

GTS NX_標準教學系列

3D&2D結果比對

台灣邁達斯

註:範例相關參數使用假設條件。

平面應變元素

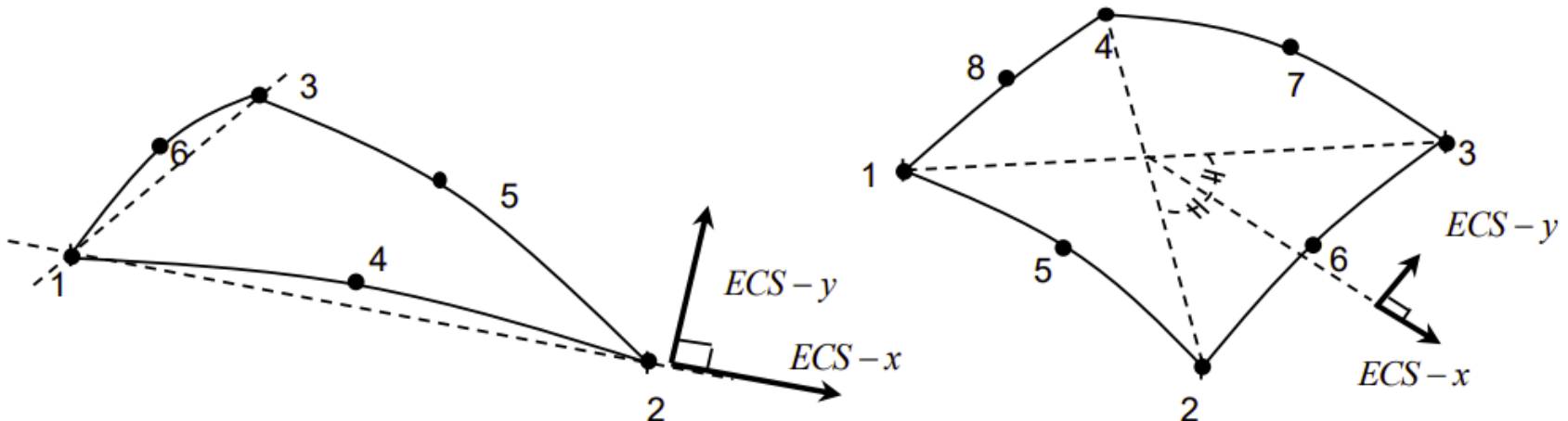
(Plane Strain Element)

A plane strain element is a triangular or rectangular element consisting of 3/4/6/8 nodes in a plane.

It is mainly used for the ground and structural analysis of dams or tunnels, which maintains a consistent section and has a long length in the direction normal to the section.

Because stress exists in the element thickness direction, it is technically not a 2D stress state.

A plane strain element can be modeled in 3D space but generally it is modeled in the particular coordinate plane (x-y, x-z, y-z) on the GCS for convenience. 2D modeling on GTS NX is done in the x-y plane.



Reference

GTS NX & FEA NX Manual



殼元素

(Shell Element)

Shell elements are triangular or rectangular elements consisting of 3/4/6/8 nodes on a curve surface.

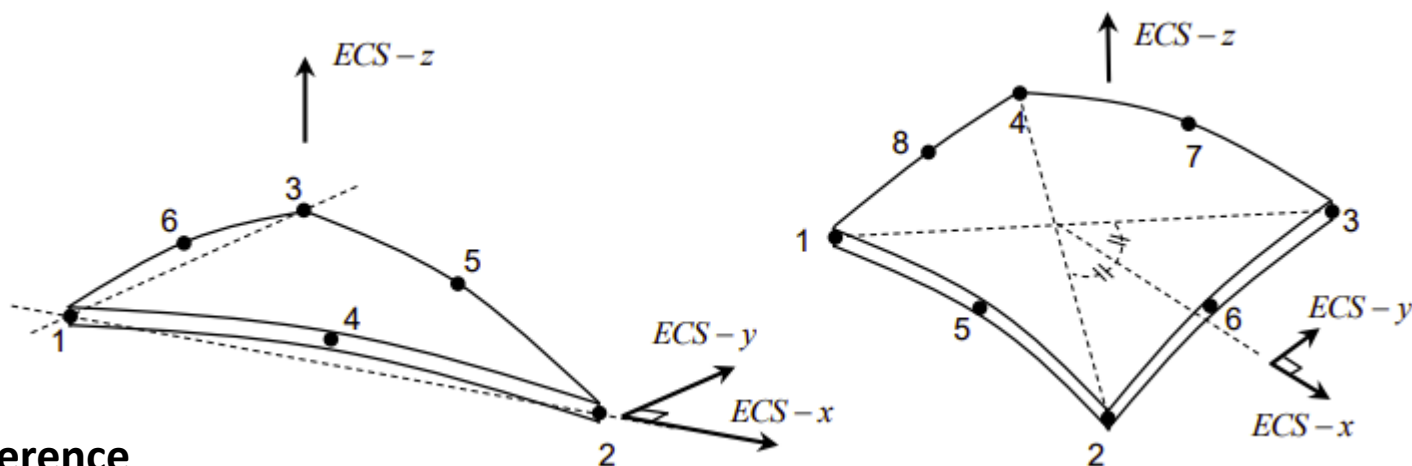
It is mainly used on thin structures that experience bending deformation and 2D stress states.

Bending and shear deformation can be considered.

Element thickness

The thickness of a shell element can be defined at the vertices in the same way as plane stress elements.

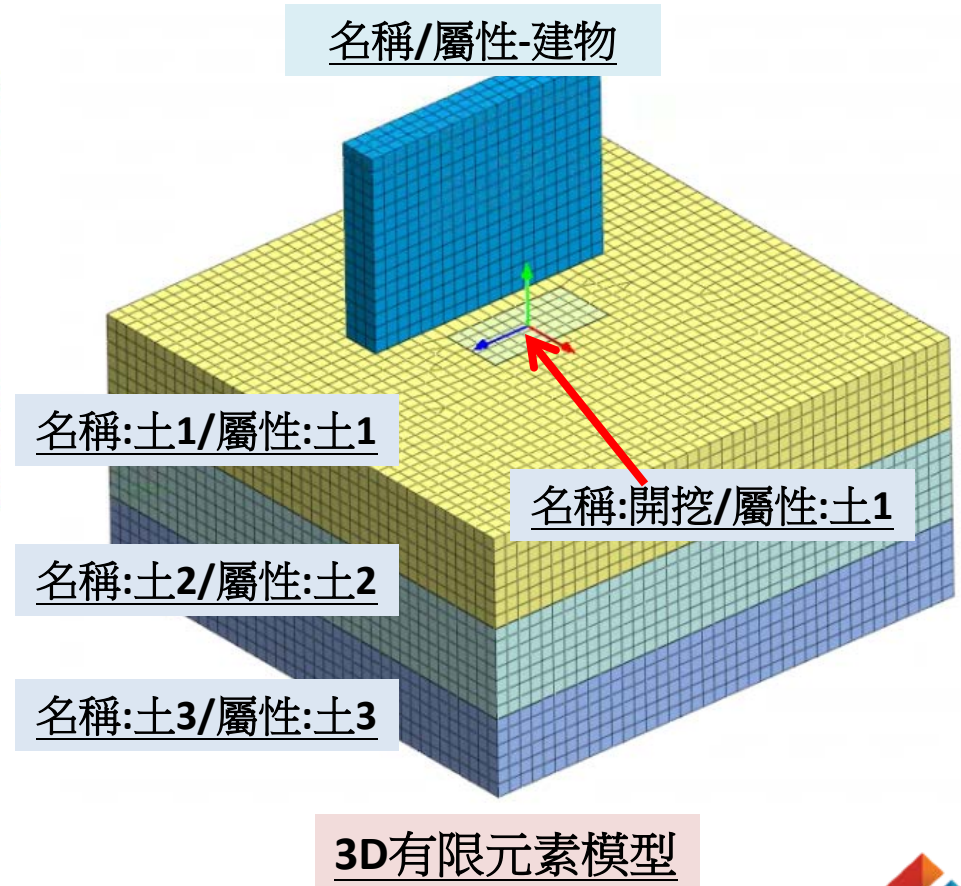
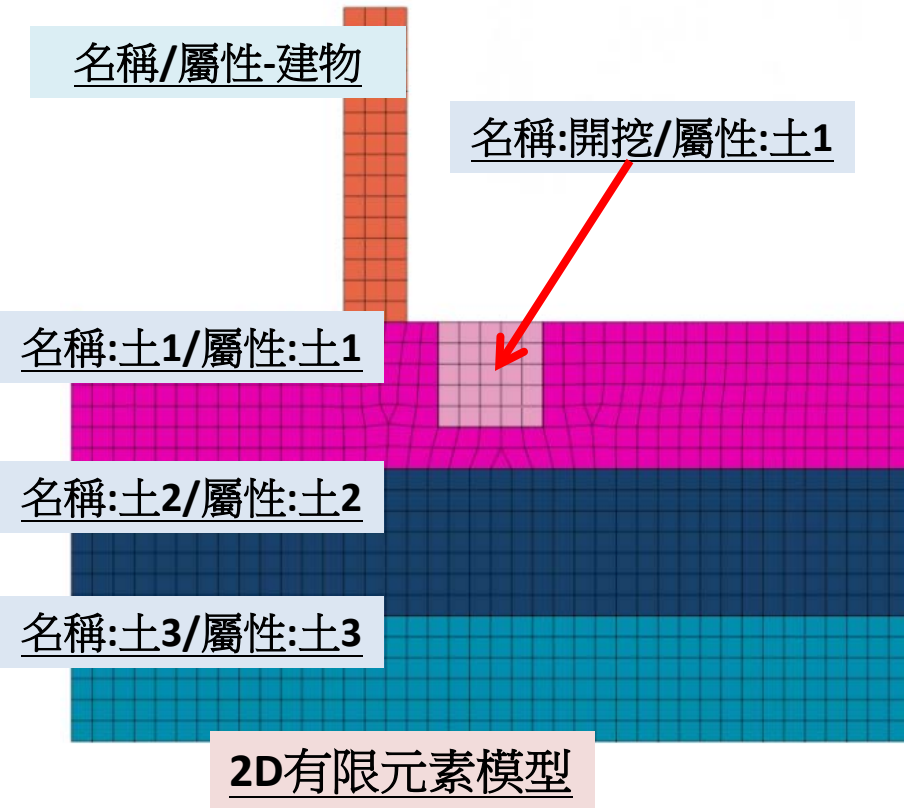
The material and effective thickness for bending and shear deformation can also be assigned individually.



Reference

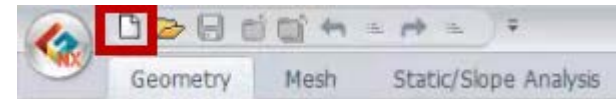
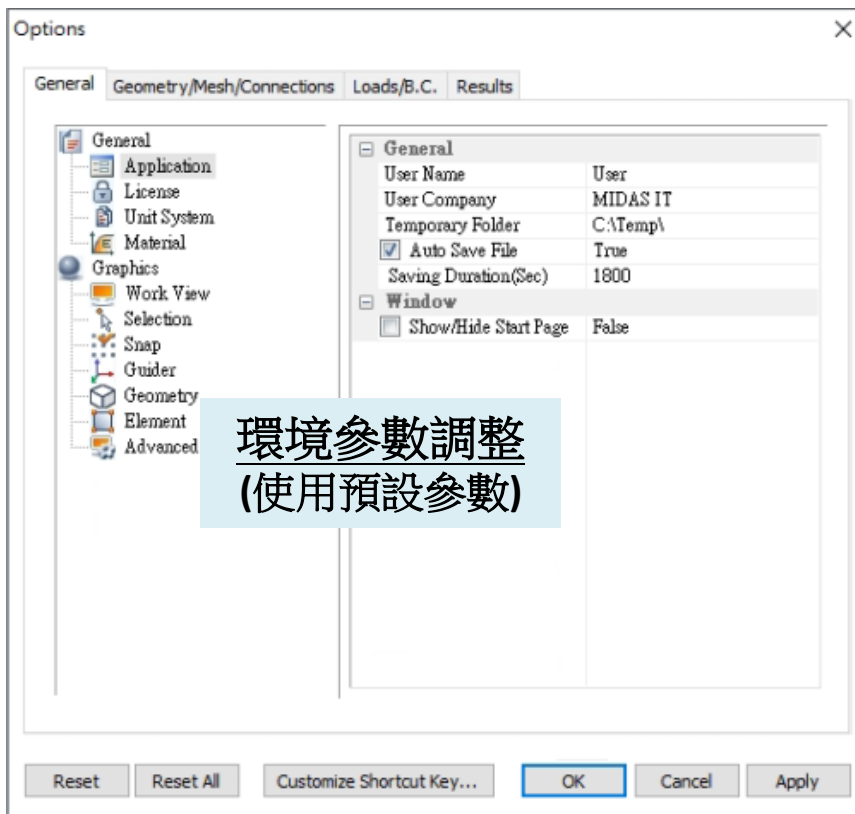
GTS NX & FEA NX Manual

分析說明



Part1.2D操作

環境

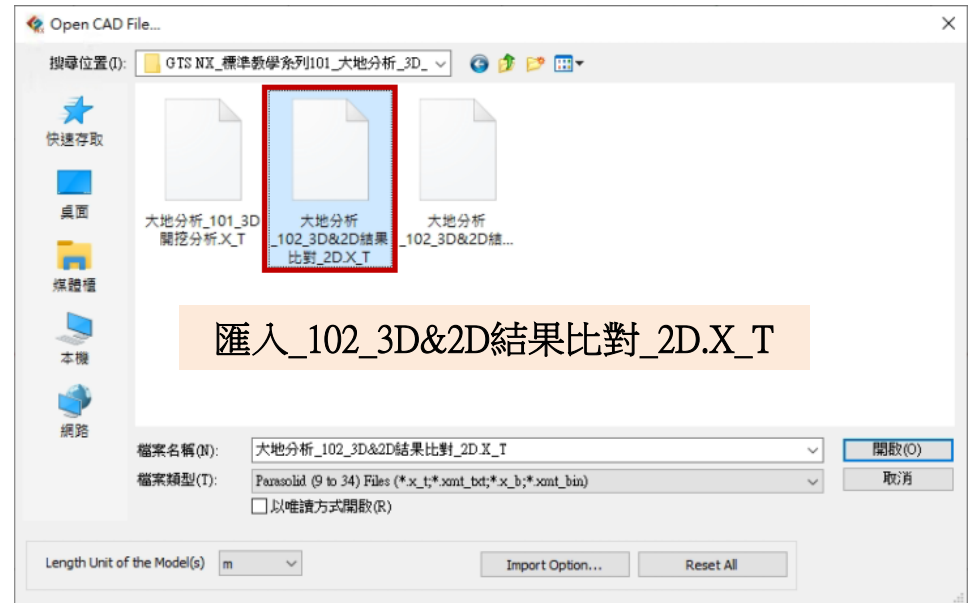
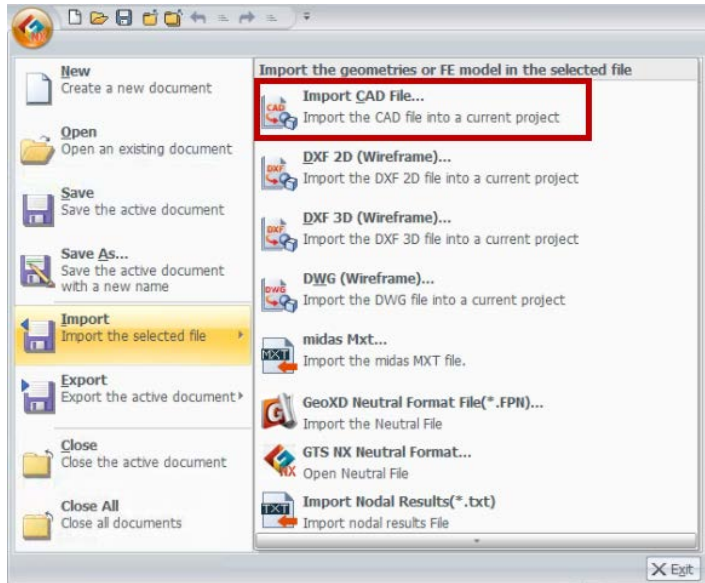


新文件

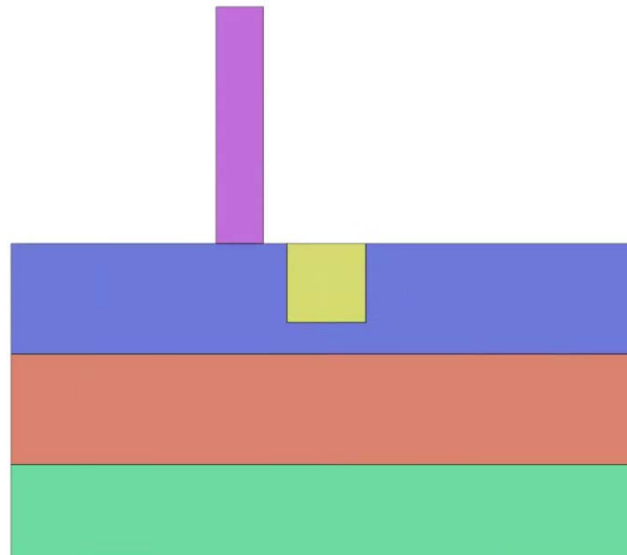


單位使用KN/m/J/sec

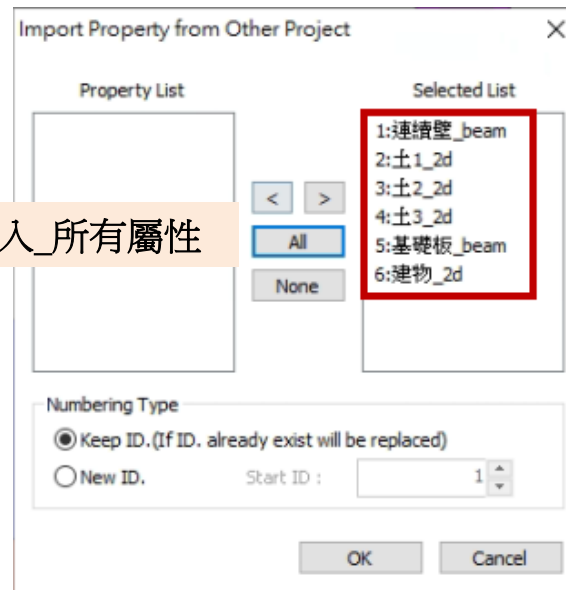
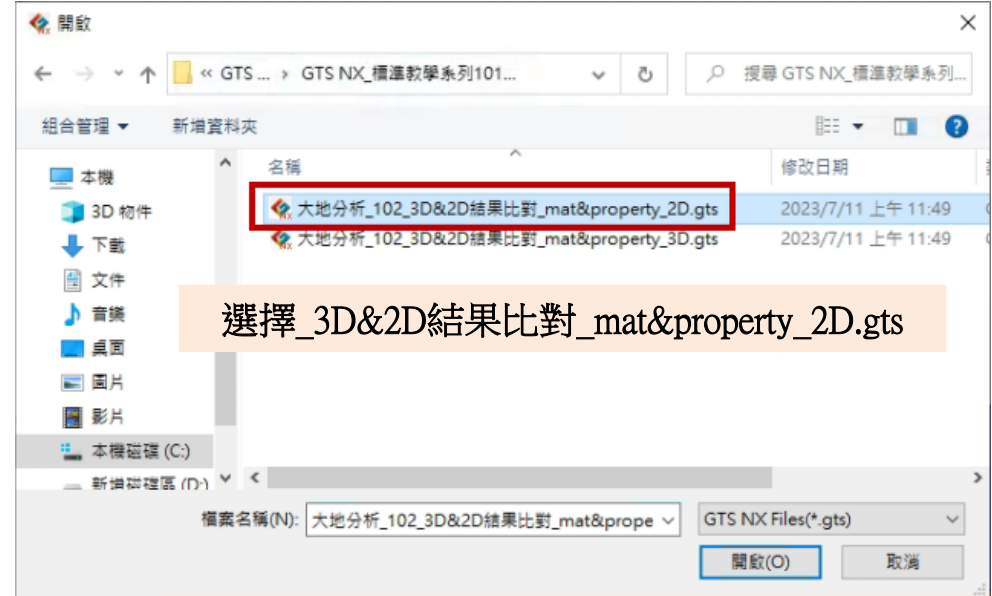
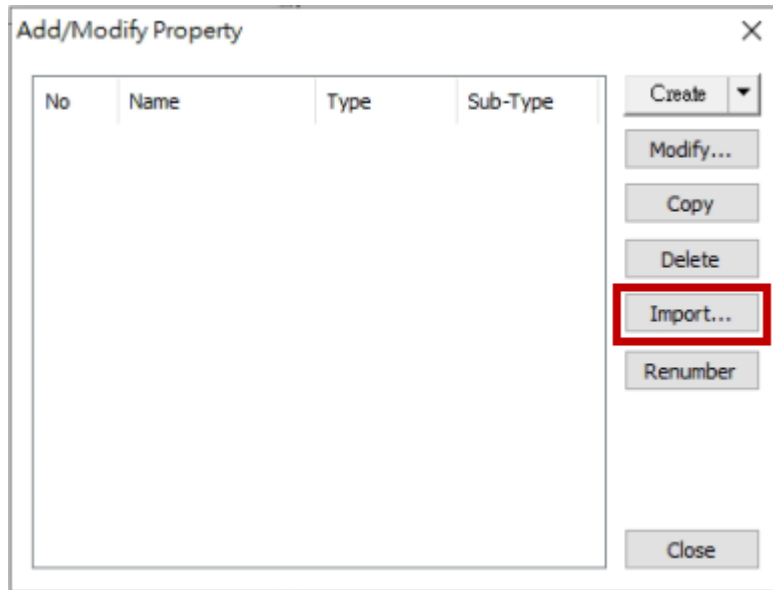
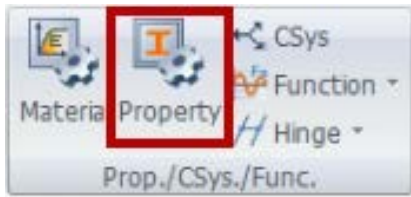
2D模型匯入



匯入_102_3D&2D結果比對_2D.X_T



2D屬性匯入



匯入_所有屬性

2D網格模型

依序完成特徵網格生成/網格尺寸: 4/相鄰特徵/共節點

名稱/屬性-建物

名稱:開挖/屬性:土1

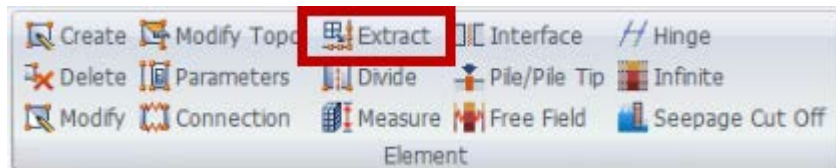
名稱:土1/屬性:土1

名稱:土2/屬性:土2

名稱:土3/屬性:土3

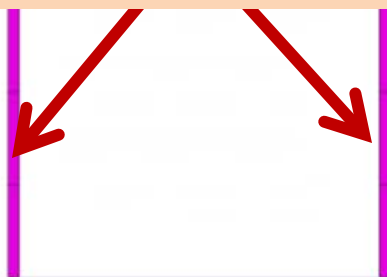
1D網格提取生成-1

(連續壁)



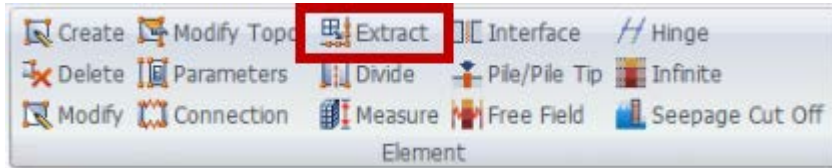
提取Edge特徵上節點作為連續壁元素

網格集名稱-連續壁
屬性:連續壁_beam



1D網格提取生成-2

(基礎板)

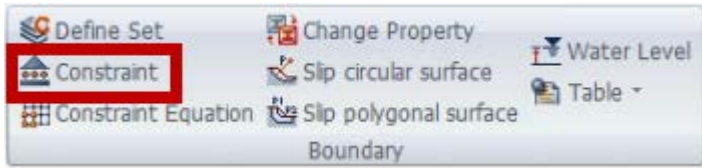


提取Edge特徵上節點作為基礎板元素

網格集名稱-基礎板
屬性:基礎板_beam

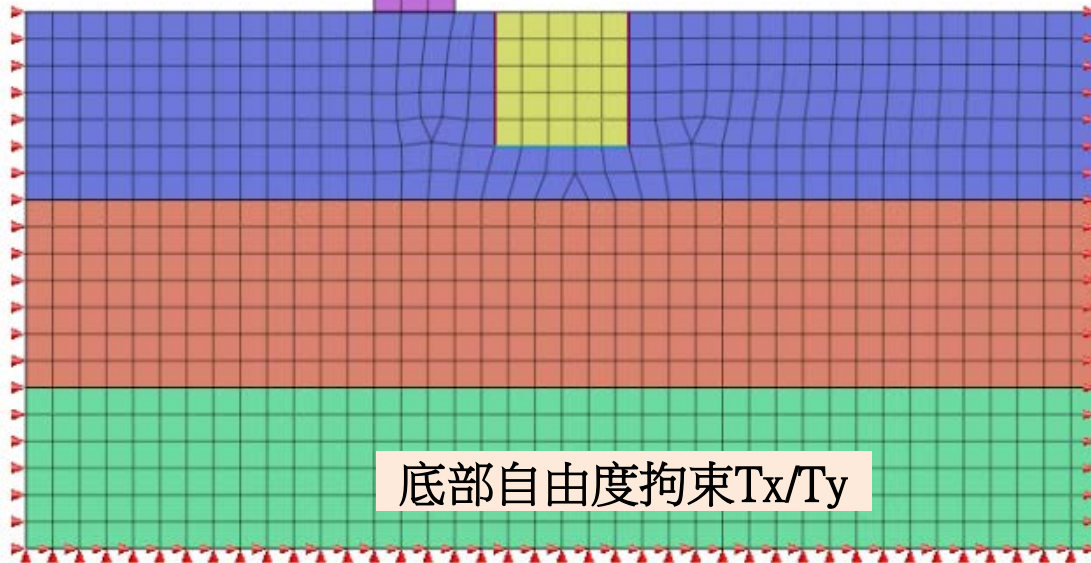


邊界



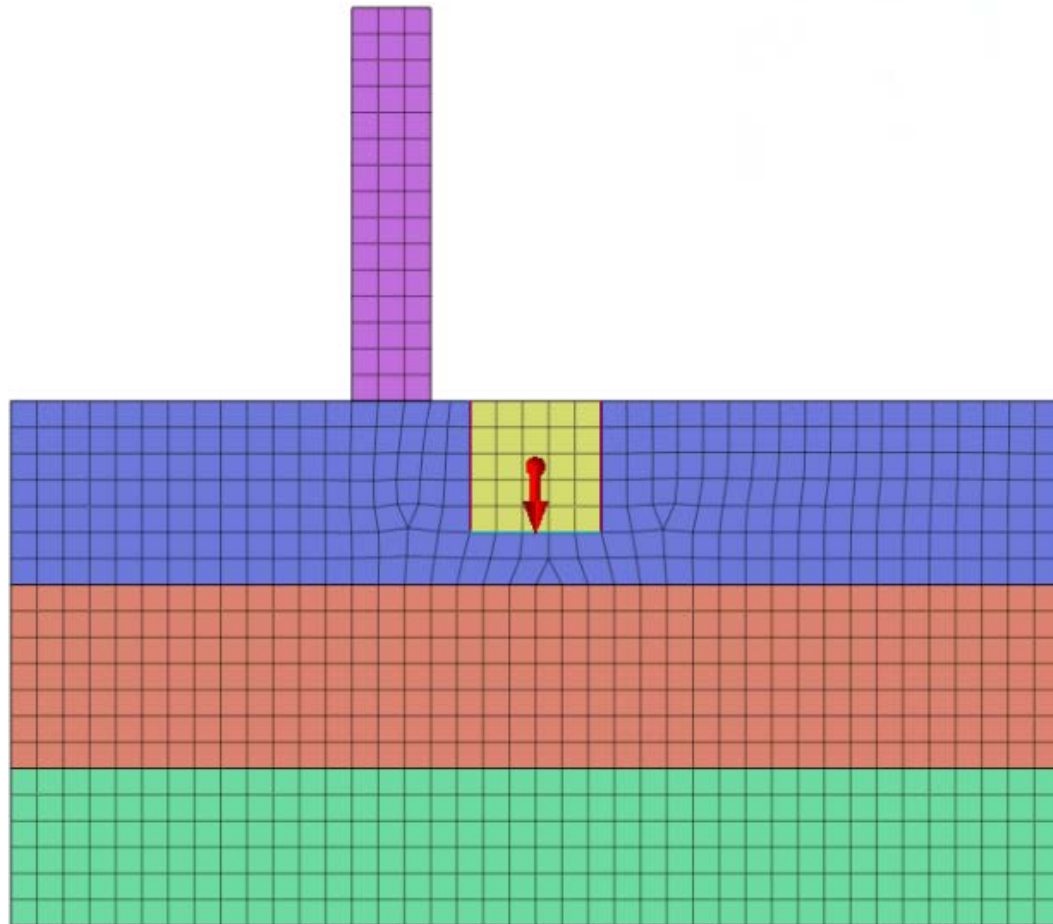
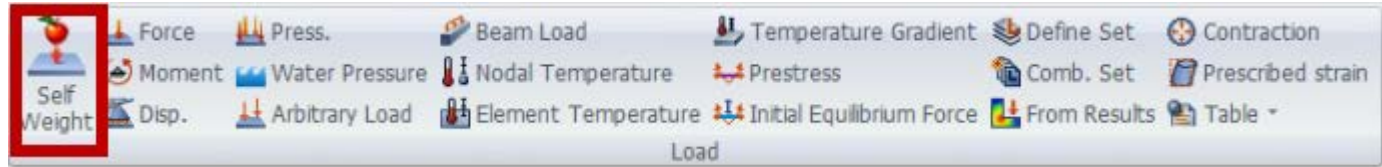
2側自由度拘束Tx

2側自由度拘束Tx



底部自由度拘束Tx/Ty

初始應力-自重



分析定義

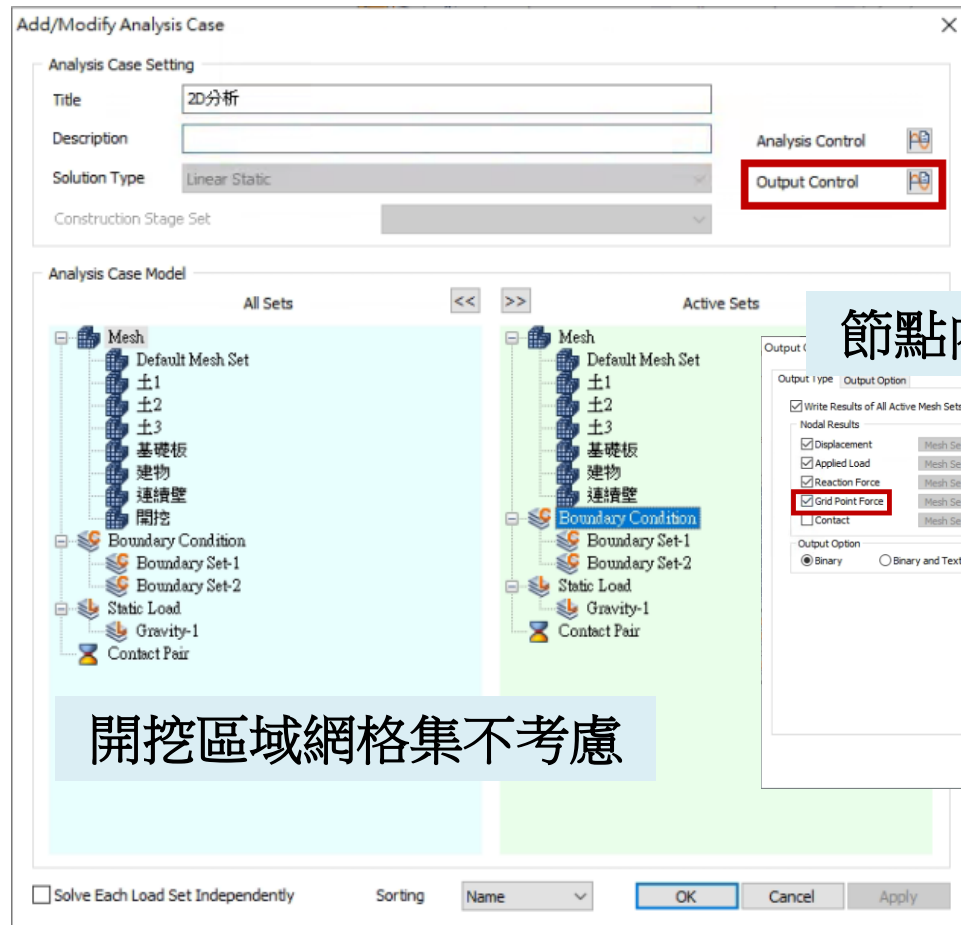
(未考慮施工階段分析)



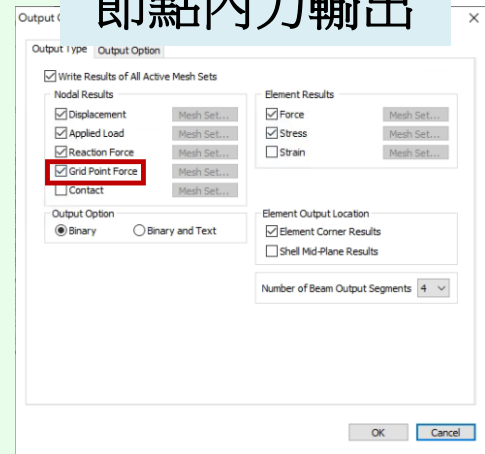
分析名稱:2D分析
分析類型:Linear Static

Linear Static

- Linear Static
- Nonlinear Static
- Construction Stage
- Eigenvalue
- Response Spectrum
- Linear Time History(Modal)
- Linear Time History(Direct)
- Nonlinear Time History
- Nonlinear Time History + SRM
- 2D Equivalent Linear
- Consolidation
- Fully Coupled Stress Seepage
- Seepage(Steady-state)
- Seepage(Transient)
- Slope Stability(SRM)
- Slope Stability(SAM)



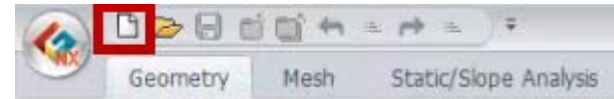
節點內力輸出



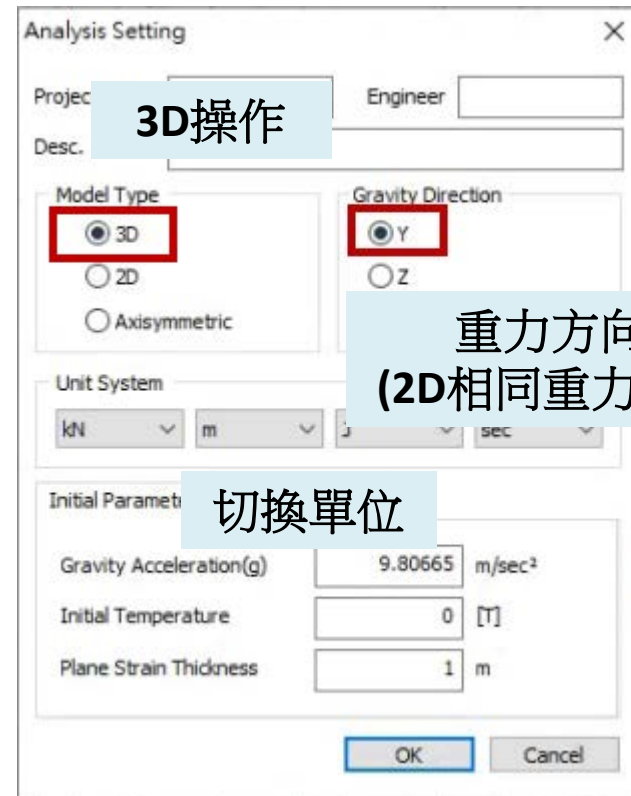
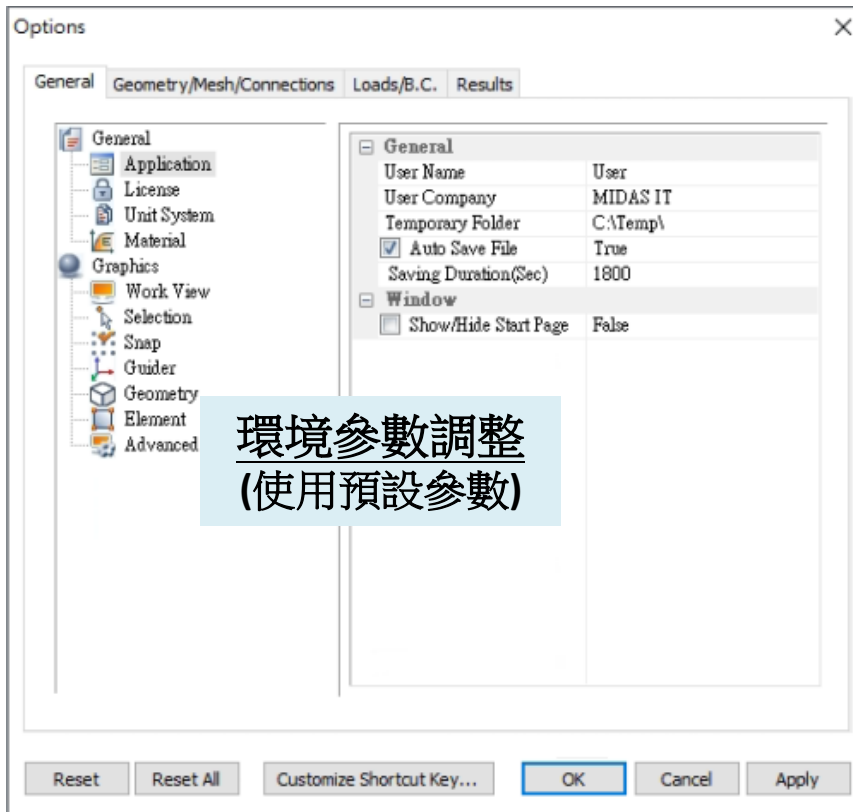
開挖區域網格集不考慮

Part2.3D操作

環境

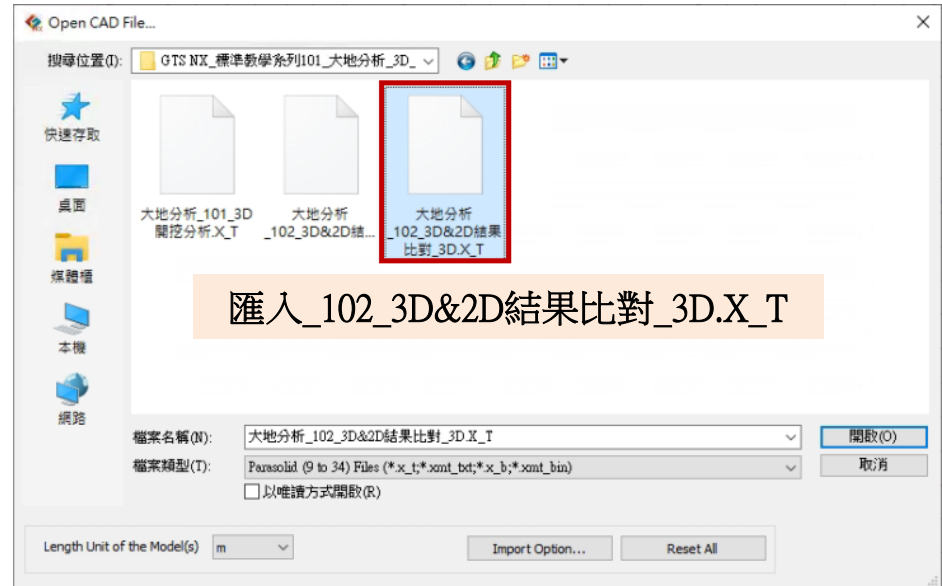
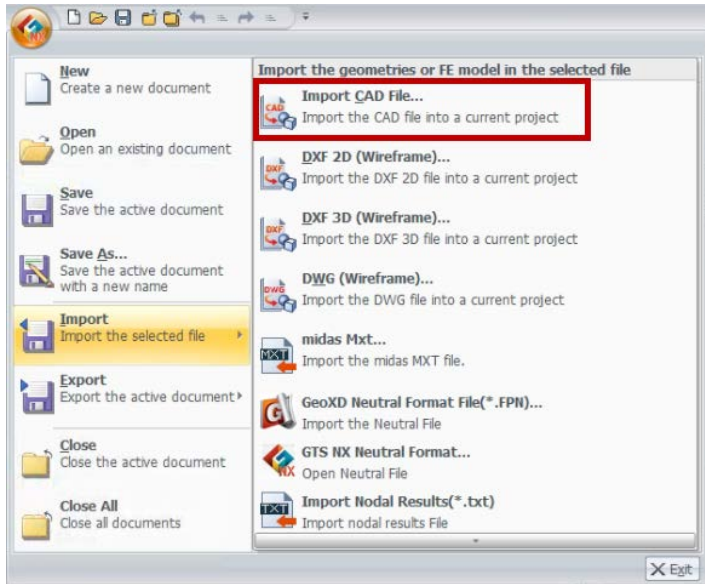


新文件

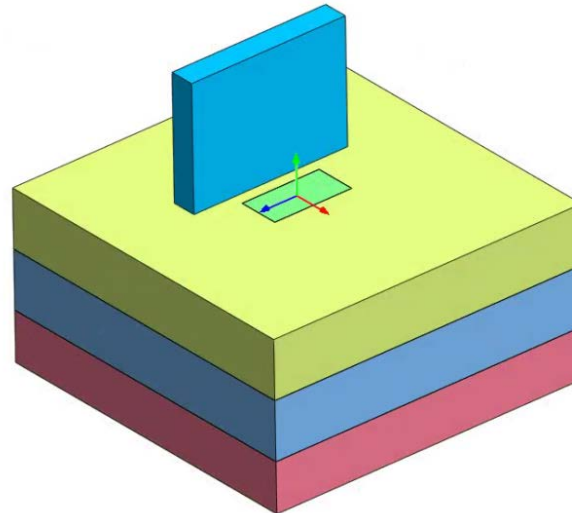


單位使用KN/m/J/sec

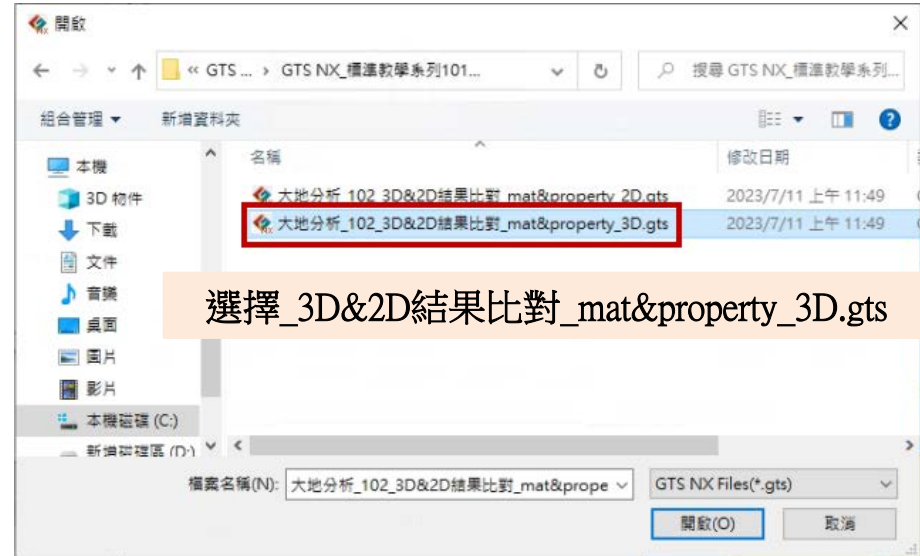
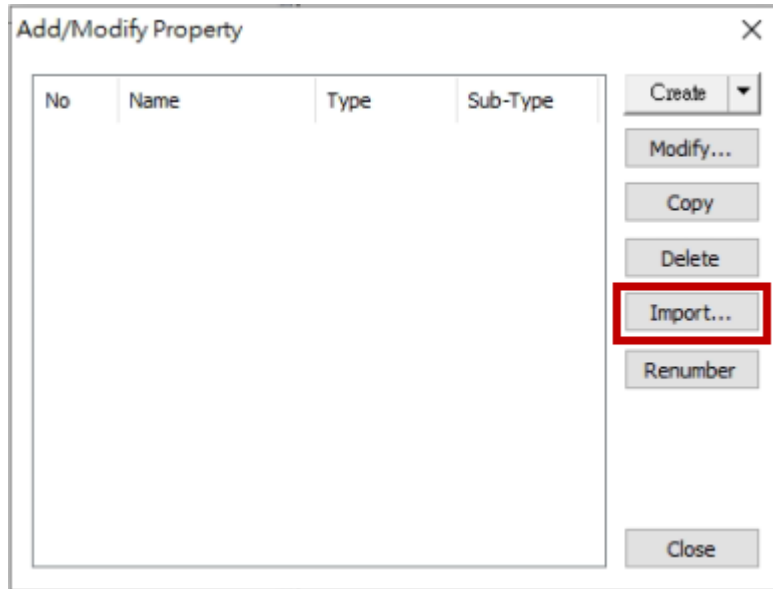
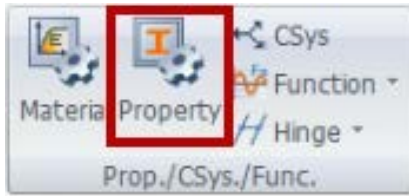
3D模型匯入



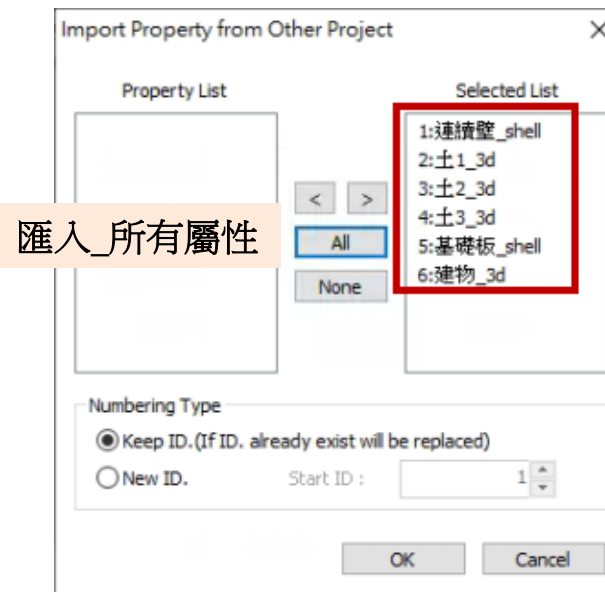
匯入_102_3D&2D結果比對_3D.X_T



3D屬性匯入



選擇_3D&2D結果比對_mat&property_3D.gts

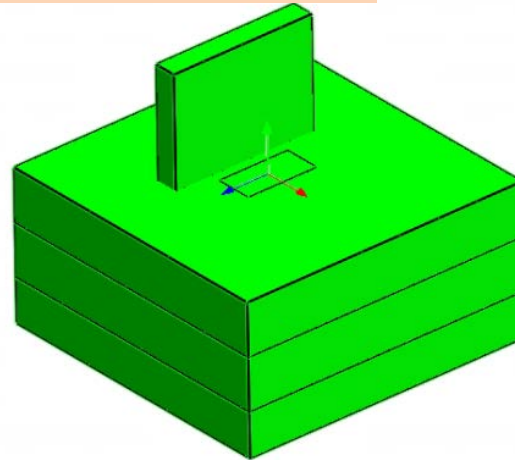
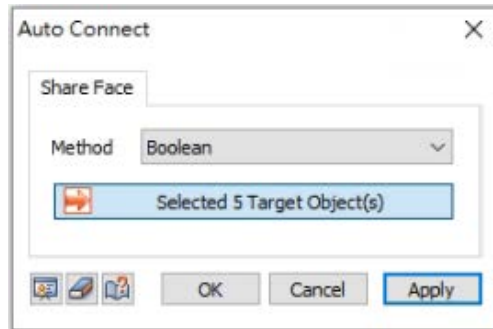


匯入_所有屬性

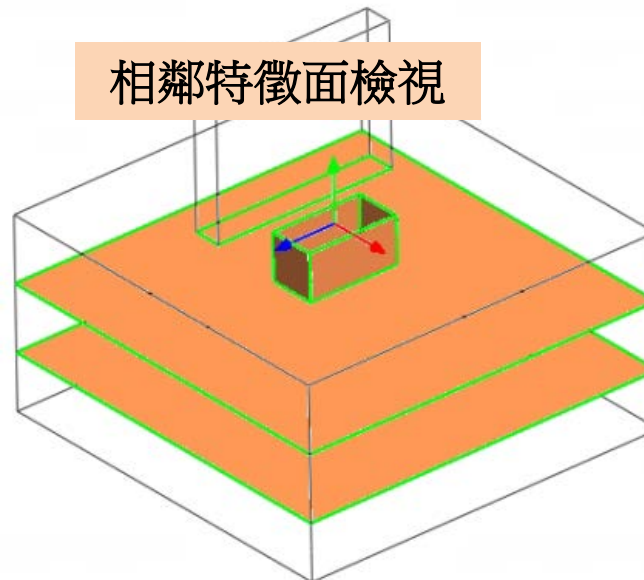
相鄰面特徵建立&檢視



框選所有實體特徵

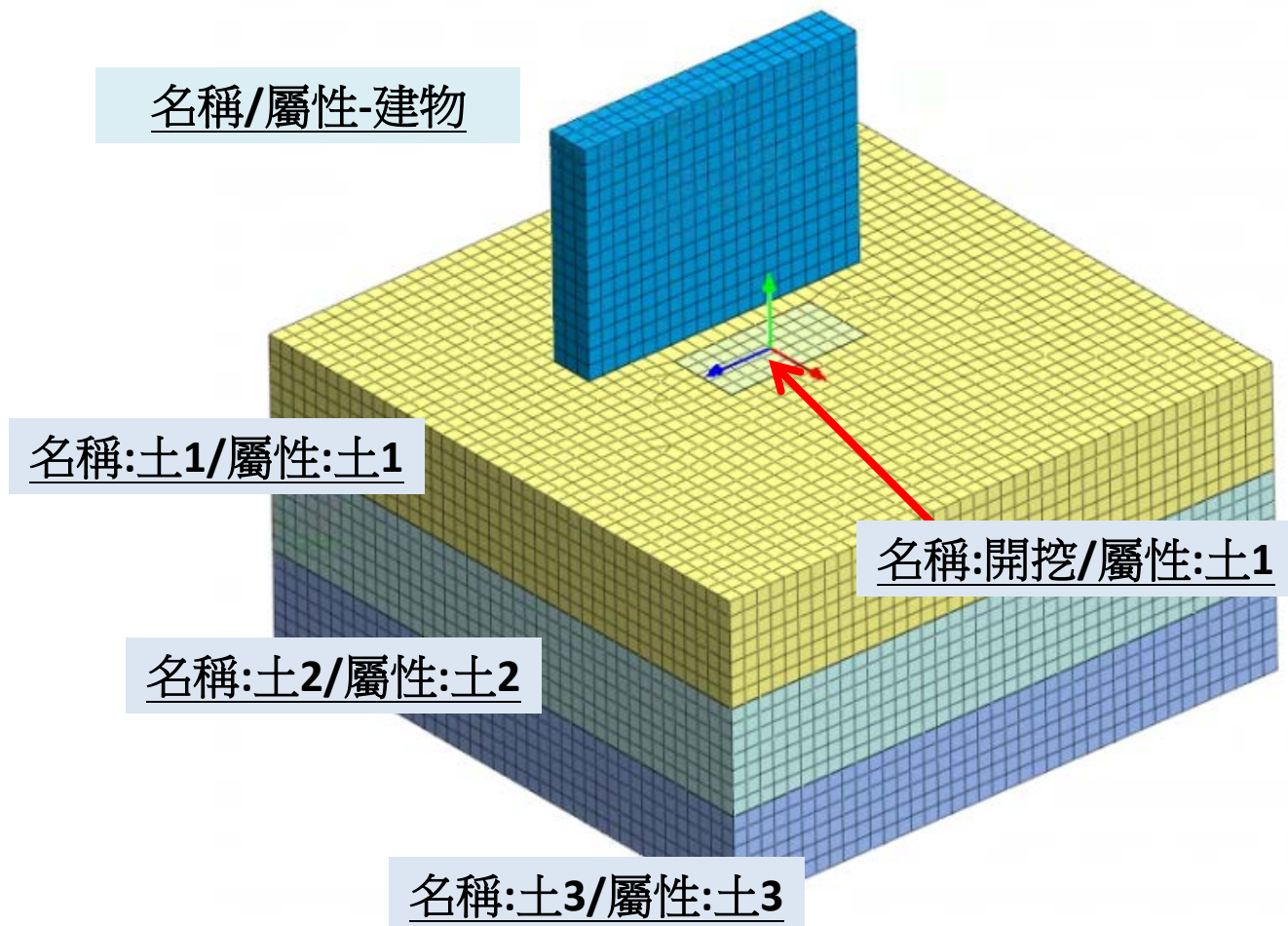


相鄰特徵面檢視



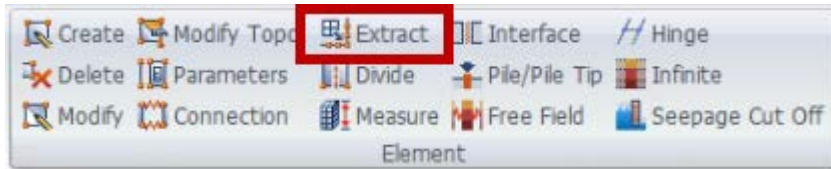
3D網格模型

依序完成特徵網格生成/Hybrid Mesher/網格尺寸: 4/相鄰特徵/共節點

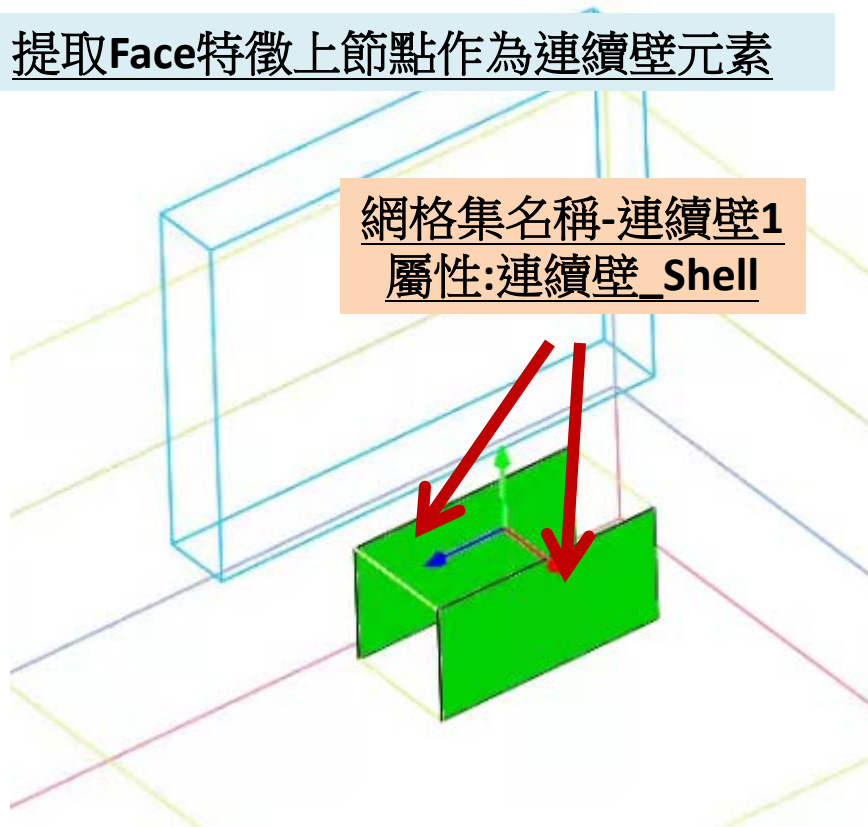


2D網格提取生成-1

(連續壁1)



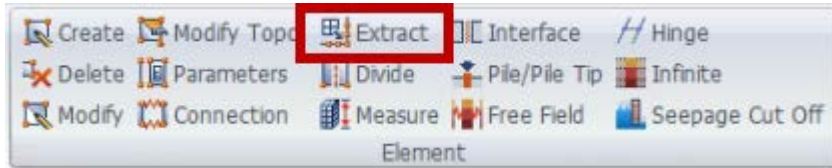
提取Face特徵上節點作為連續壁元素



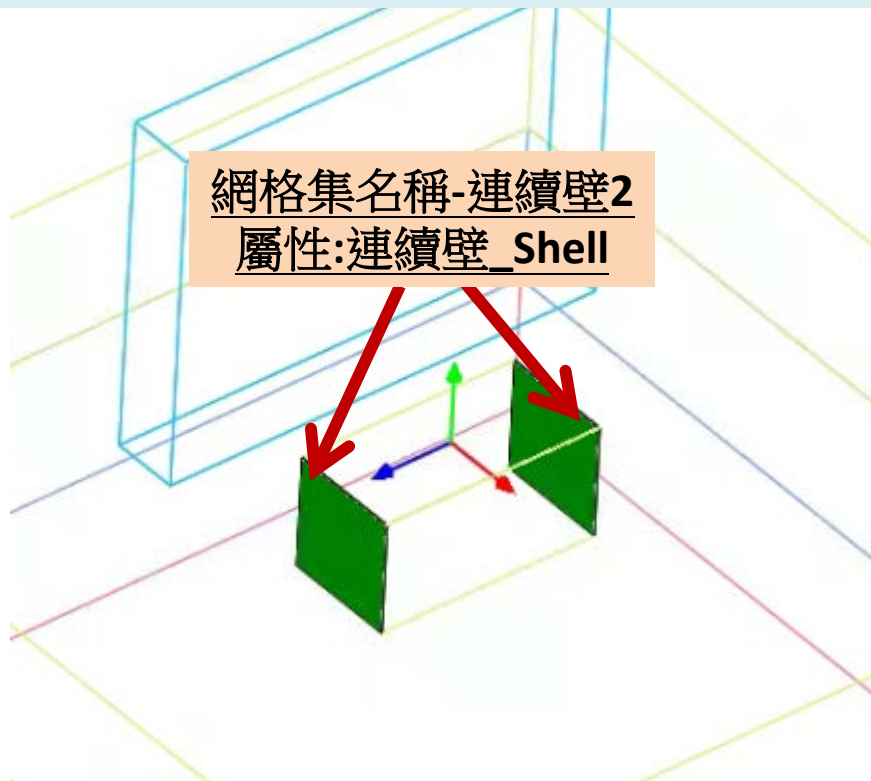
網格集名稱-連續壁1
屬性:連續壁_Shell

2D網格提取生成-2

(連續壁2)

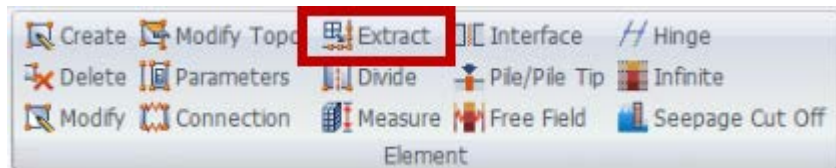


提取Face特徵上節點作為連續壁元素



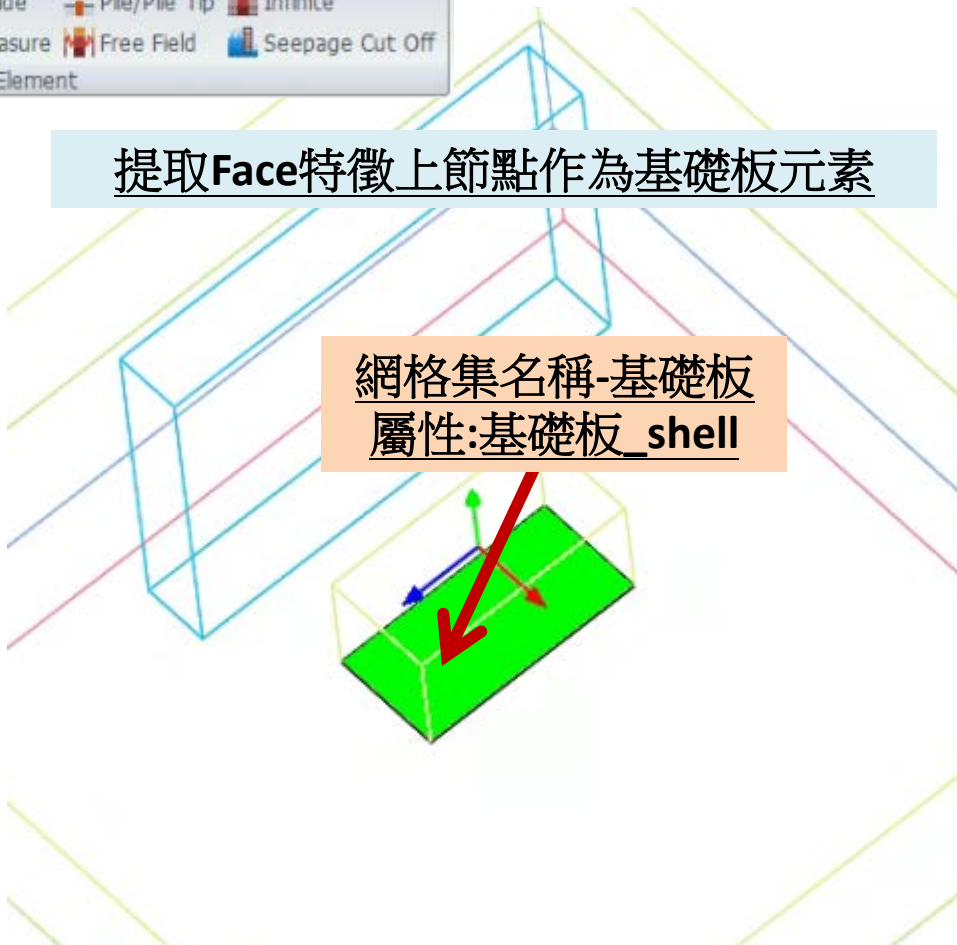
2D網格提取生成-3

(基礎板)

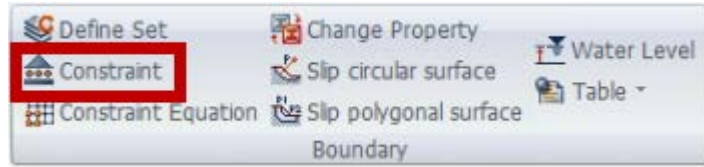


提取Face特徵上節點作為基礎板元素

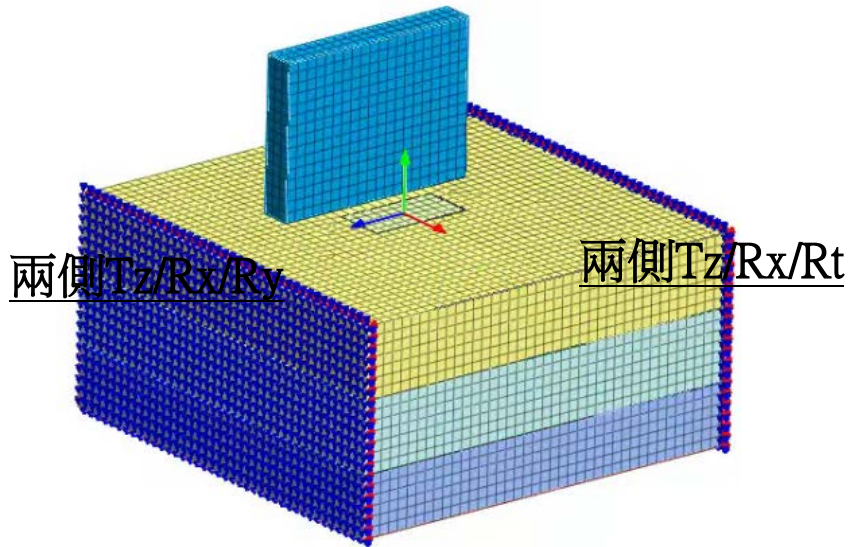
網格集名稱-基礎板
屬性:基礎板_shell



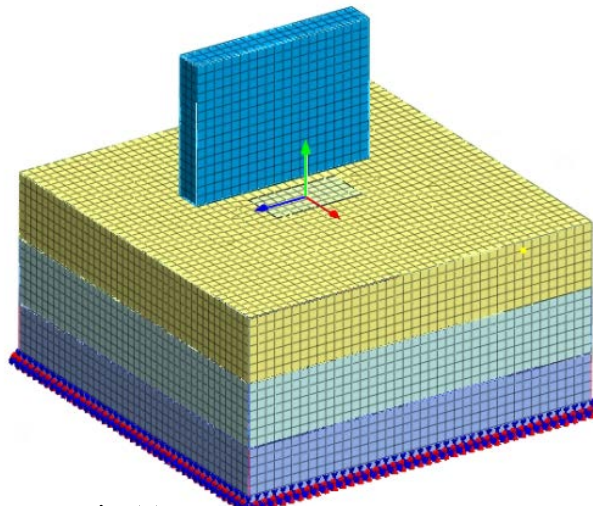
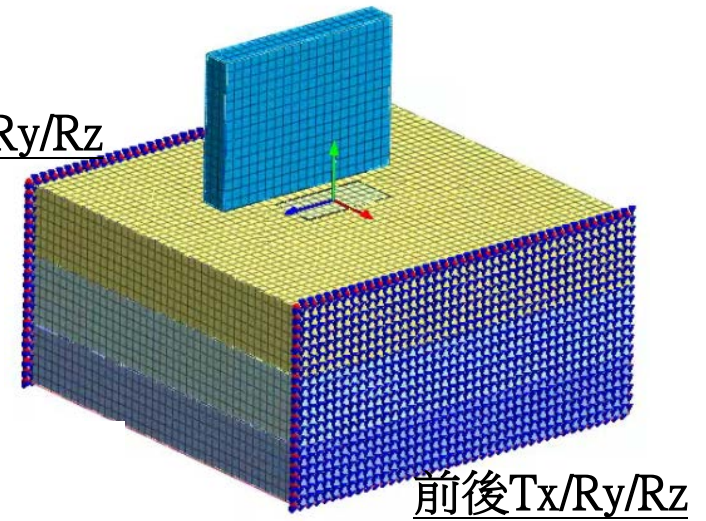
邊界



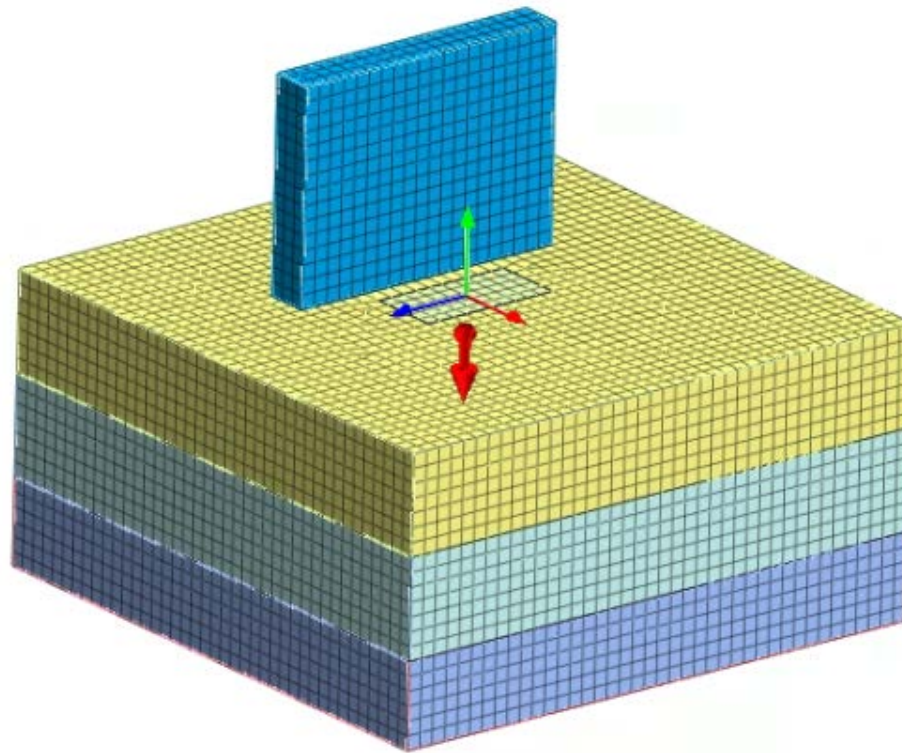
使用Face特徵選取節點



前後 $T_x/R_y/R_z$



初始應力-自重



分析定義

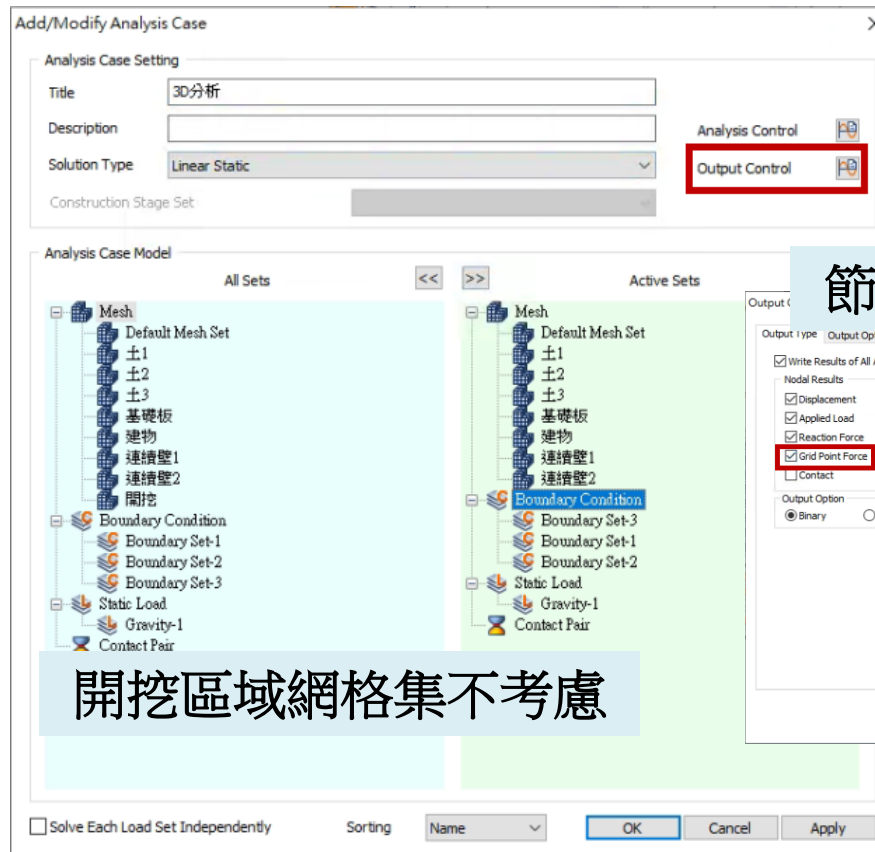
(未考慮施工階段分析)



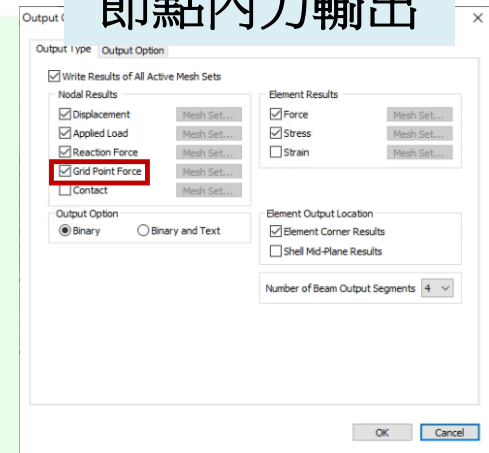
分析名稱:3D分析
分析類型:Linear Static

Linear Static

Linear Static
Nonlinear Static
Construction Stage
Eigenvalue
Response Spectrum
Linear Time History(Modal)
Linear Time History(Direct)
Nonlinear Time History
Nonlinear Time History + SRM
2D Equivalent Linear
Consolidation
Fully Coupled Stress Seepage
Seepage(Steady-state)
Seepage(Transient)
Slope Stability(SRM)
Slope Stability(SAM)



節點內力輸出

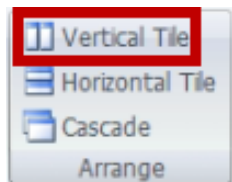


開挖區域網格集不考慮

Part3.2D&3D分析結果比對

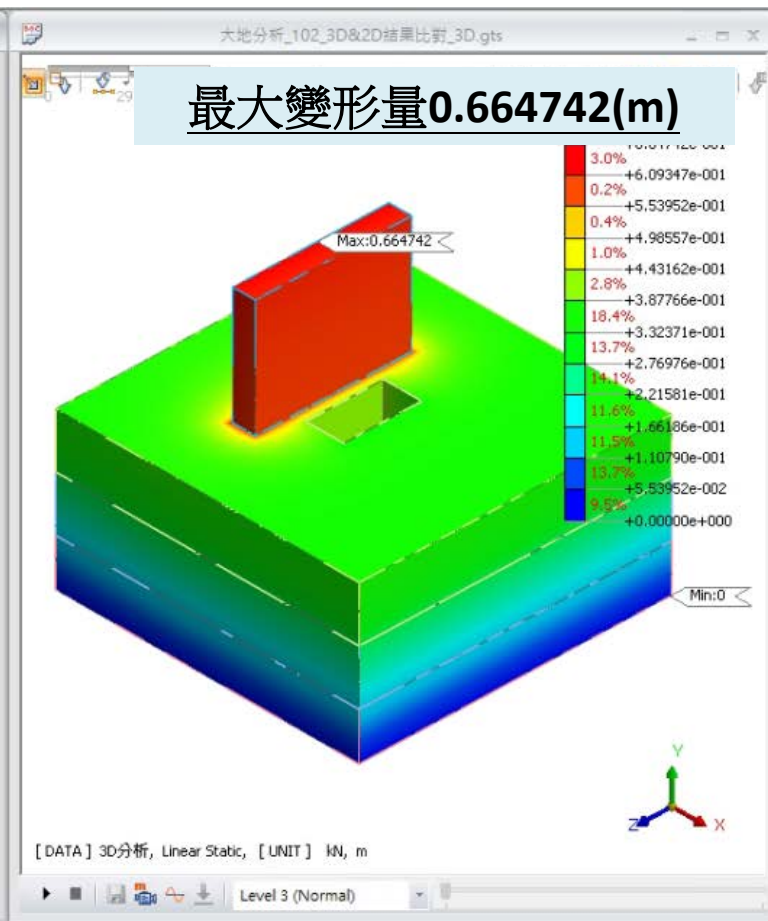
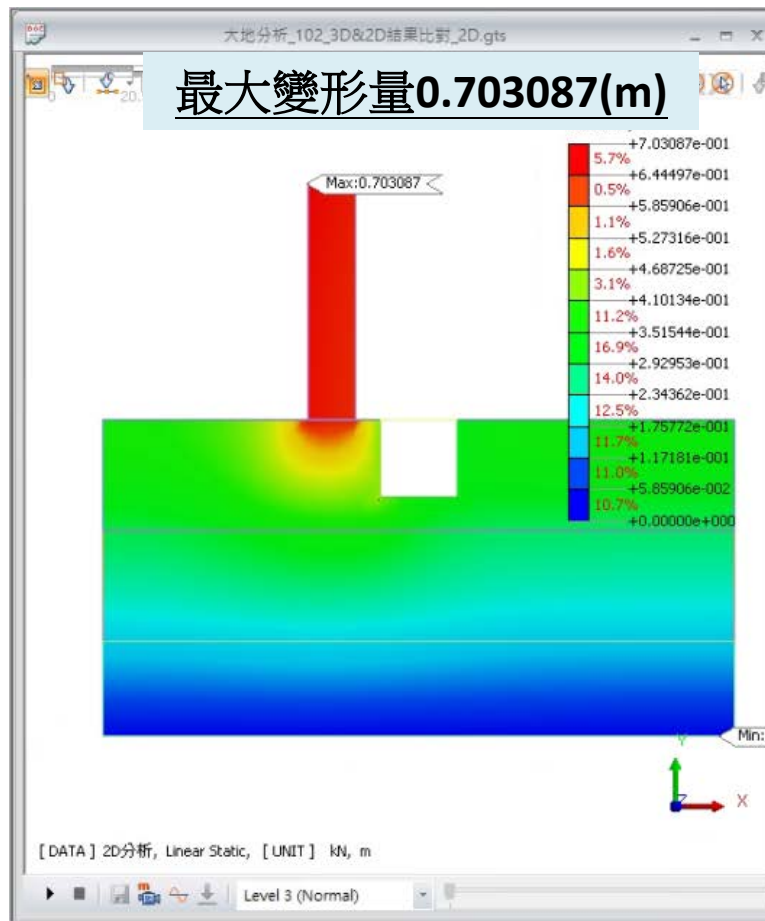
分析結果-1

(Total Translation(m))

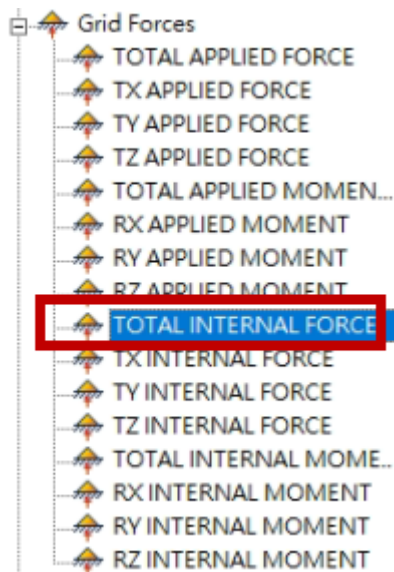
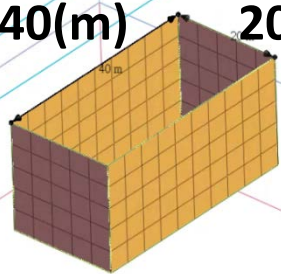


2D

3D



40(m) 20(m)



提取結果進行數據整理



分析結果-2

(Total Internal Force(KN))

2D

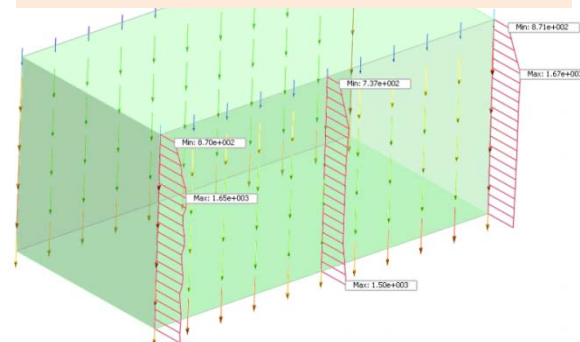
連續壁特徵_2D內力總計
3550.24KN)

2D反推3D內力(連續壁長60m)
=2D內力×連續壁長
=3550.24×60m
=213,041.472(KN)

3D

連續壁特徵_3D內力總計
223,816.71(KN)

3D內力分佈
中間段/角落分佈不同



GTS NX

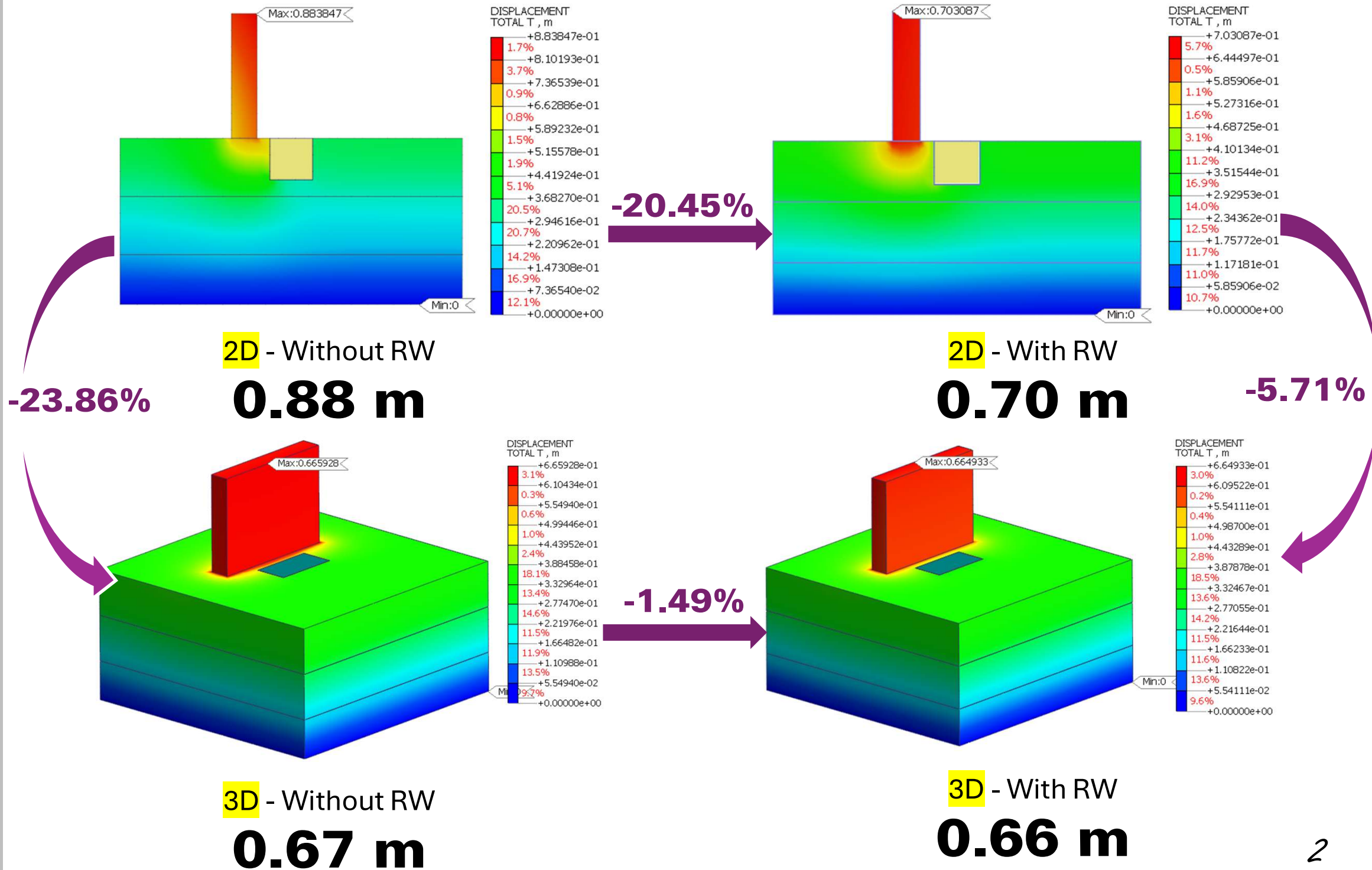
2D & 3D Excavation Comparison

Extra lesson

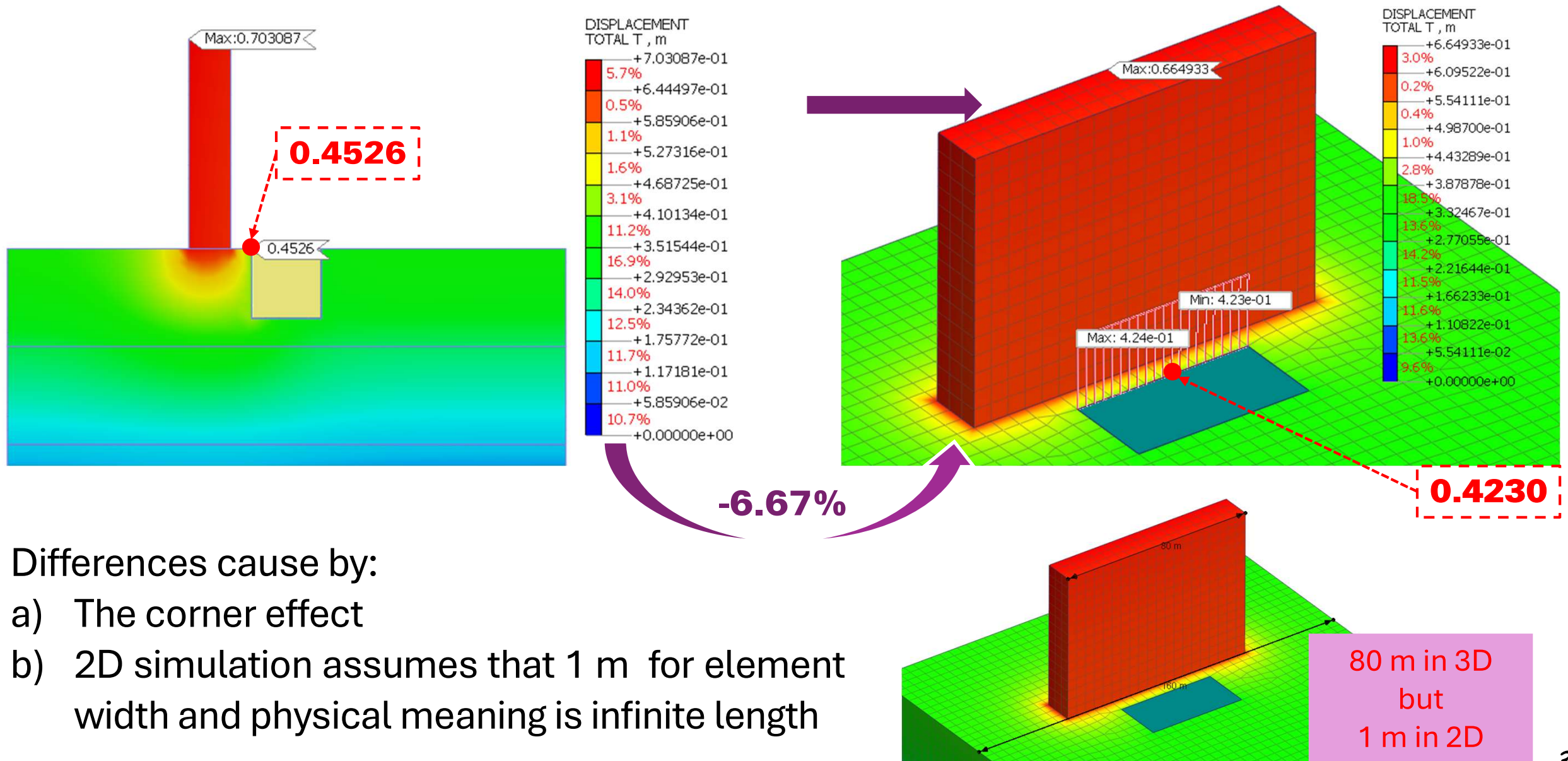
Midas Taiwan

Reference: Midas GTX NX Tutorials

Total translation comparison ~ 2D & 3D ~



What does it make the difference between 2D & 3d simulation?



Differences cause by:

- a) The corner effect
- b) 2D simulation assumes that 1 m for element width and physical meaning is infinite length

Thank you! 