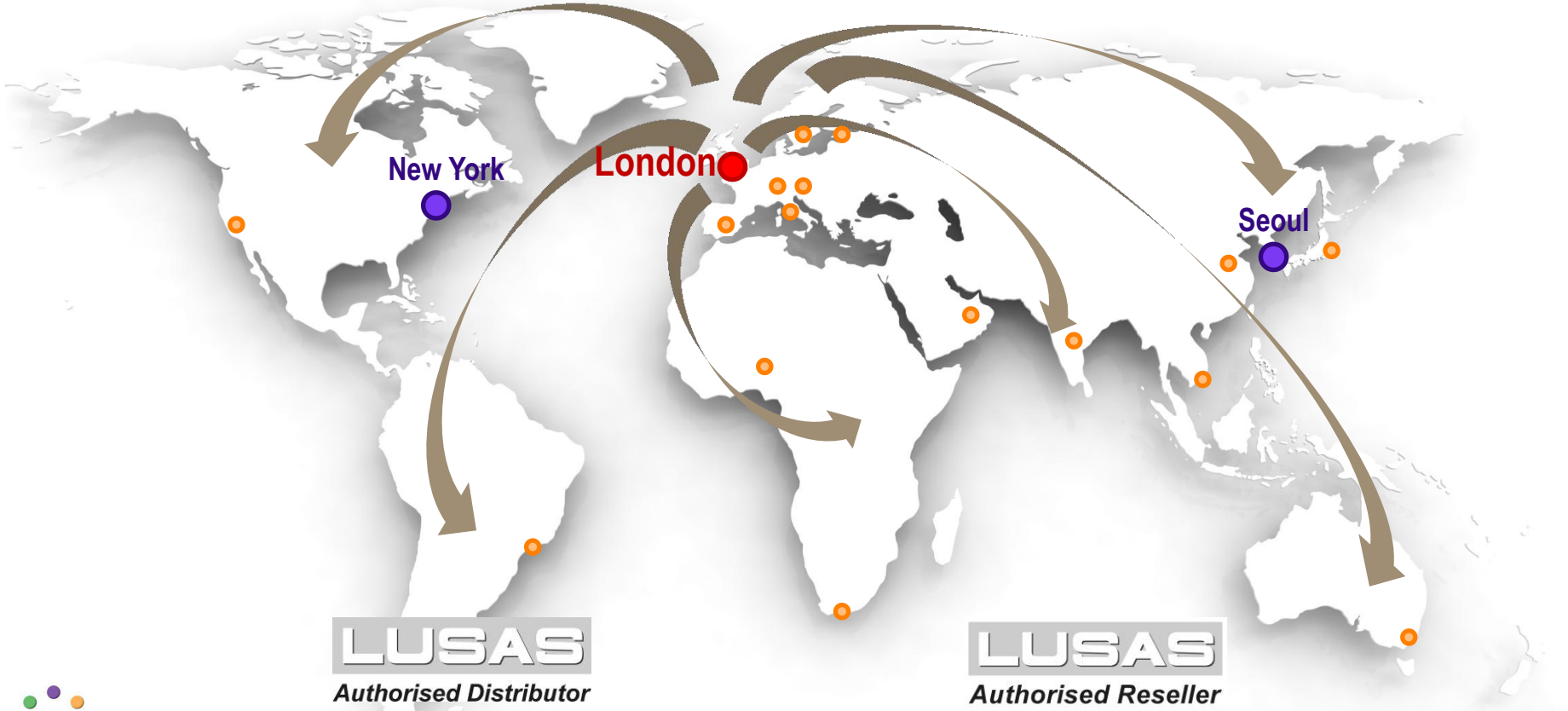
LUSAS – The Company

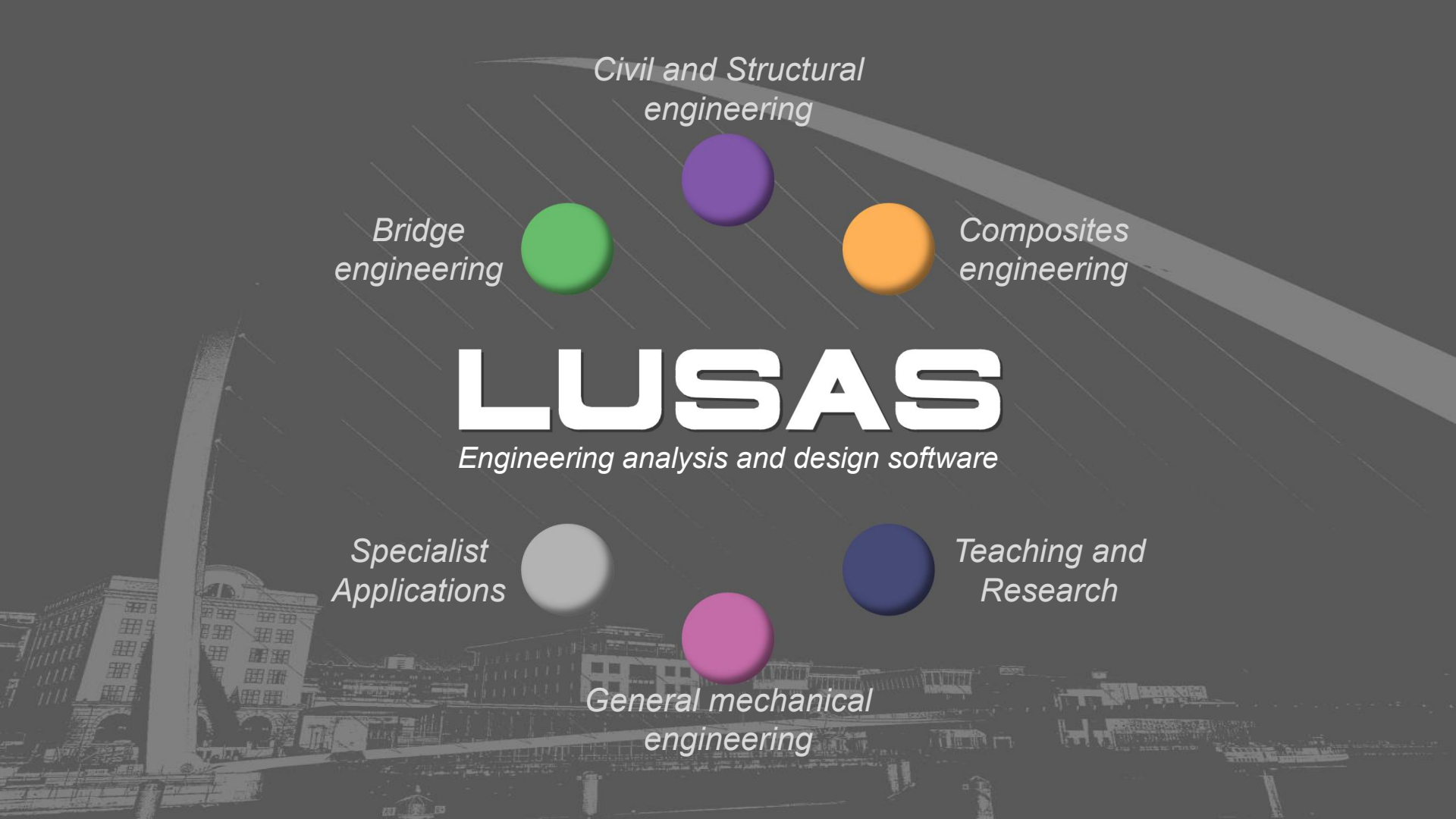
- Headquartered in the UK, with a global presence
- Over 30 years in the business, with origins in Imperial College, London
- Develops, markets and supports a range of LUSAS software products used in all engineering industries
- Also offers consultancy services

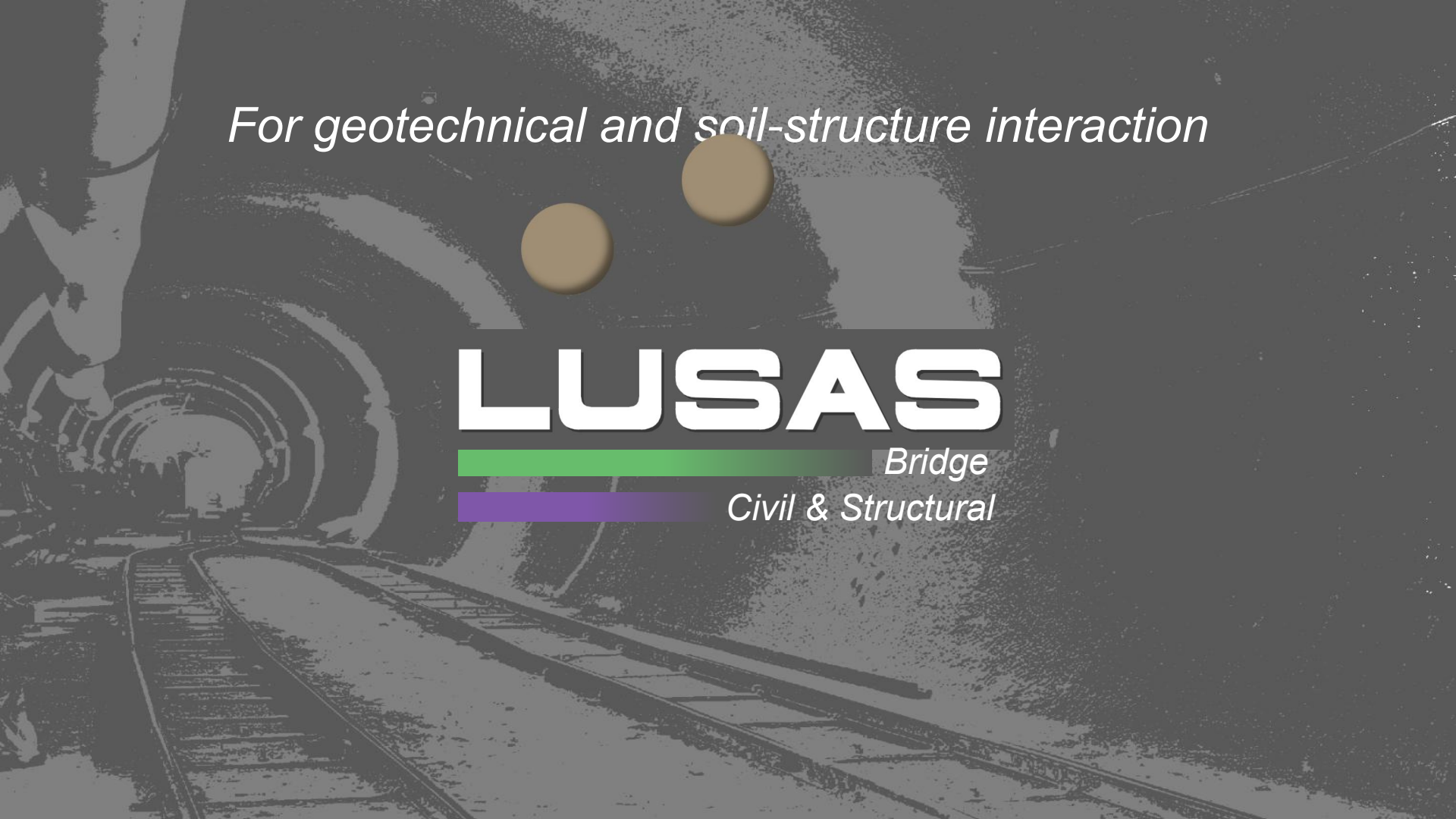
'LUSAS'

London **U**niversity
Structural **A**nalysis **S**ystem

Global coverage and support



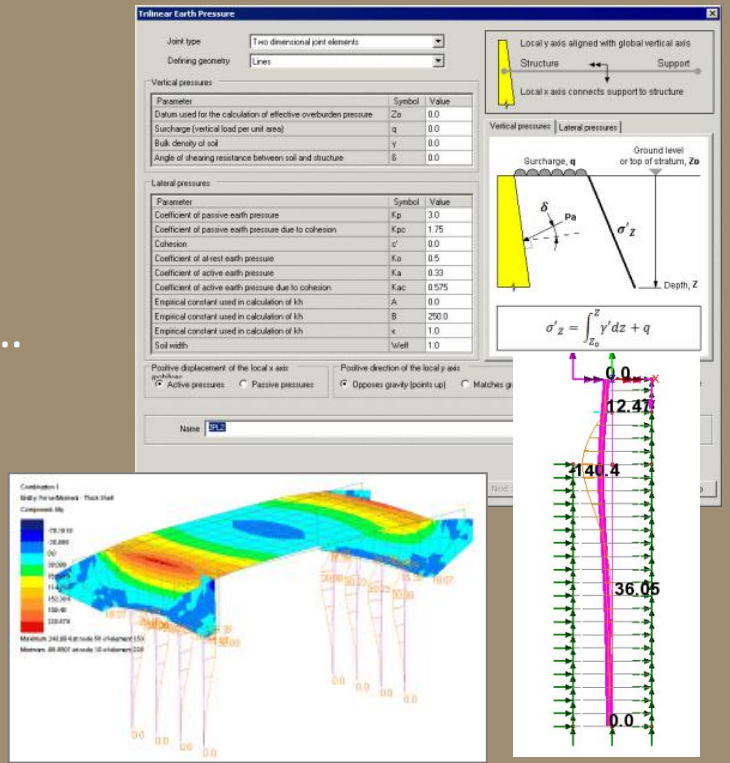

Civil and Structural engineering
Bridge engineering
Composites engineering
LUSAS
Engineering analysis and design software
Specialist Applications
Teaching and Research
General mechanical engineering


For geotechnical and soil-structure interaction
LUSAS
Bridge
Civil & Structural

Why use LUSAS for Geotechnics/SSI?

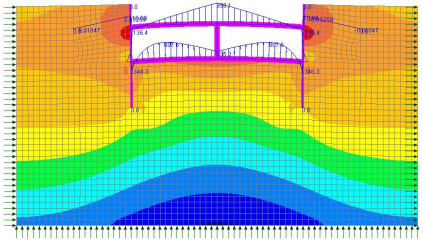
Model ground and structure <u>in a single model</u>

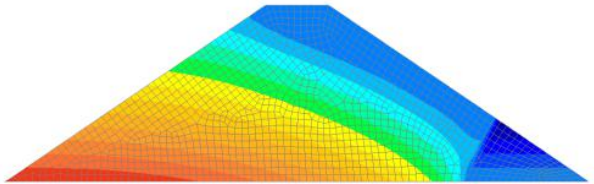
- Represent soil as continuums or interfaces (active / passive joints) and in 2D or 3D
- Nonlinear soil material models include Mohr Coulomb, Modified Cam Clay, Drucker-Prager…
- Water phase analysis for consolidation and seepage effects
- Time stage facilities for excavation and filling processes
- Linear and nonlinear soil dynamics



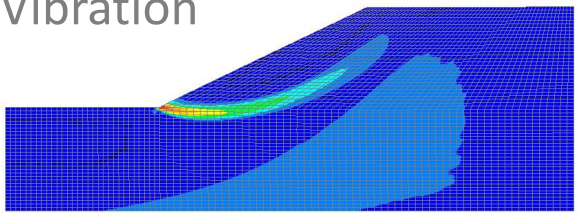
Application areas

- Use for:
  - Pad, Pile and Basement Foundations
  - Tunnelling and Excavations
  - Retaining Walls
  - Integral Bridges
  - Dams



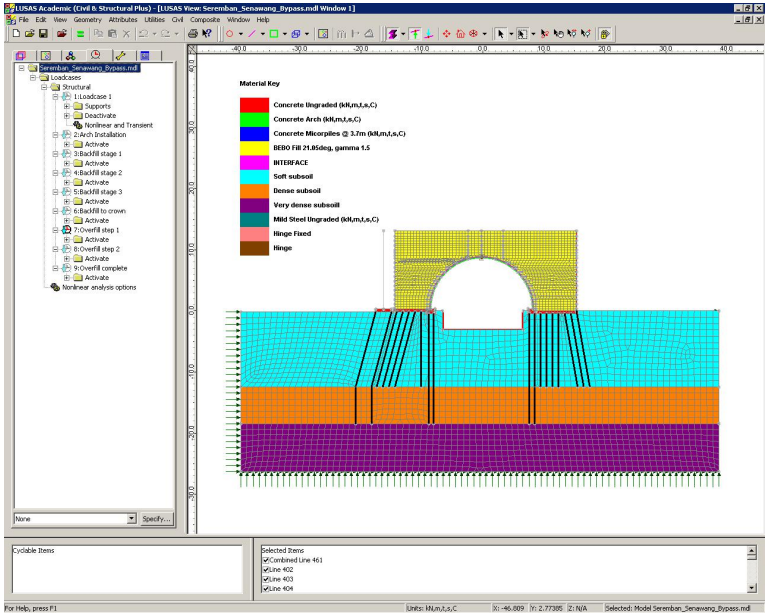


- To investigate:
  - Bearing Capacity
  - Overturning
  - Stability
  - Consolidation
  - Seepage
  - Vibration

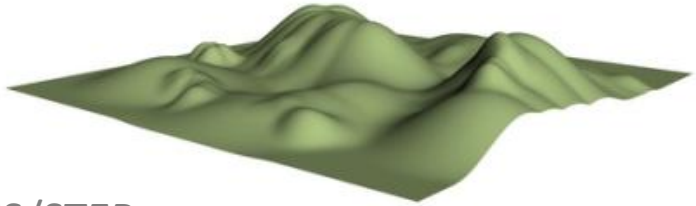


Working with LUSAS

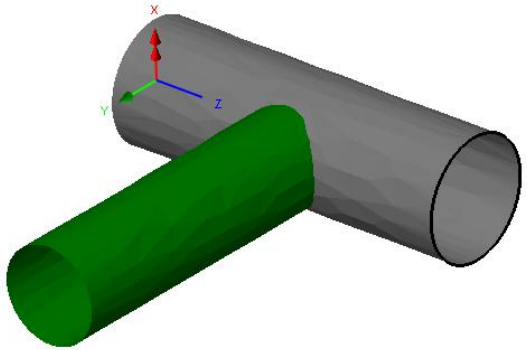
- Easy-to-use application-specific **Modeller**
- Fully integrated **Solver** which can be used independently.
- Models are formed of layers and are created using feature-based geometry methods (points, lines, surfaces, volumes)
- Easy to use mesh refinement capabilities
- Associative modelling provides an intelligent link between all model data



General modelling tools

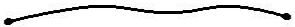


- CAD Import / Export
  - Points and lines through DXF
  - Points, lines, surfaces and volumes through IGES/STEP
  - Triangulated surfaces from ground models through STL
- Drawing Tools
  - Snap to grids
  - Arcs, Splines
  - Copy, Mirror, Rotate, Scale, Transform
  - Extrude, Intersect and Manifold
  - Subtract, Union



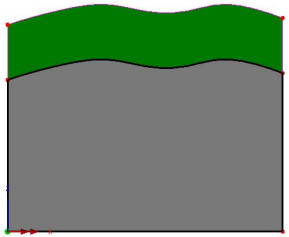
Example modelling in 2D

Spline from terrain point data and borehole logs



Sweep to create strata

Surface from bounding points and lines to complete soil mass



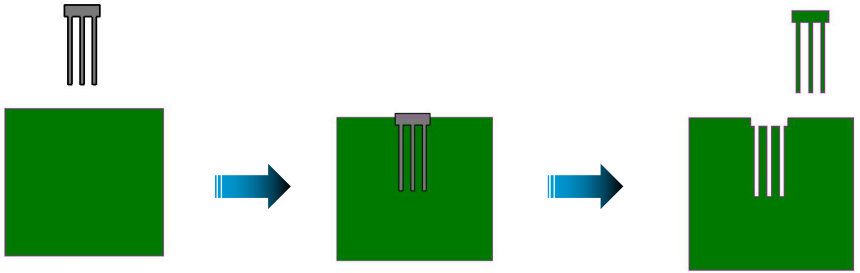
Move & Sweep points and lines

Union to create single soil mass

Separated structure and soil components

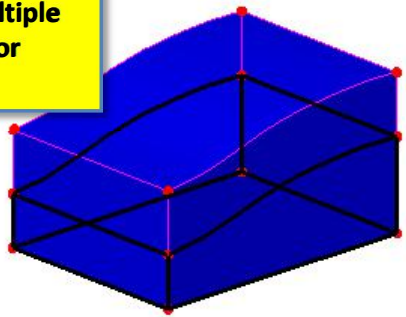
Components in position

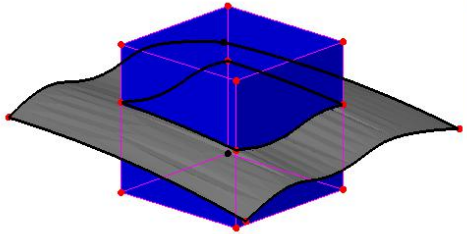
Subtract to create soil void. Retain or remove structure.



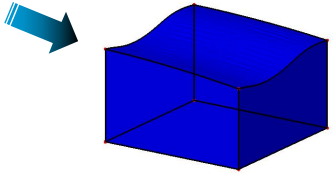
Example modelling in 3D

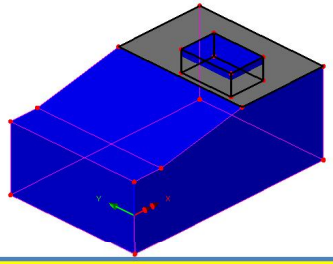
Surface sweeping for multiple volume creation, planar or curved





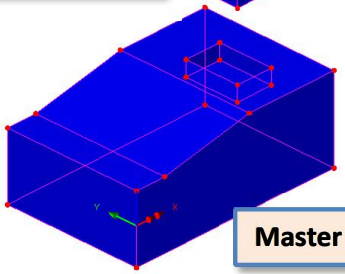
Intersection command for slicing of volumes, planar or curved.





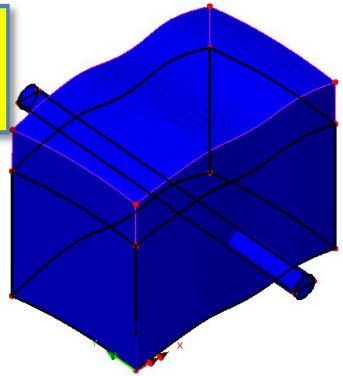
Subtraction command for creation of voids

Tool Object



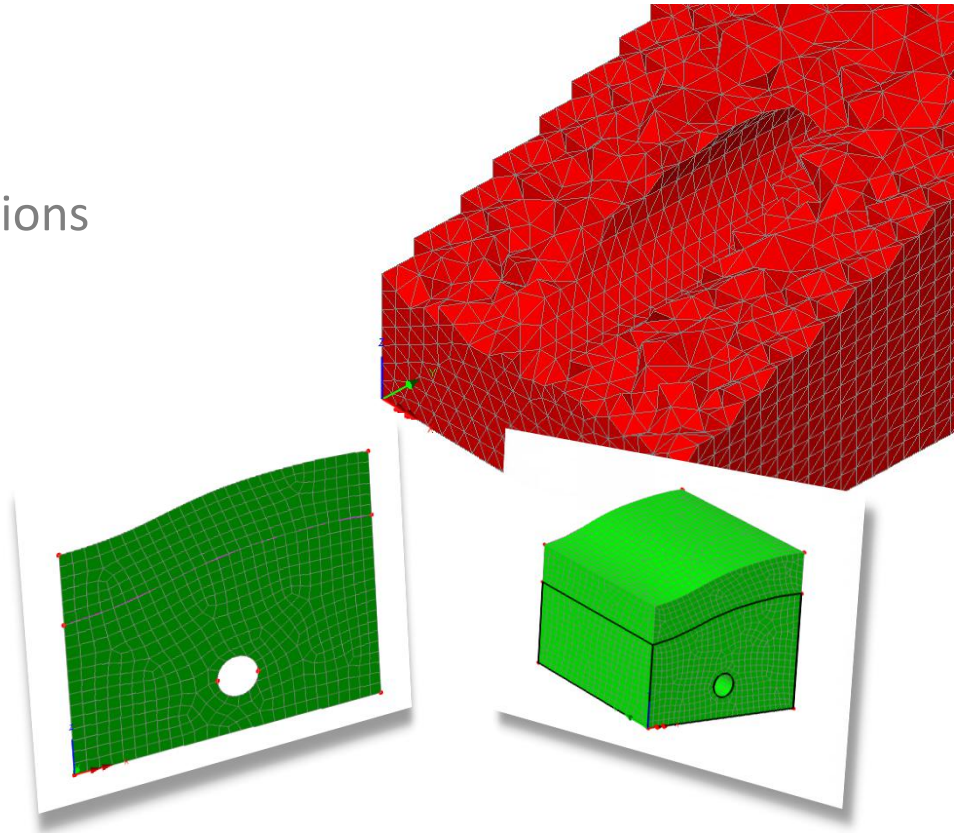
Master Object

Intersection and subtraction commands for cylindrical surface with internal void through volume



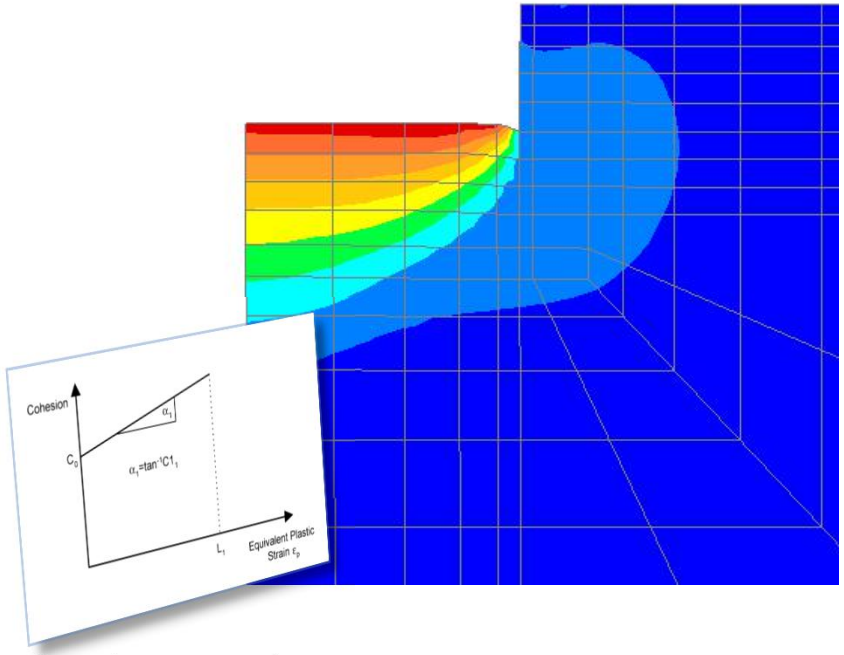
Meshing tools

- General Facilities:
  - Linear and Quadratic formulations
  - Mesh refinement
- 2D Meshing:
  - Quads and Triangles
- 3D Meshing:
  - Tetrahedral
  - Penta/Hexahedral



Soil and structural material models

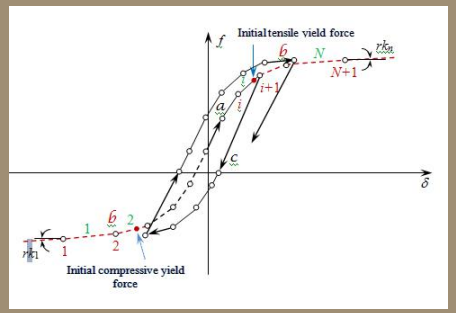
- Constitutive Soils models
  - Tresca
  - Von Mises
  - Druker Prager
  - Mohr Coulomb
  - Cam Clay
- Structural Models
  - Concrete Cracking and Crushing
  - Steel yielding

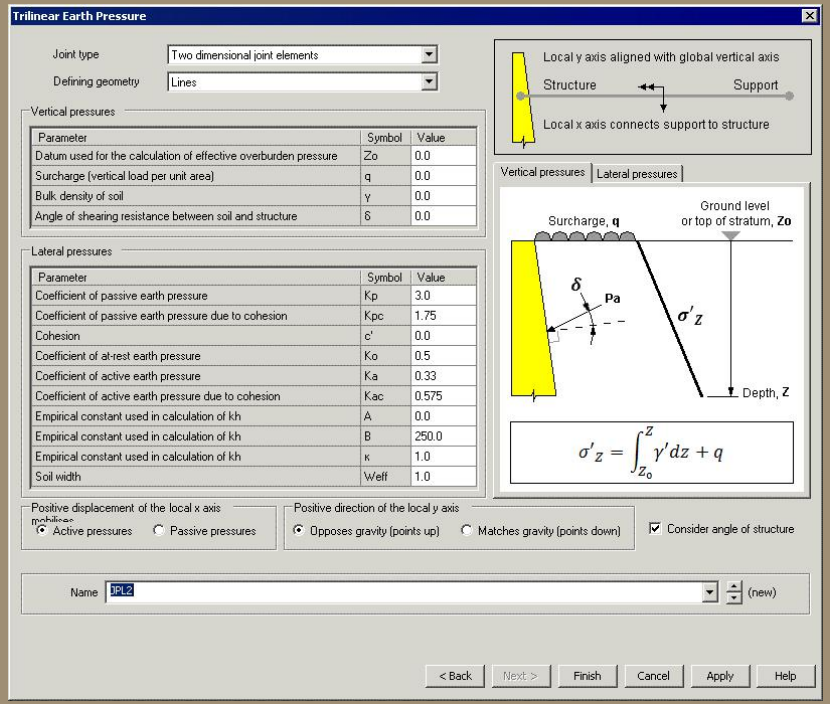


- All models can incorporate strain hardening and softening

Boundary Modelling

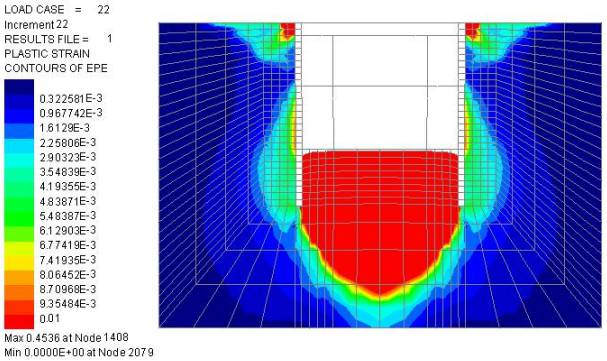
- Modelling of soil-structure interface:
  - Linear springs
  - Non Linear (Active-Passive)
  - Hysteretic behaviour (cyclic loading / unloading)

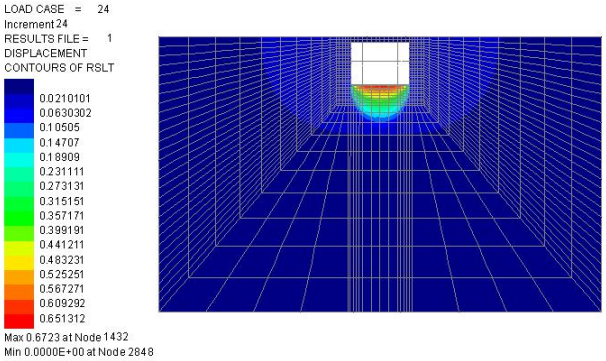


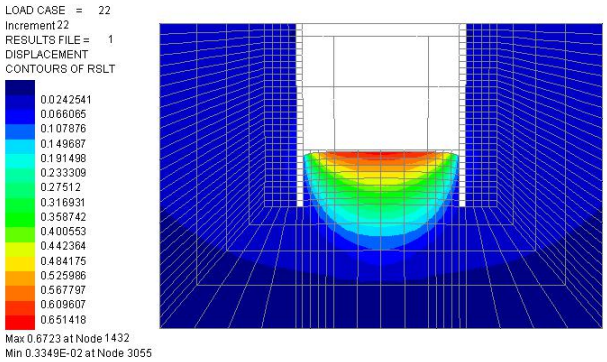


Typical Application

Deep excavations



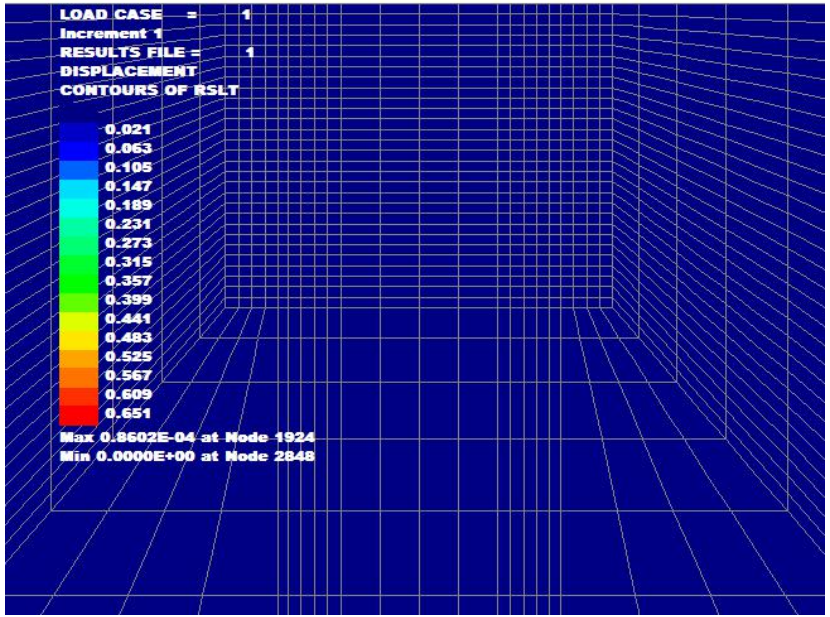




Typical Application

Deep excavations

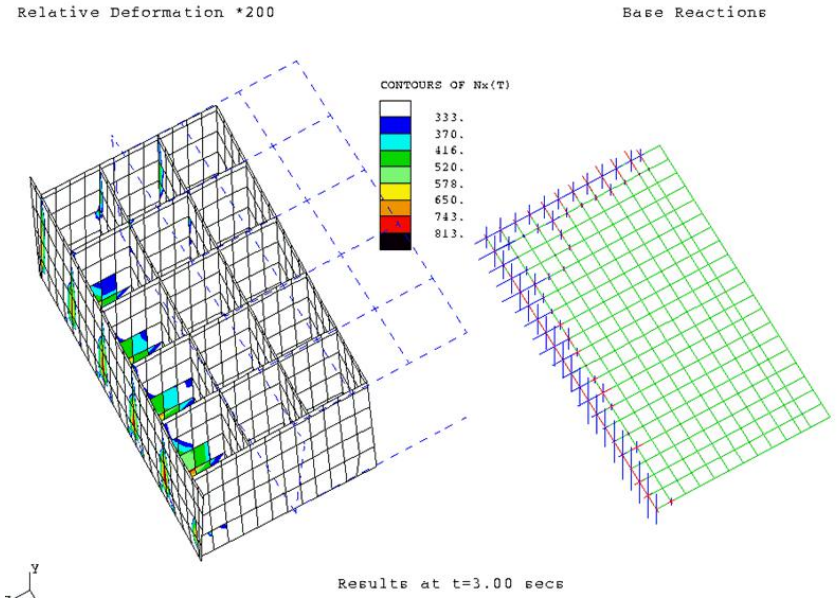
- Construction sequence including temporary and permanent propping
- Design of wall and props in single model



Typical Application

Seismicity in soils

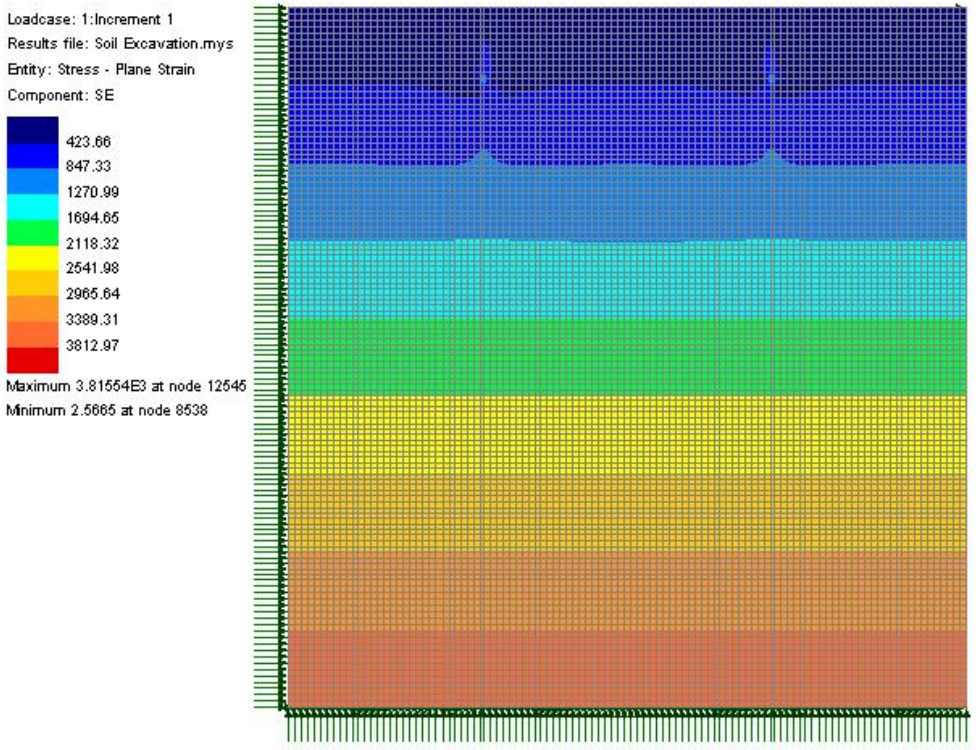
- Multiple seismic events
- Analysis of nonlinear reinforced concrete and soils
- Time-history of all stresses including contact stresses through event



Caisson / ground contact during seismic event

Rock bolting

- Excavation with rock bolts and gunite concrete wall

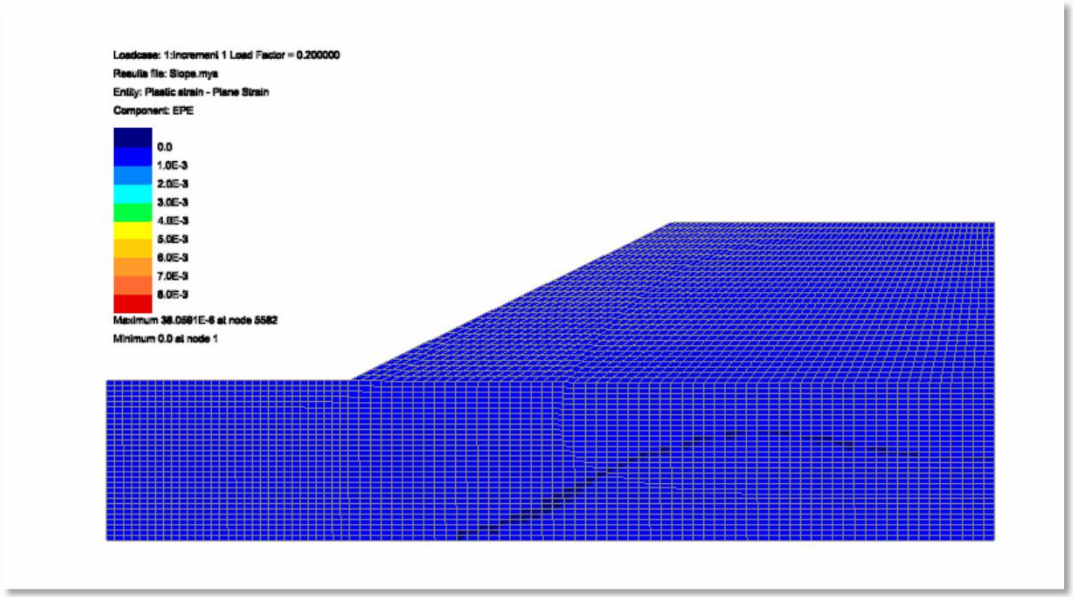


Typical Application

Stability of embankments

- Formation of slip circle

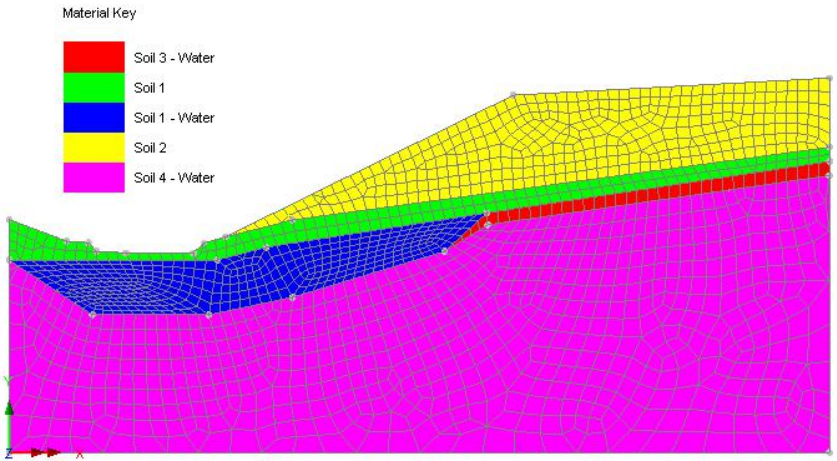
Sevenoaks slip in Weald clay

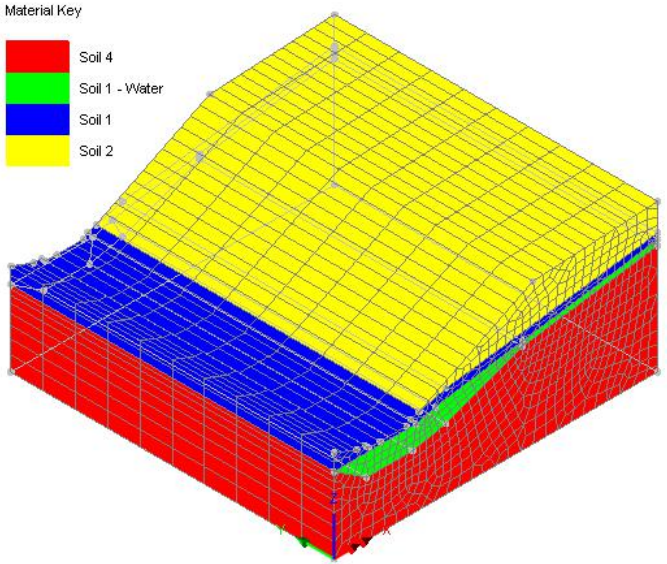


Typical Application

Stability of embankments

- Formation of slip circle and strata in 2D and 3D

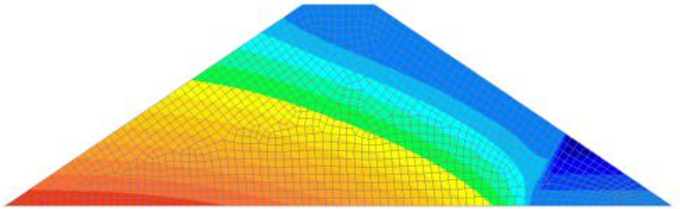


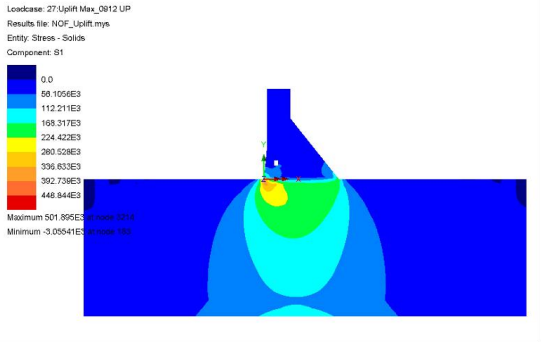


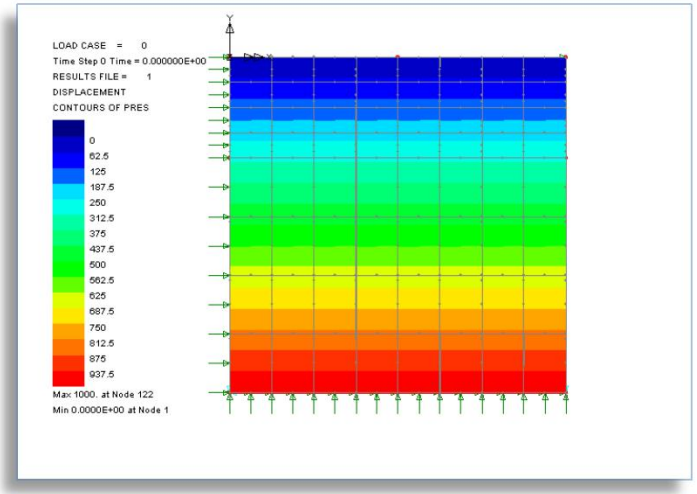
Typical Application

Consolidation and Seepage

- Consolidation
  - Pore-Water pressure
  - equalisation with time
  - 2D and 3D
- Seepage
  - Dams
  - Dewatering

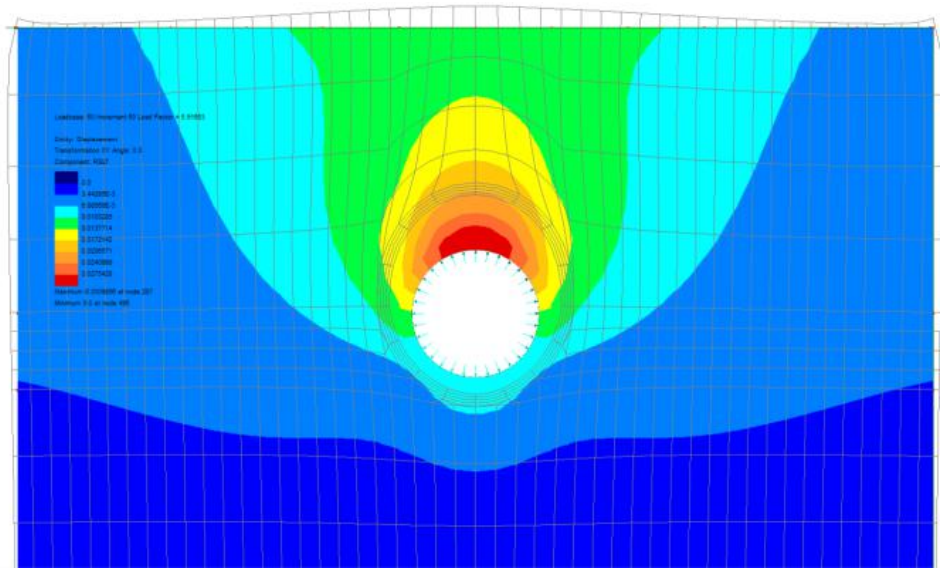






Tunnelling

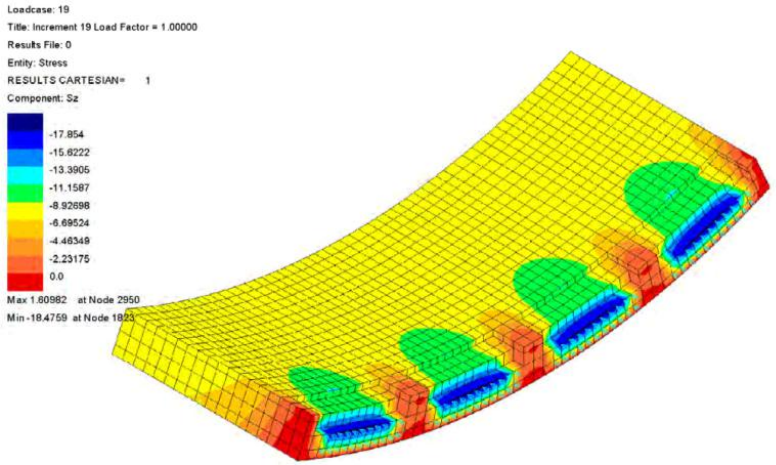
- Analysis of vertical displacement of backfill in tunnel with increased pressure

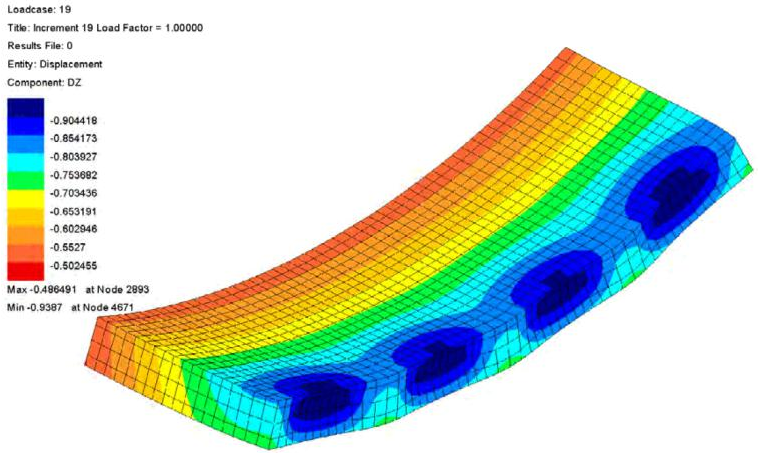


Typical Application

Tunnel Linings

- Longitudinal stress and displacement in tunnel segment under service load

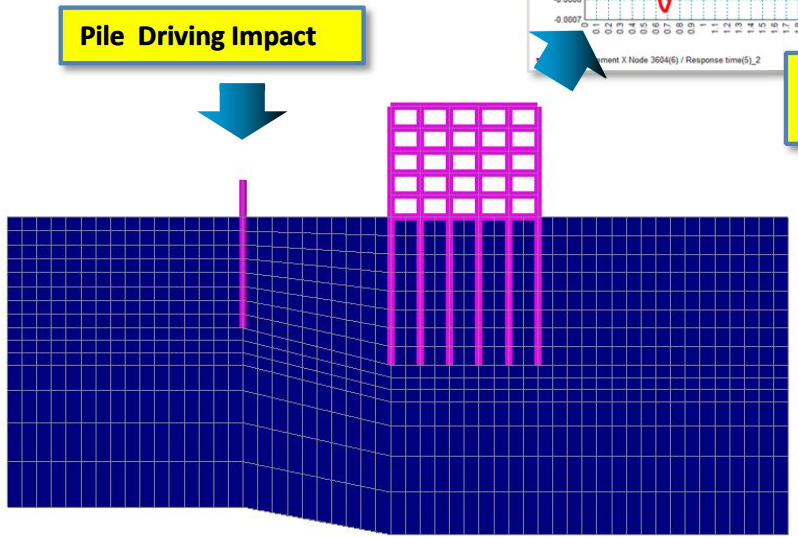


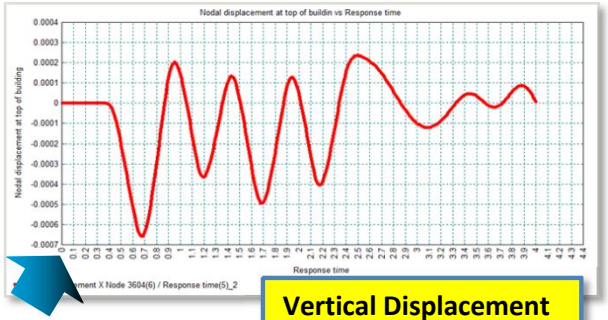


Typical Application

Soil-Structure Vibration

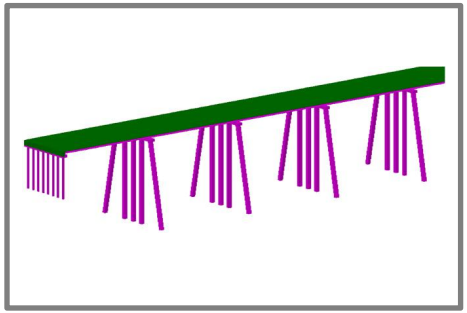
- Modal and Time History Dynamics
- Material damping
- Nonlinear behaviour
  - Soil plasticity
- Boundary behaviour
  - Spring/damping





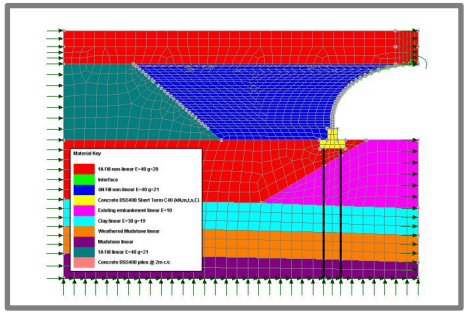
As used on these projects…

Click images to see projects



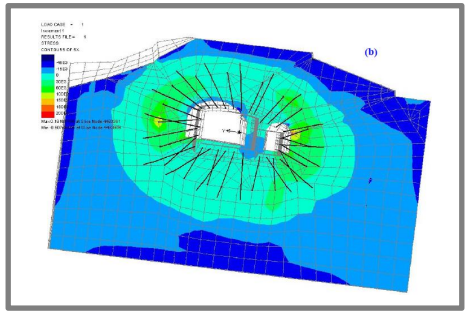
Bodcau Bayou Bridge

Götatunneln

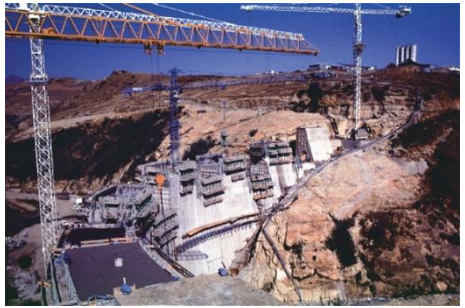


Sperritt Tunnel

Devonport Royal Dockyard



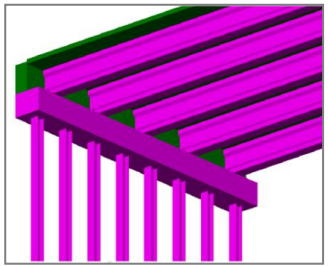
Söderström Tunnel

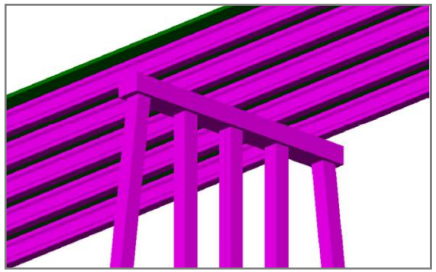


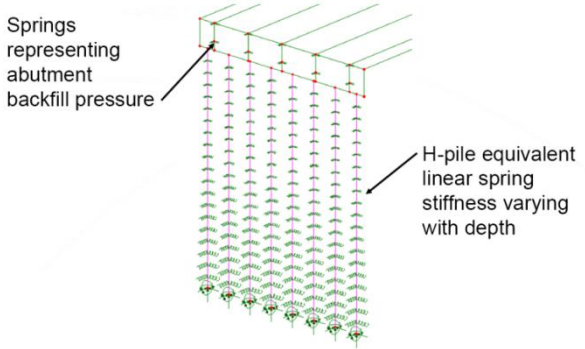
Muela Dam

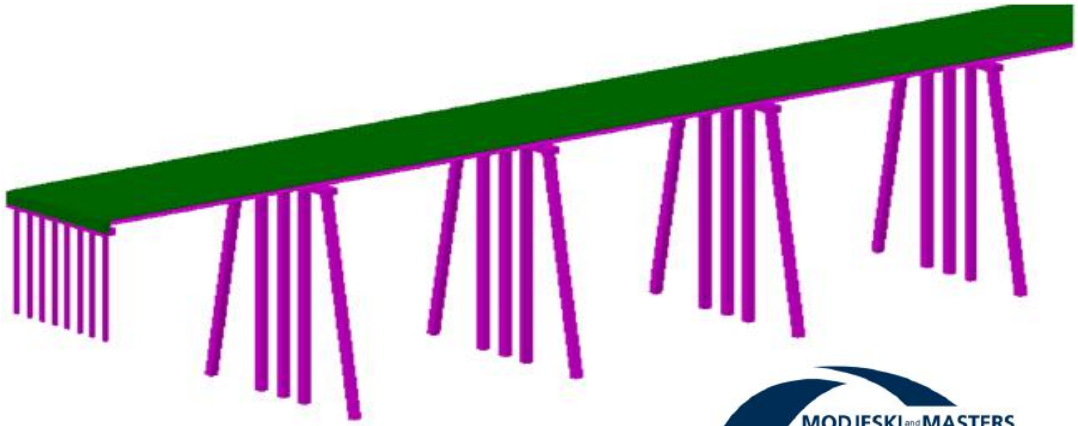
As used on

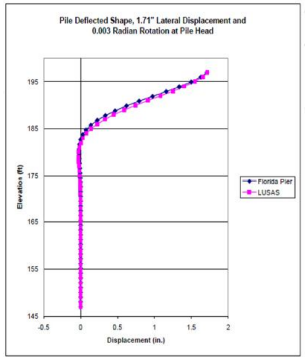
Bodcau Bayou bridge

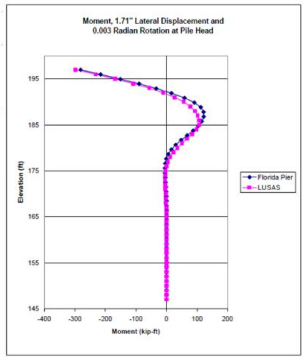








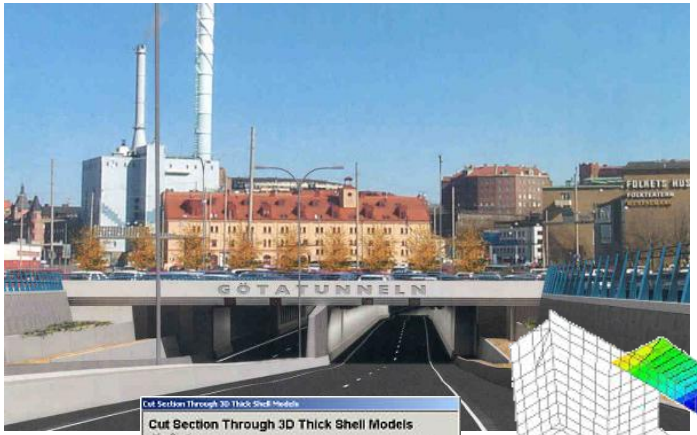


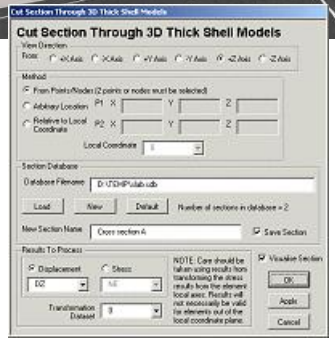


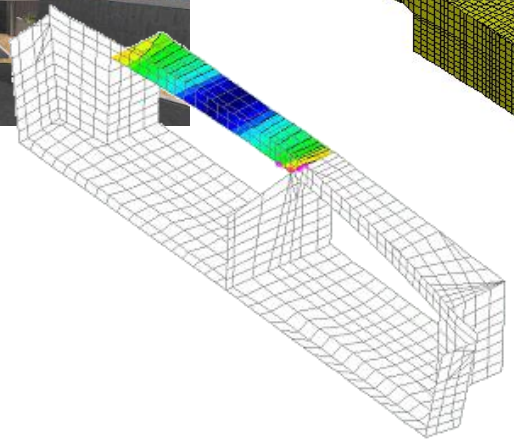
MODJESKI and MASTERS
Experience great bridges.

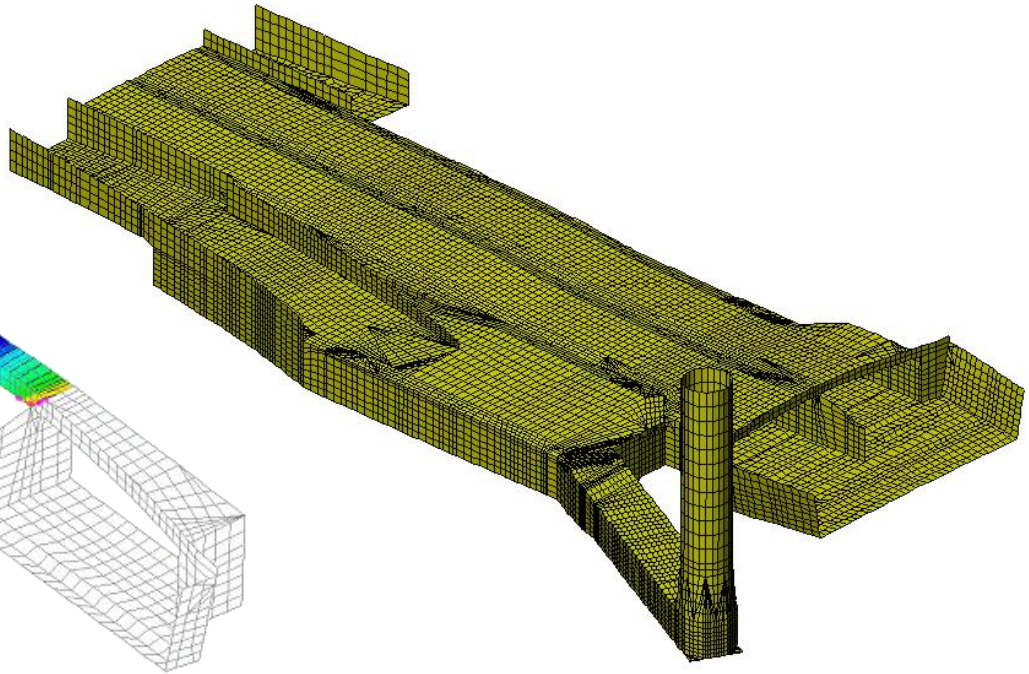
As used on

Gota tunnel



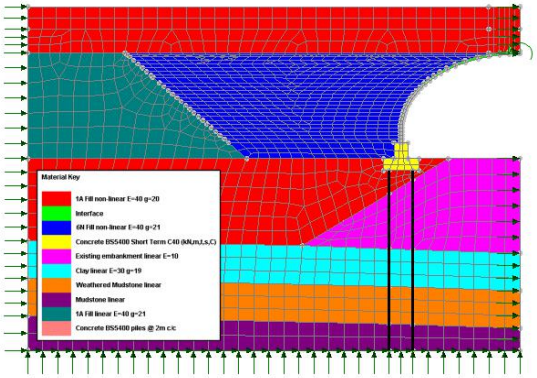


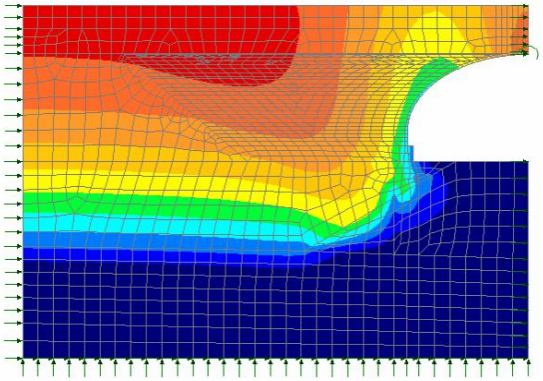




As used on

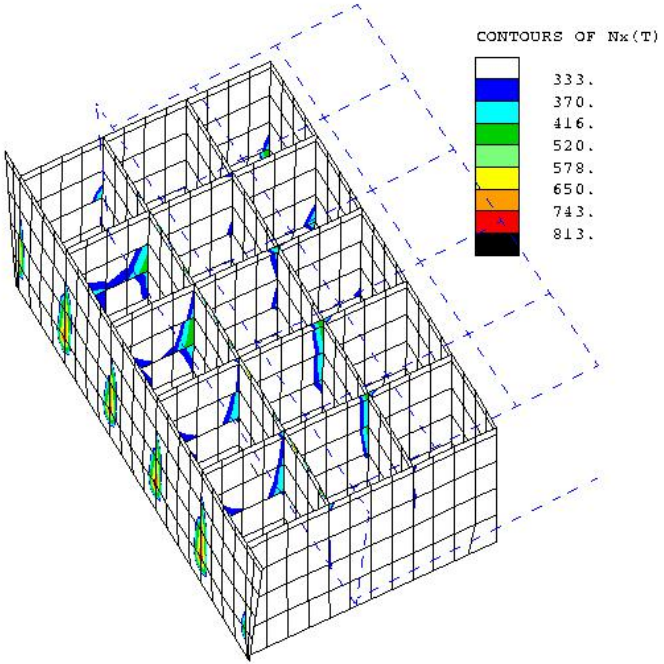
Sperritt tunnel

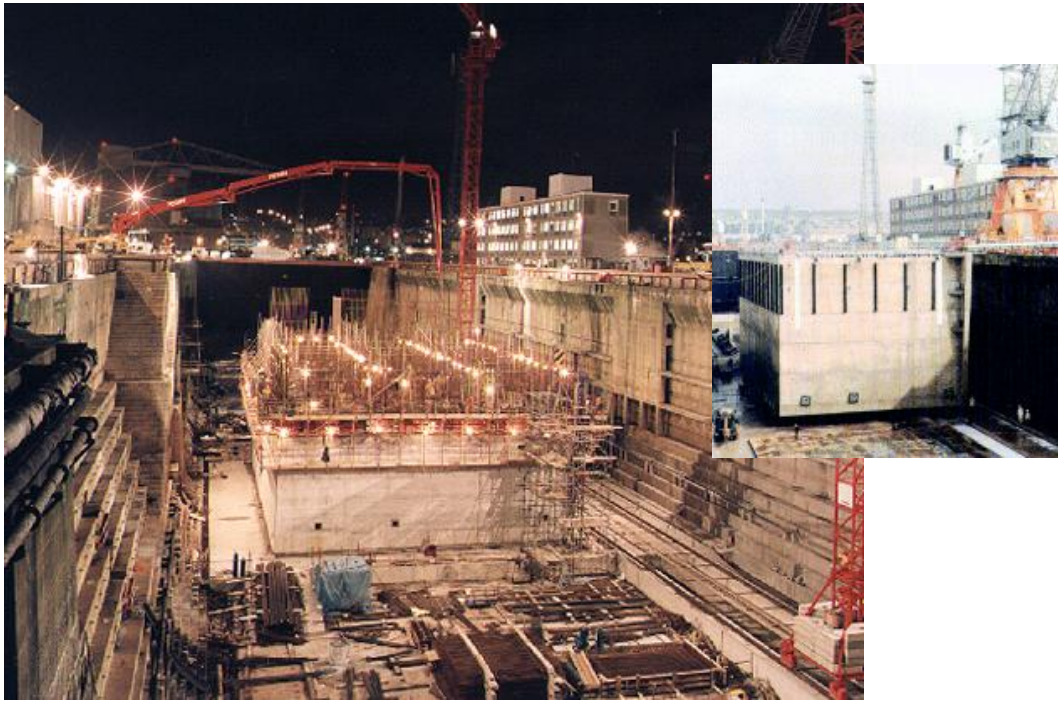




As used on

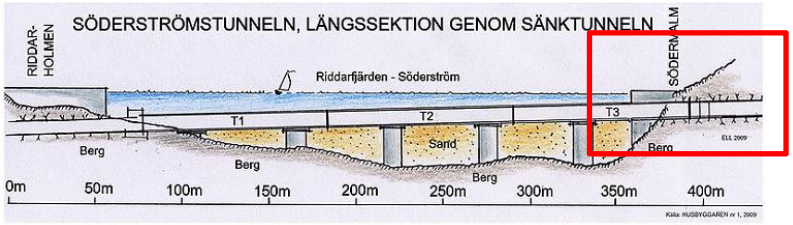
Devonport Royal Dockyard

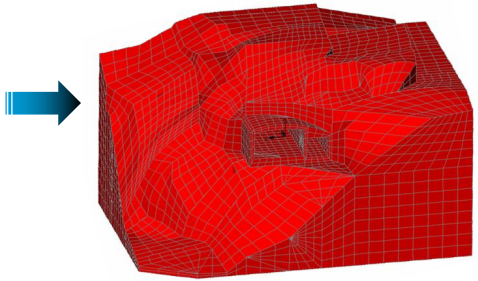


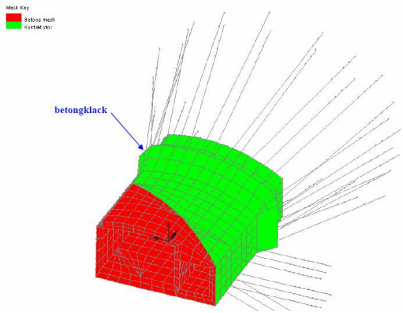


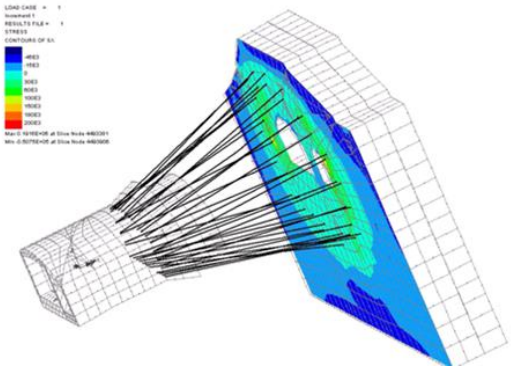
As used on

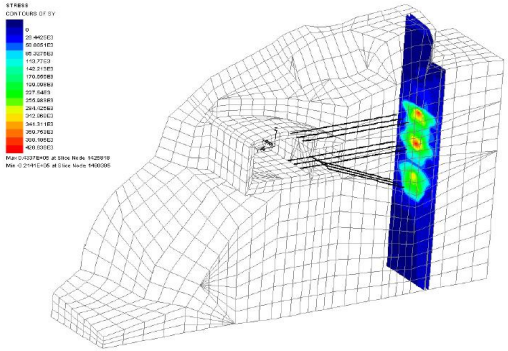
Soderstrom tunnel

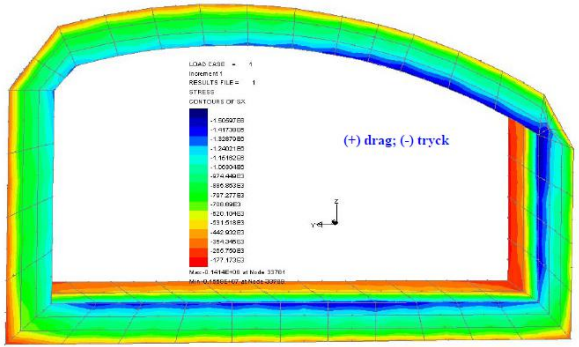






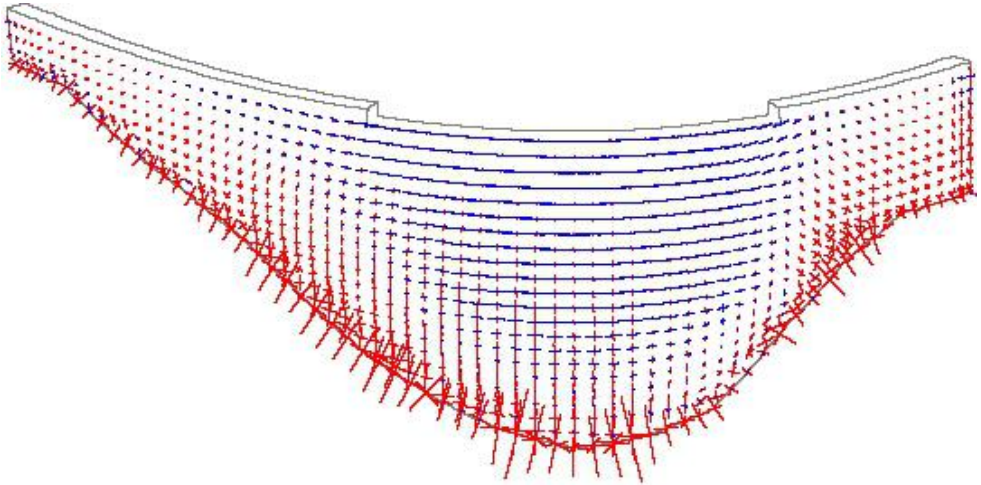


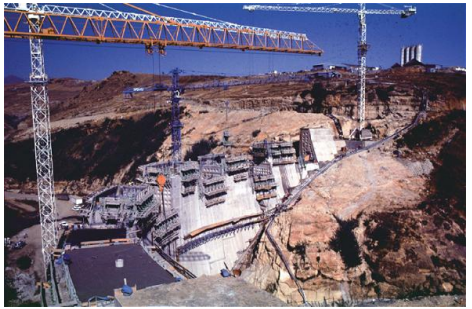


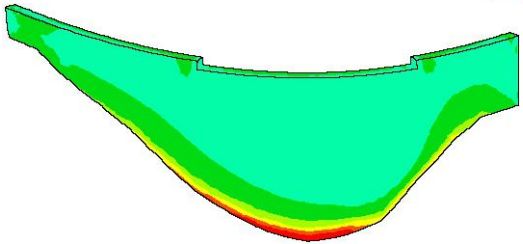


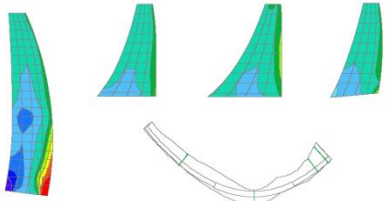
As used on

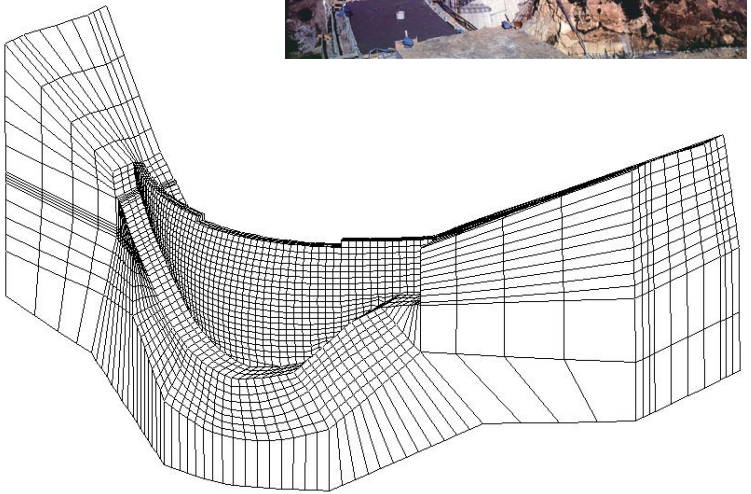
Muela dam











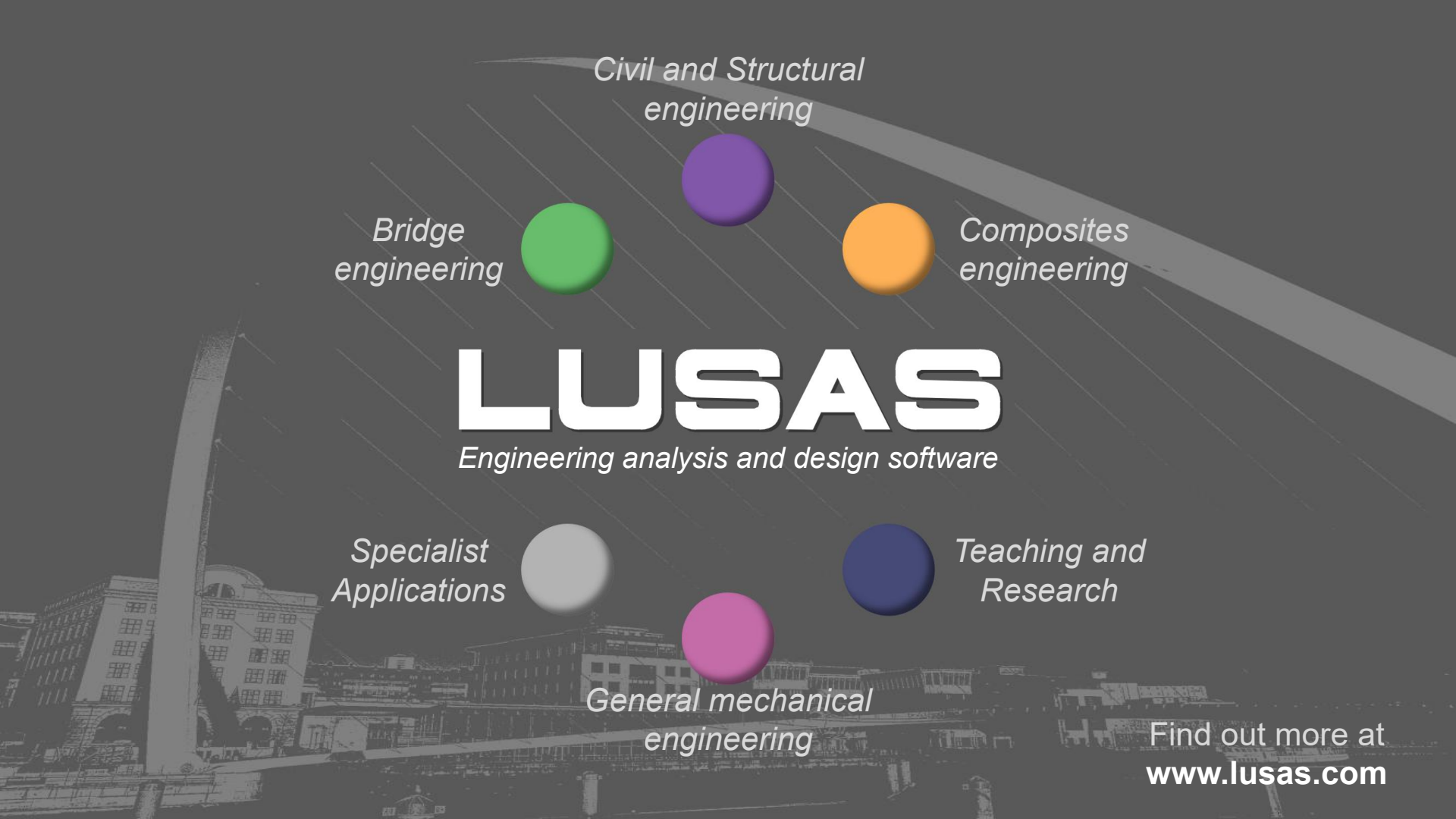
Key advantages of using LUSAS

- Detailed soil and structure models can be analysed in a single program e.g. springs, 2D or 3D, linear or nonlinear
- Any geometry of soil strata can be modelled
- Time-dependent (consolidation/dewatering etc) modelling
- Excavation/backfill of soil, and staged construction
- Extensive soil and structural material models
- Contact and interface modelling
- Can model dynamic effects in soil/structure interaction

Thank you for watching this presentation on…

LUSAS

Engineering analysis and design software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