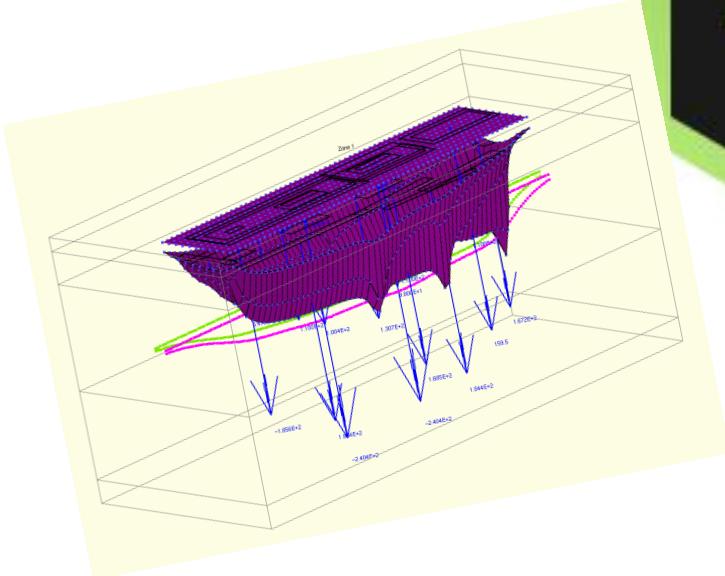
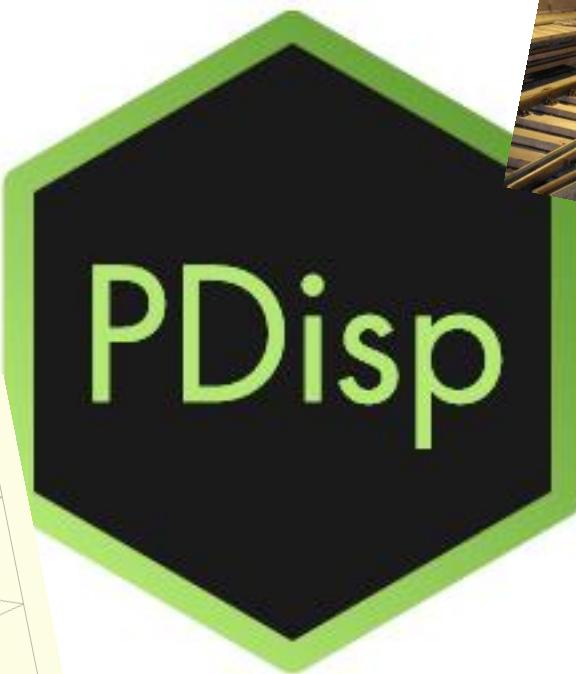


PDisp Training Webinar

Oasys



Who is Oasys?

- Wholly owned by Arup
- Formed in 1976 to develop software for in-house and external use
- Most programming and sales staff are engineers
- In recent years have added marketing and sales staff
- Have expanded the development team worldwide

Oasys Customers

Gensler
expedition

PS&S

CAPITA SYMONDS

Greenfield
associates



ROWECORD
STRUCTURAL STEELWORK

VINCI
CONSTRUCTION

Watson

CampbellReith
consulting engineers

FAIRHURST

TECHNIKER

crowd dynamics

BDP.

HINMAN

Balfour Beatty

Raison Foster Associates
Geotechnical Design and Consulting



SKANSKA



**Sir Robert
MCALPINE**



ATKINS

mouchel

Gammon

RAMBOLL

RFR

pba
peterbrett

KELLER

AECOM

**BG
&E**

**Scott+
Wilson**

Bovis
Lend Lease



Halcrow

elioth

L&B
Aviation Planning at the Leading Edge

**PARSONS
BRINCKERHOFF**

WSP

Gifford

Objectives

1. Introduce Methodology in Pdisp
2. Case Study of how Pdisp is used
3. Set up analysis
4. Shortcuts and tips



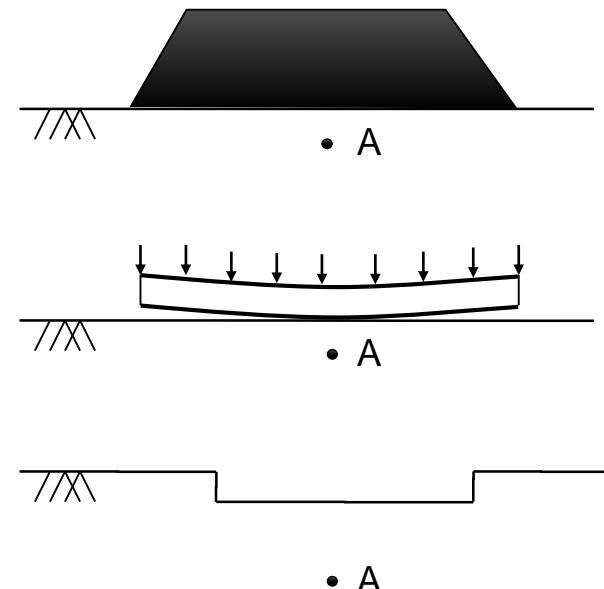


PDisp

Soil Displacements due to Pressure



- Calculates displacements due to the application of a pressure, either loading or unloading
- Typical use:
 - Predicting settlement of ground due to surcharging
 - Predicting settlement of flexible footing/raft
 - Predicting settlement of tunnel due to loading/unloading of soil



PDisp analysis methods



Elastic Analysis Method

Methods assume elastic response:

- Boussinesq
(gives stresses and displacements in soil)
- Mindlin
(gives displacements only, but can also deal with shear)

PDisp analysis methods



Comparison of Elastic Methods

Feature	Mindlin	Boussinesq
Vertical Displacements	✓	✓
Vertical normal pressure on horizontal plane	✓	✓
Horizontal displacements	✓	✗
Traction forces and/or horizontal pressures	✓	✗
Soil non-linearity	✗	✓
Stress change calculated	✗	✓
Theoretically exact for homogeneous soil	✓	✗

PDisp analysis methods



Boussinesq:

- Number of displacement levels affects accuracy
- Considerations:
 - If there are soils with varying poissons ratio
 - If there are sudden changes in stress between soil strata

Mindlin:

- Gives horizontal movements
- Considers settlements above loads

PDisp analysis methods



Consolidation Method

Why does consolidation settlement occur?

- Expulsion of the water from the voids
- Variable soil permeability so rate of settlement may vary from soil to another

What is happening in the soil?

- Primary - volume change is due to reduction in pore water pressure
- Secondary - volume change is due to the rearrangement of the soil particles. Constant pore water pressure.

PDisp analysis methods



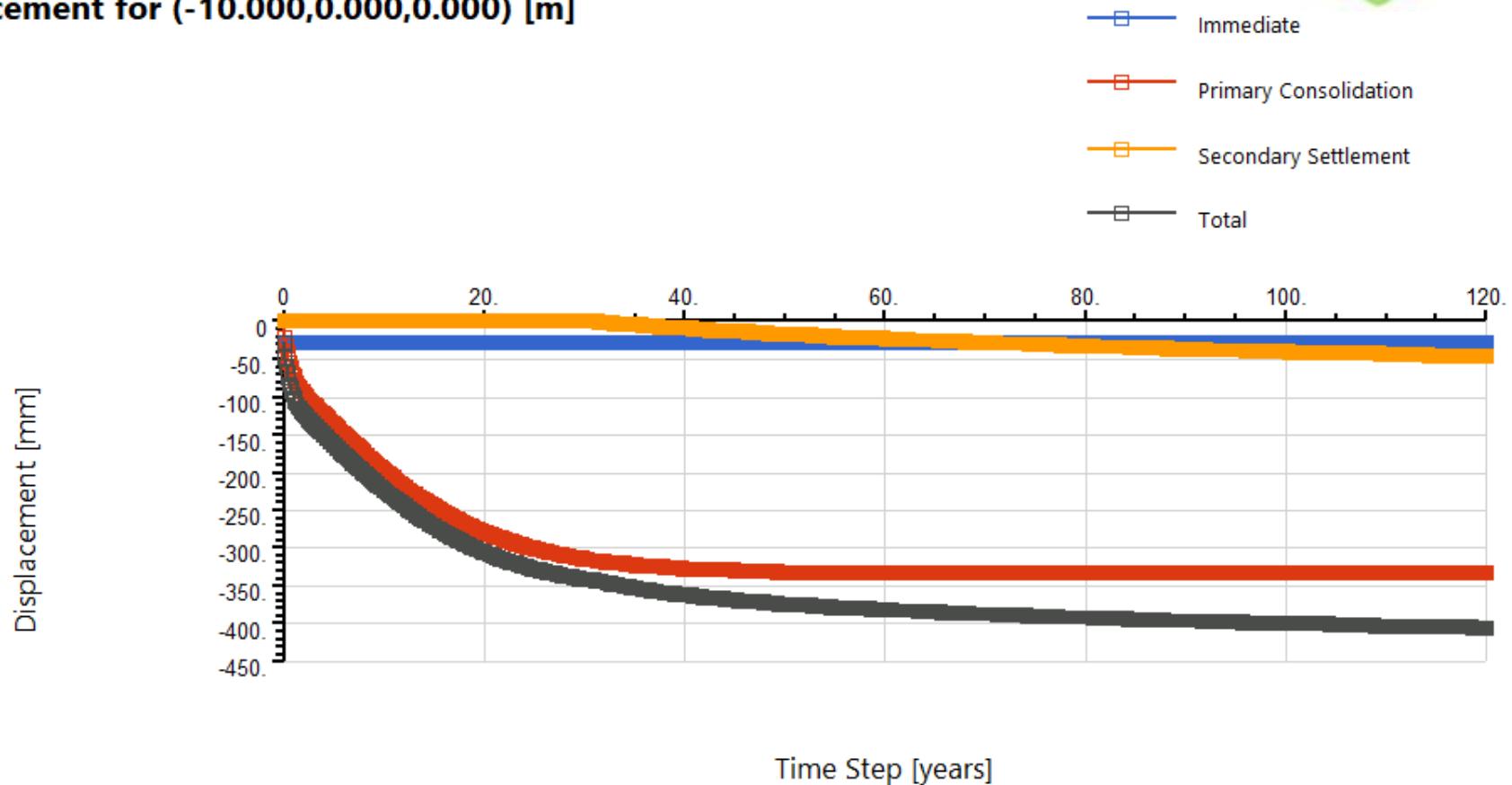
Consolidation Method

- Instantaneous Settlement (in Drained and Undrained Soil)
- Primary Consolidation (in Undrained Soil)
 - mv Method (linear)
 - Cc Method (non-linear)
 - Normally Consolidated Soils
 - Overconsolidated Soils
- Secondary Consolidation (in Undrained Soil)

PDisp analysis methods



Displacement for (-10.000,0.000,0.000) [m]



PDisp input



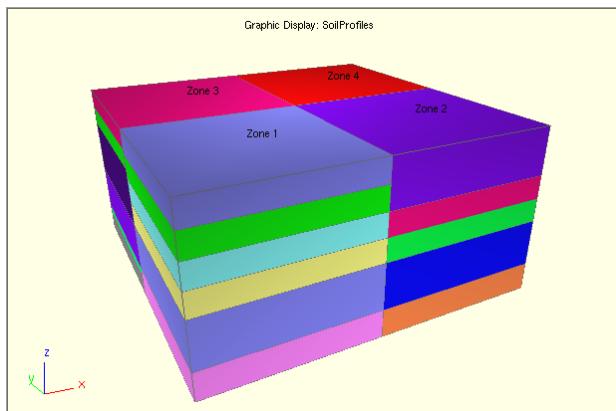
- Grids, lines and points for displacement calculations
- Loaded areas as rectangles, circles and polygons
- Base defined by rigid boundary
- Ground modelled as
 - vertical soil profiles
 - Plan soil zones
- Analysis method

Ref.	Type	Name	Direction of extrusion	Line/Line for extrusion						No. of intervals across extrusion/line	Extrusion depth	No. of intervals along extrusion	Calculate	Show detailed results						
				First point			Second point													
				X [m]	Y [m]	Z(level) [m]	X [m]	Y [m]	Z(level) [m]											
Defaults	Point		Global X	0.00	0.00	0.000	1.00	1.00	1.000	5	1.00	5	No	No						
1	Grid	Grid 1	Global Y	0.00	0.00	7.500	40.00	40.00	7.500	10	40.00	10	Yes	Yes						
2	Line	Line 1		10.00	0.00	7.500	10.00	40.00	7.500	10			Yes	No						
3	Line	Line 2		10.00	0.00	5.000	10.00	40.00	5.000	10			Yes	No						
4	Line	Line 3		30.00	0.00	7.500	30.00	40.00	7.500	10			Yes	No						
5	Line	Line 4		0.00	0.00	7.500	40.00	40.00	7.500	10			Yes	No						
6	Point	Point 1		0.00	0.00	10.000							Yes	No						
7	Point	Point 2		10.00	10.00	7.500							Yes	No						
8	Point	Point 3		20.00	20.00	5.000							Yes	No						
9	Point	Point 4		30.00	30.00	2.500							Yes	No						
10																				

Layer	Level at top [m]	No of intermediate displacement levels	Young's modulus [kN/m ²]		Poisson's ratio	Colour	Non-linear curve
			Top	Bottom			
Defaults					0.20		None
1	10.000	5	20000	20000	0.20		None
2	7.500	5	18000	18000	0.20		None
3	5.000	5	25000	25000	0.20		None
4	2.500	5	18000	18000	0.20	Clay 1	
5	0.000	5	20000	20000	0.20		None
6	-5.000	5	24000	24000	0.20		None
7	-6.000	5	24000	25000	0.20		None
8							

Cell [A][1]

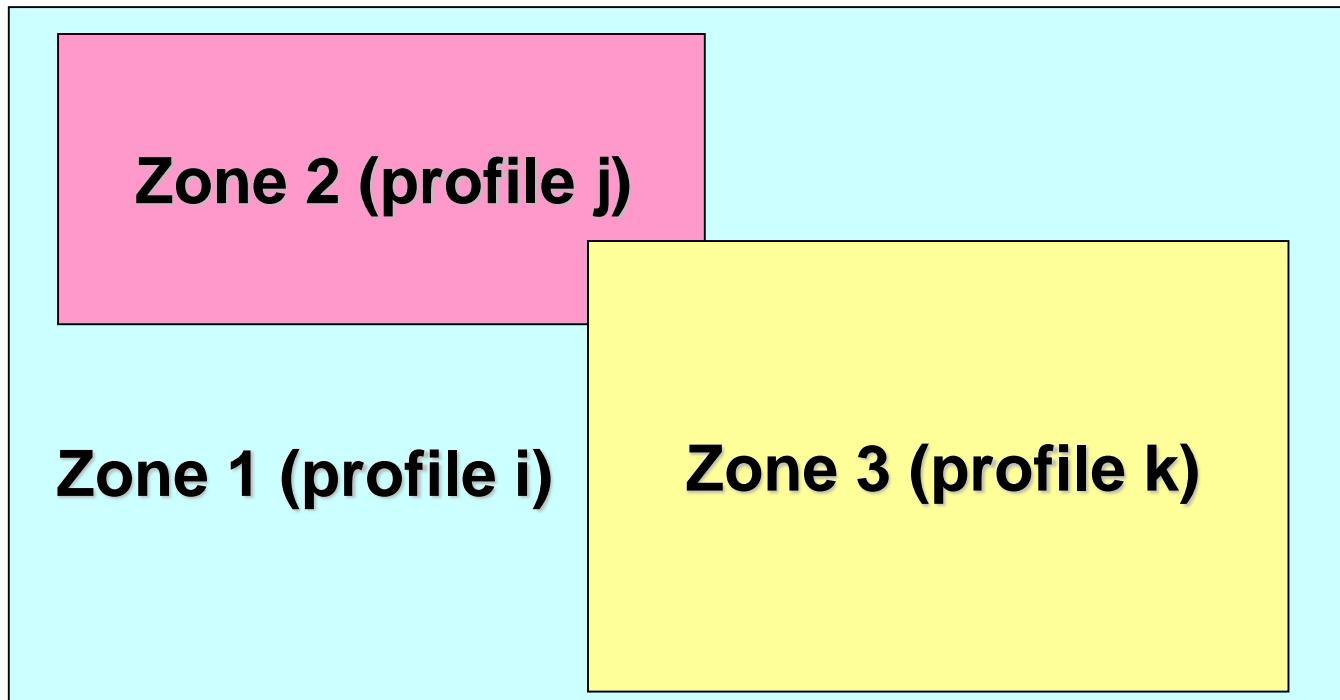
1: Soil Profile 1 2: Soil Profile 2 3: Soil Profile 3 4: Soil P Cell [A][1]



PDisp soil zones



- Define Soil Zones in plan



PDisp inputs - Preferences and defaults

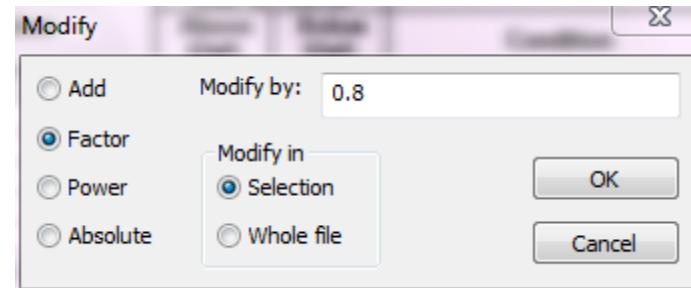
- Tabbing past a table cell with a default will fill the cell with the default value
- Defaults can also be edited – click in the grey cell at the top

	A	B	C	D	E	F	G	
Load ref.	Name	Orientation	Loaded plane				Shape	
			Centre of load (Global)			Angle of local x w.r.t global X		
			X	Y	Z(level)			
	Defaults	Load #	Horizontal	0.00	0.00	0.000	0.00	Rectangular
1	Load 1	Horizontal	0.00	45.00	0.000	0.00	0.00	Rectangular
2	Load 2	Horizontal	10.00	-55.00	-2.000	0.00	0.00	Rectangular
3	Load 3	Horizontal	0.00	-5.00	-1.000	0.00	0.00	Circular

PDisp inputs - Table tips



- = in a cell copies the cell above
- == in a cell copies the rest of the line above
- In long tables, ctrl-G lets you type in the line to go to
- Right-click brings up a whole list of options – modify probably the most useful





Case Study

Comparison Analysis to check LSDyna Outputs

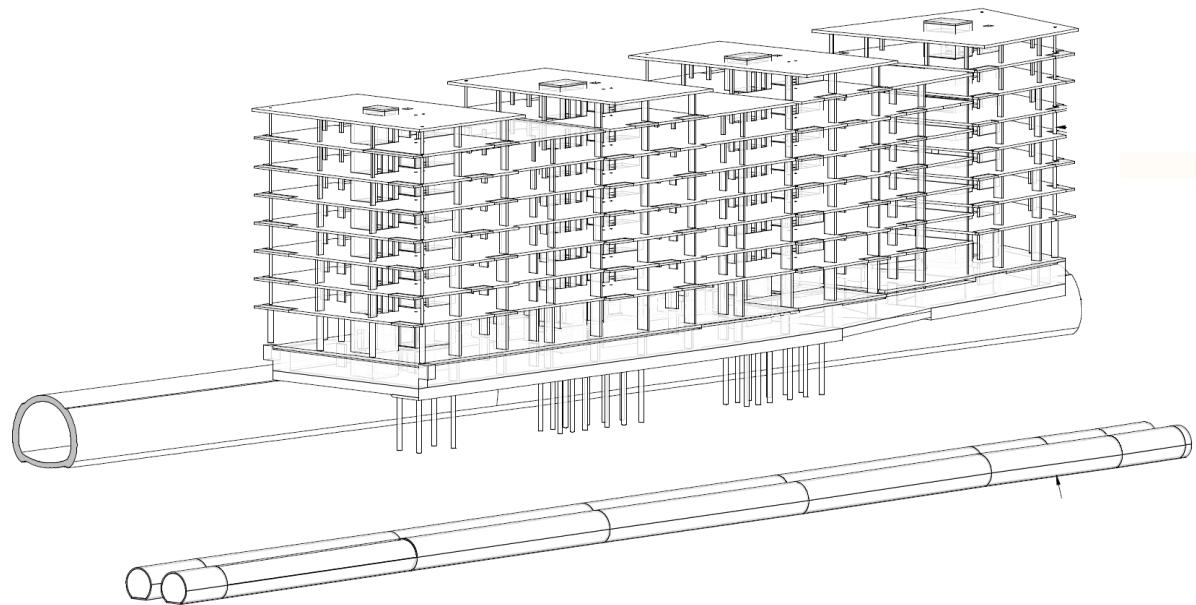
ARUP

3D FE Analysis Check

ARUP

Arup was responsible for designing a building in London directly above LUL tunnels

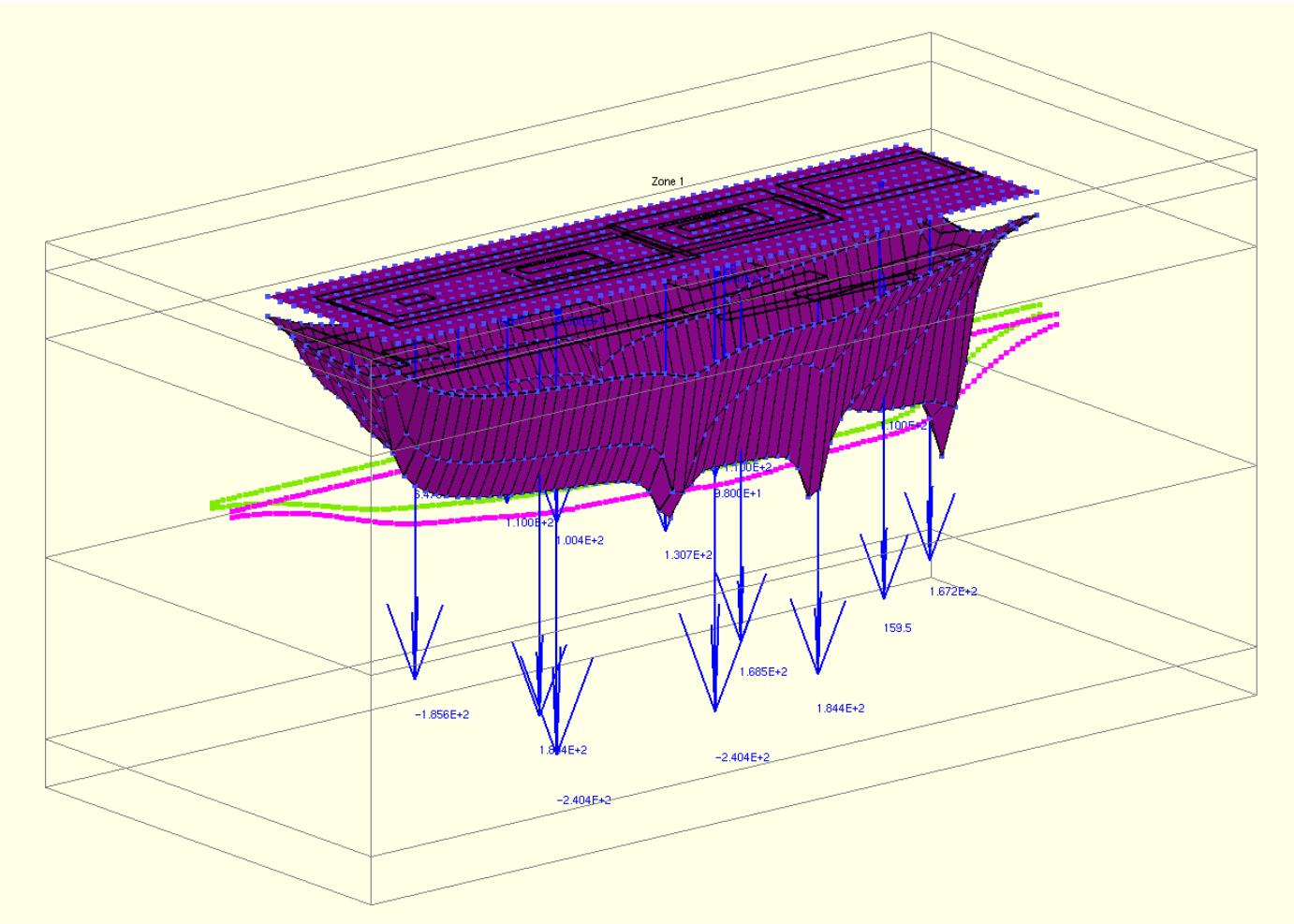
- 3D FE Analysis was used to model the building and piles
- A Category II check has been undertaken by using separate software in the form of Oasys PDisp to separately analyse the same scenario



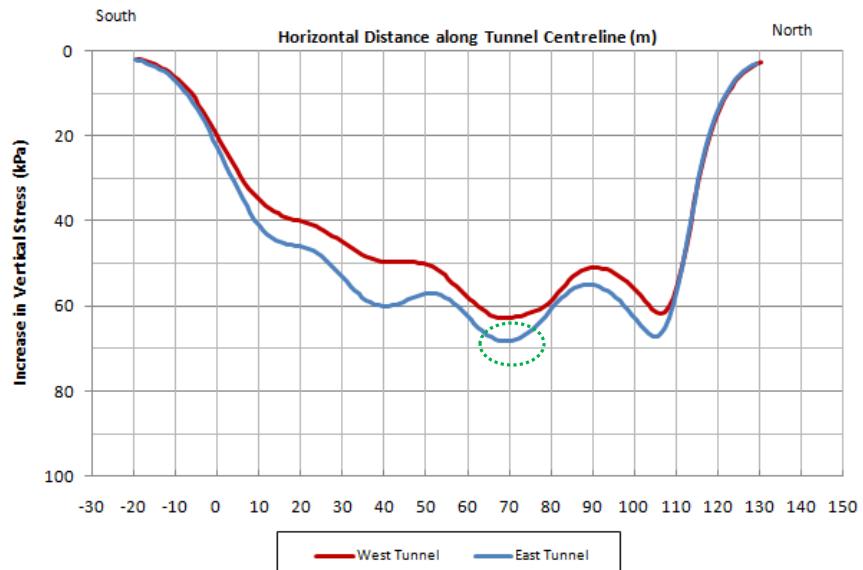
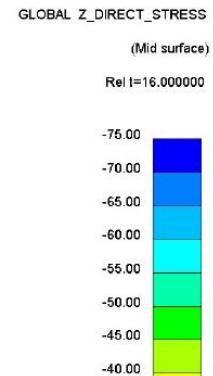
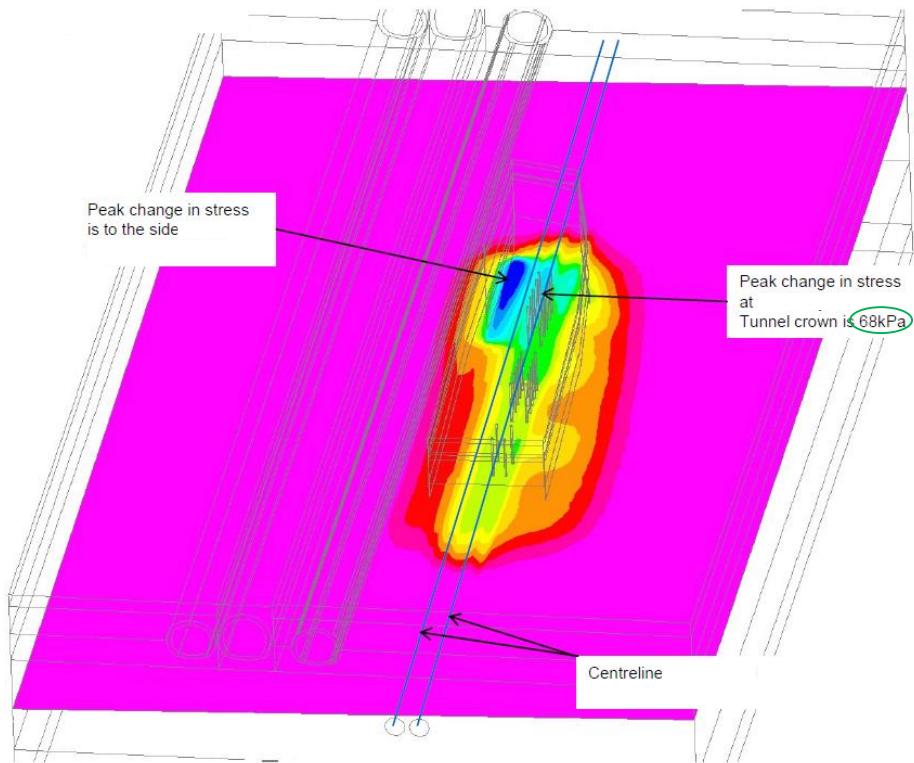
LSDyna Analysis Check

ARUP

Oasys PDisp Analysis



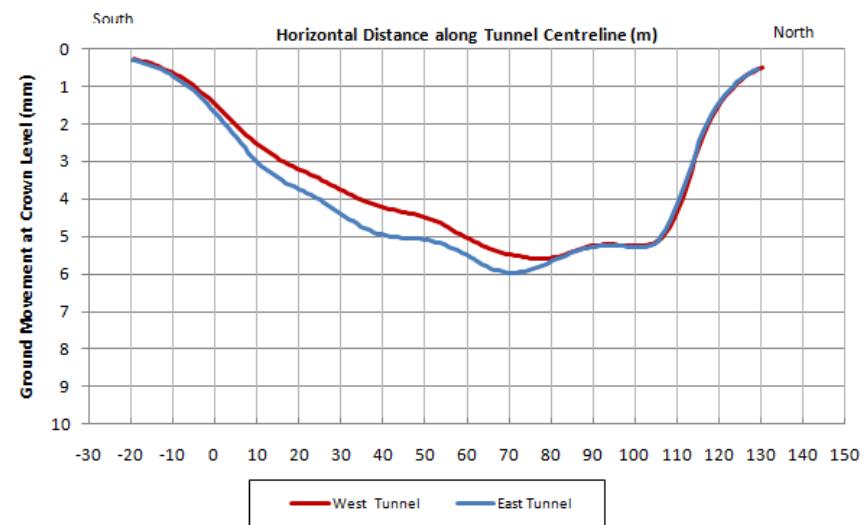
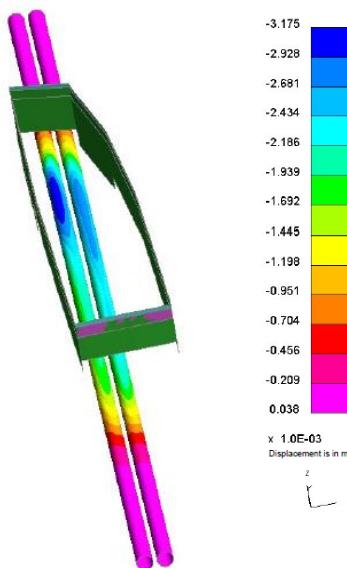
Vertical Stress Comparison



- Maximum vertical stress of 68kPa in both PDisp and LSDyna

Vertical Displacement Comparison

- Peak vertical ground movement is 3.18mm in LSDyna compared to 6mm in PDisp.
Differences because PDisp does not model the structural stiffness of foundations, tunnels, walls, etc.
- The trends of movement are similar





Developments

PDisp Developments



- Multi threading and multi core processing
- Grid views in tabular output
- Polygonal loading
- Consolidation settlement

PDisp Developments

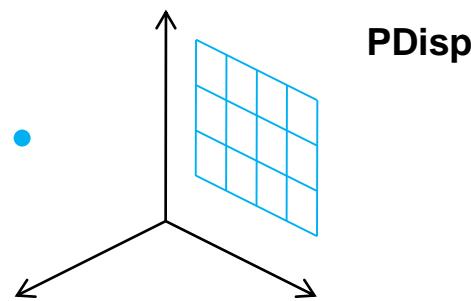
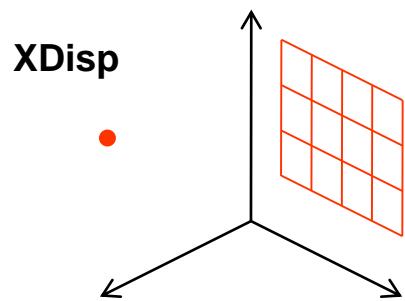
XDisp

- Calculates ground movement due to excavations



PDisp

- Calculates displacements due to the application of a pressure, either loading or unloading

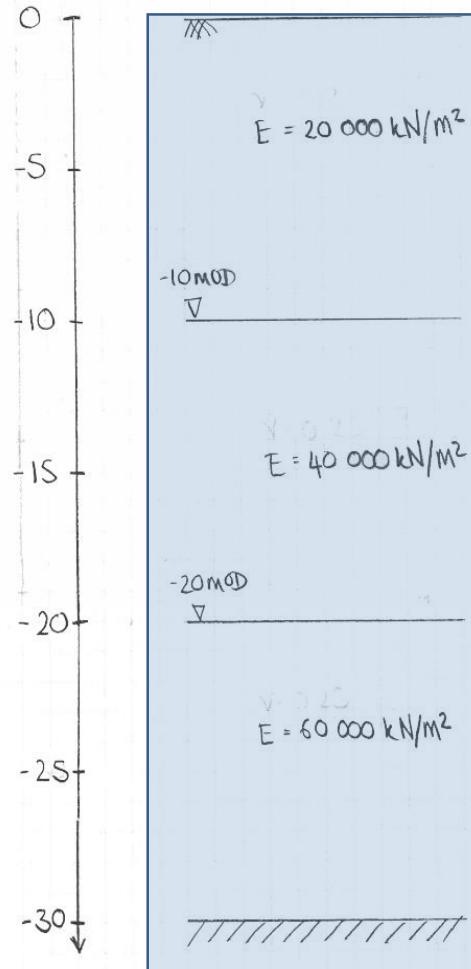




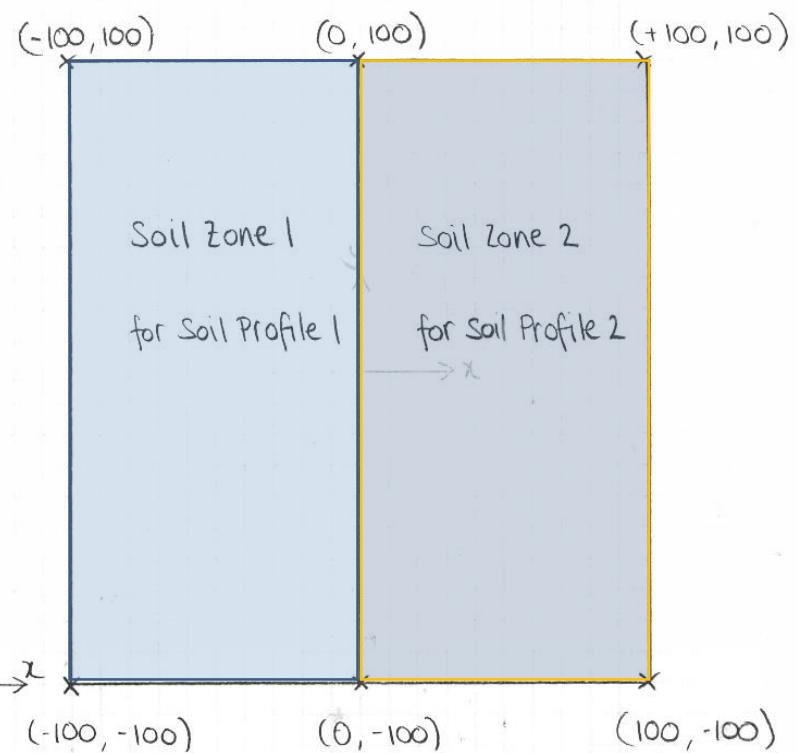
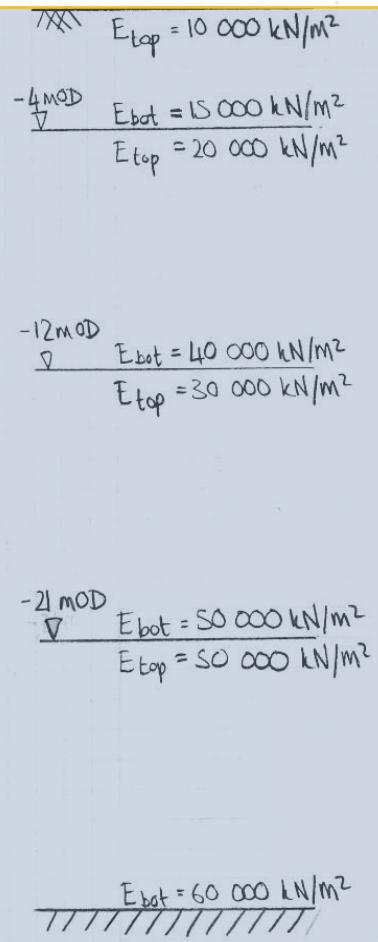
Setting up an Analysis

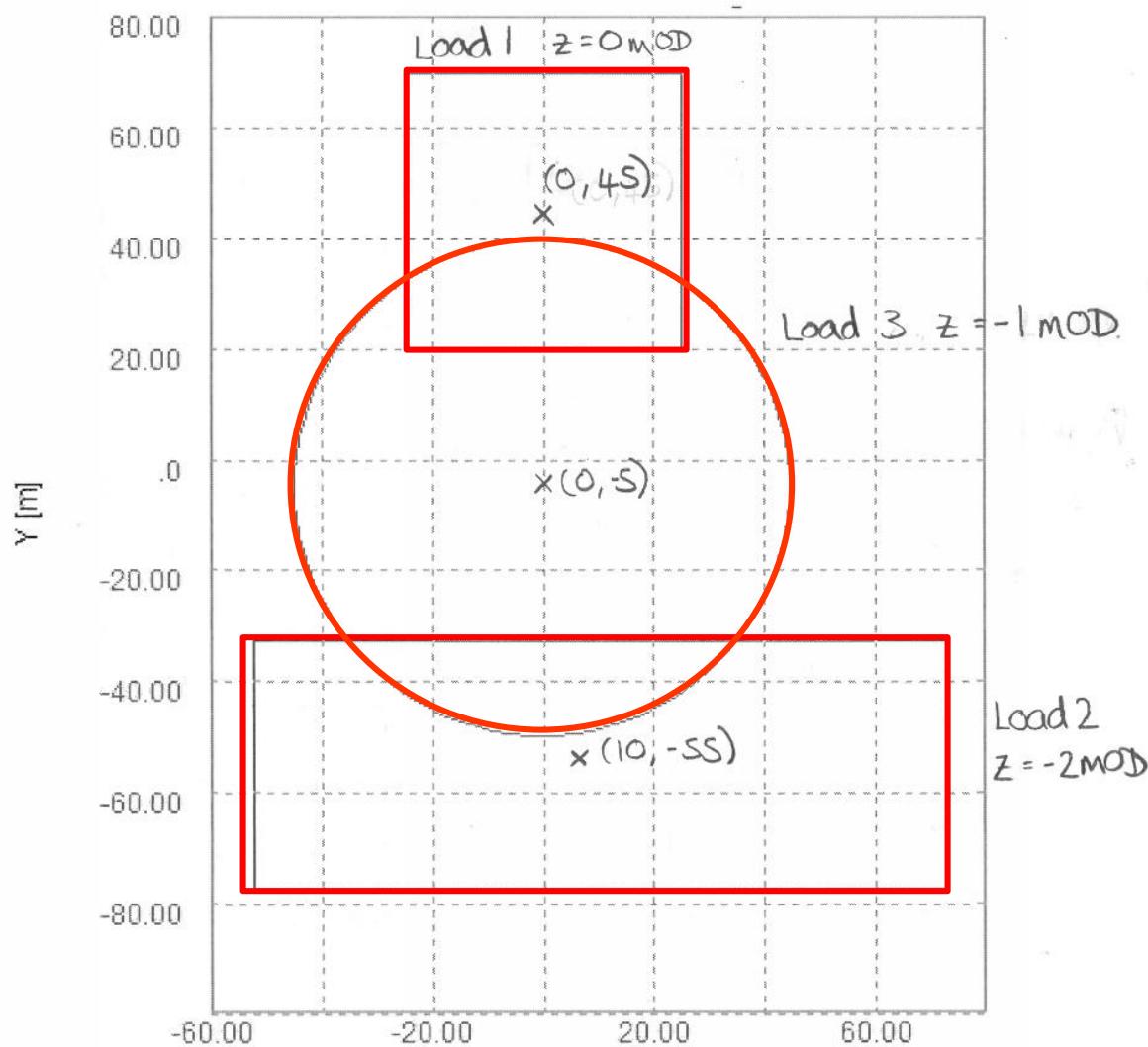
Level (MOD)

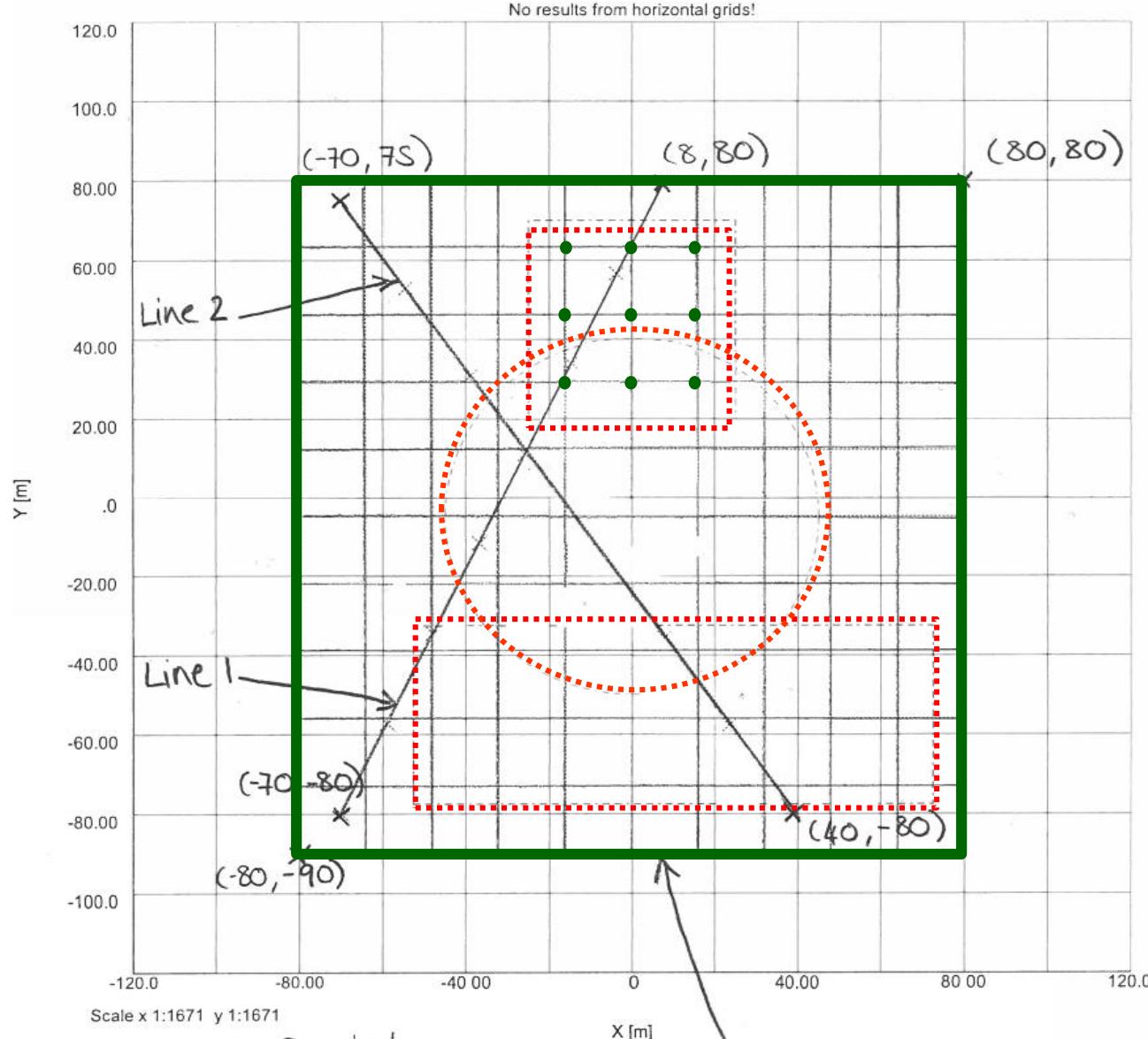
SOIL PROFILE 1



SOIL PROFILE 2

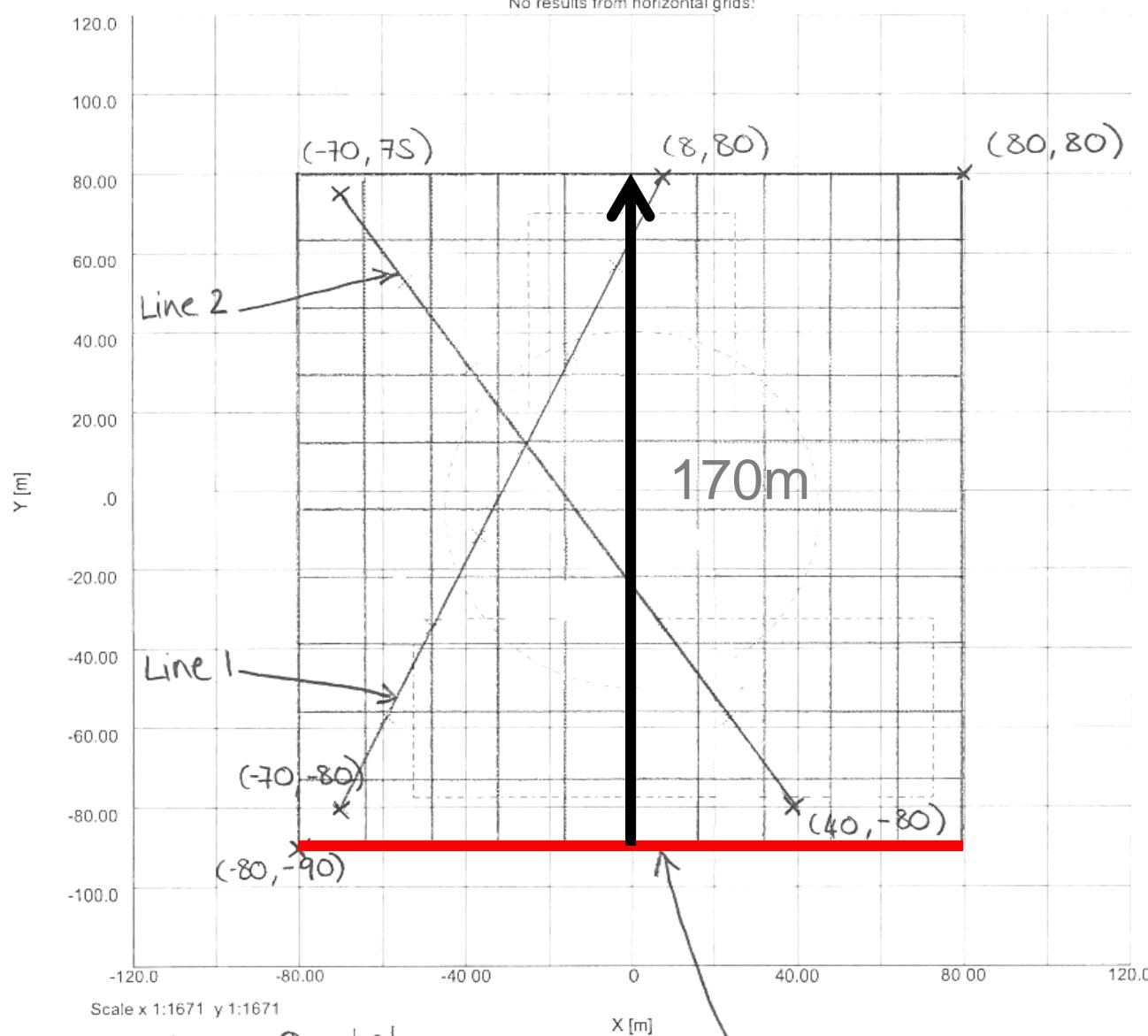






Line 1 $z = 0 \text{ m bgl}$
Line 2 $z = 0 \text{ m bgl}$
Grid 1 $z = 0 \text{ m bgl}$
Grid 2 $z = -3 \text{ m bgl}$

Grid 1 and Grid 2
in plan.



Scale x 1:1671 y 1:1671

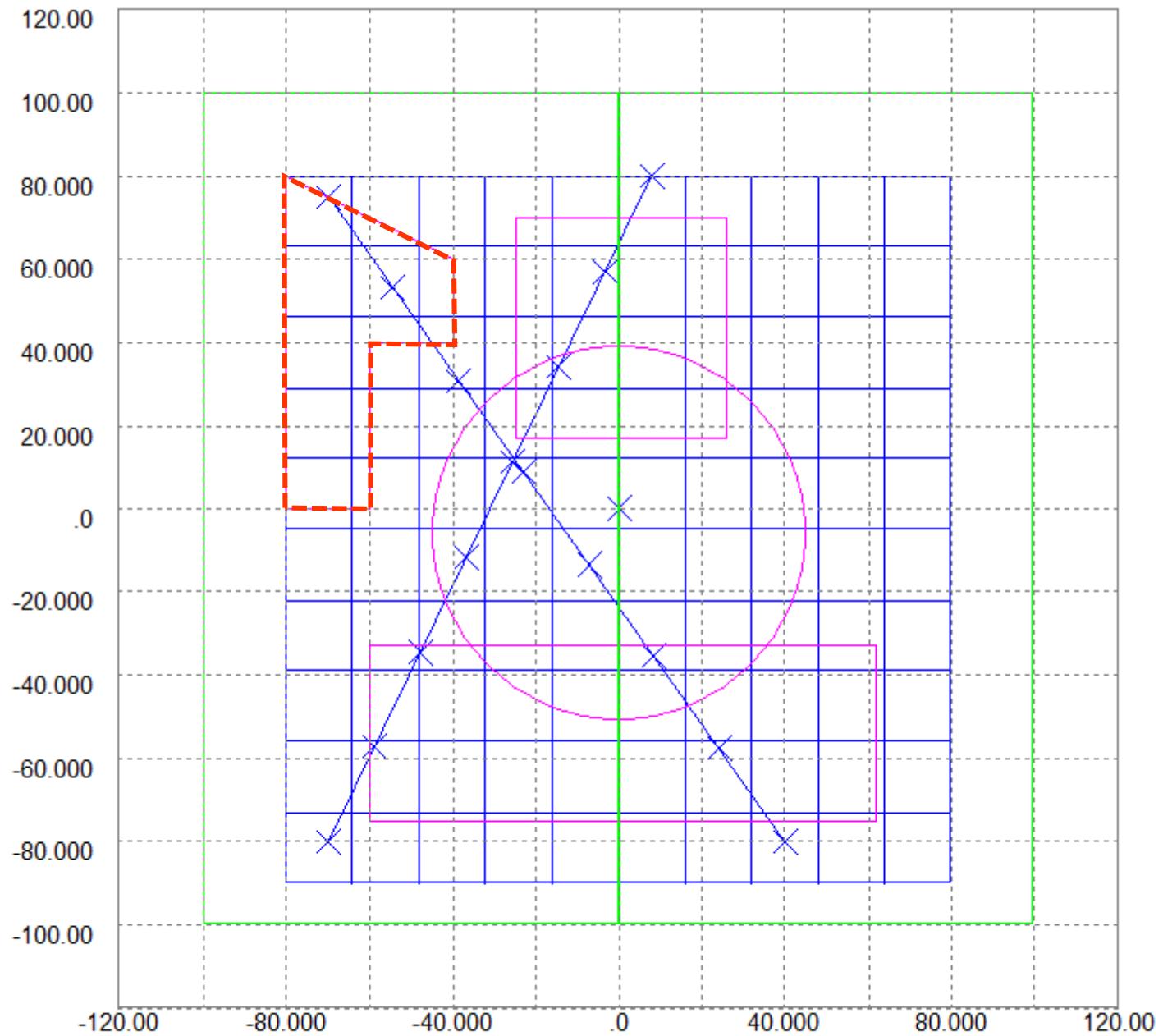
Line 1 $z = 0 \text{ m bgl}$

Line 2 $z = 0 \text{ m bgl}$

Grid 1 $z = 0 \text{ m bgl}$

Grid 2 $z = -3 \text{ m bgl}$

Grid 1 and Grid 2
in plan.



Scale x 1:2585 y 1:2585

PDisp tips - Inputs



Table Entry

- = in a cell copies the cell above
- == in a cell copies the rest of the line above
- Copy and paste from Excel

Grid and Line Entry

- Graphical Input for quick grid entry
- Consider number of intervals carefully

Polygonal Load Wizard

- Import Load co-ordinates from Excel

PDisp tips - Outputs



- Options for Graphical Plan and Wizard
- Tabular Export to Excel
- Tabular Grid View

Using PDisp from home



- Run the analysis file locally (not on a remote network)
- Use the backup feature
 - Tools>Preferences
- Are you using the most recent Build?
 - Help>About Oasys
- To manage your license, use the license portal

Training and Support



- Tutorial Manual
- User Manual
- Tutorial Videos
- Previous Webinars
 - Consolidation
 - Polygonal Loading
 - Pdisp and Building Damage Assessments
- Email Support (analysis file and images)
- Training Sessions

Training and Support



- Tutorial Manual

<https://www.oasys-software.com/support/pdisp/pdisp-documentation/>

- User Manual

https://www.oasys-software.com/wp-content/uploads/2019/06/pdisp20.0_manual.pdf

- Previous Webinars

- Consolidation <https://www.oasys-software.com/webinars/pdisp-19-4-consolidation-settlement-updates/>
- Polygonal Loading <https://www.oasys-software.com/webinars/pdisp-19-3-exciting-new-features-aid-settlement-analysis/>
- Pdisp and Building Damage Assessments <https://www.oasys-software.com/webinars/combining-pdisp-and-xdisp-predicting-building-and-utility-damage-due-to-ground-settlement/>

Objectives

1. Introduce Methodology in Pdisp
2. Case Study – How is Pdisp used?
3. Set up analysis
4. Shortcuts and tips



Any Questions?

