

The background of the slide features a complex network of interconnected nodes and lines, resembling a molecular or structural mesh. The nodes are small dark dots, and the lines are thin, light-colored. The overall color scheme transitions from a bright green on the left to a warm orange and red on the right.

GTS NX

New eXperience of Geo-Technical analysis System

Piled Raft Foundation Analysis ***Advanced Course***

The MIDAS logo consists of the word "MIDAS" in a bold, sans-serif font, with a stylized white arc above the letters "I" and "D".

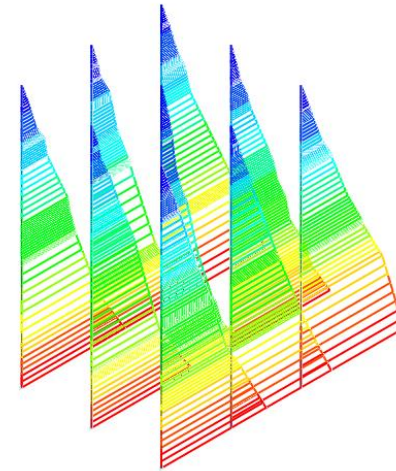
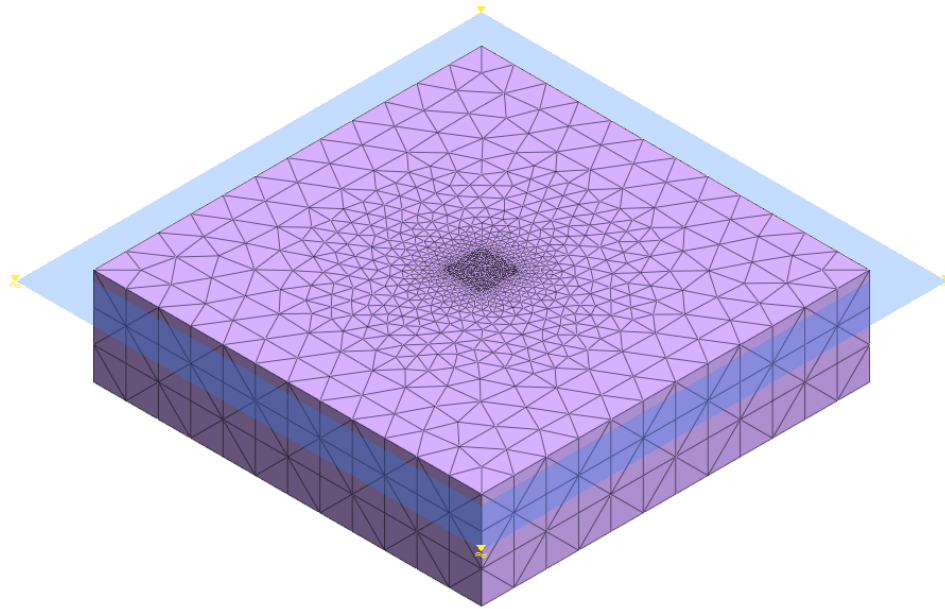
MIDAS

Modeling and Analysis Summary

The model represents 3 stage for piled raft analysis, the raft will be supported group pile (9 numbers).

This tutorial is aiming on performing the analysis to check shaft resistance and tip bearing of piles and forces from piles and raft.

This tutorial will be carried out with “Stress Analysis” and will be considered water level which is 3.0 below from ground level.



Ground

[unit : kN, m]

Name	Soil
Material	Isotropic
Model Type	Mohr-Coulomb
General	
Elastic Modulus (E) [kN/m ²]	5000
Poisson's Ratio (ν)	0.35
Unit Weight (γ) [kN/m ³]	18
Ko	0.5
Porous	
Unit Weight (Saturated) [kN/m ³]	21
Drainage Parameters	Drained
Non-Linear	
Cohesion (c) [kN/m ²]	4
Frictional Angle (Φ) [deg]	30

Structure

[unit : kN, m]

Name	Pile / Raft
Material	Isotropic
Model Type	Elastic
Elastic Modulus (E) [kN/m ²]	35000000
Poisson's Ratio (ν)	0.2
Unit Weight (γ) [kN/m ³]	25

Pile Interface / Tip

[unit : kN, m]

Name	Pile Interface	Pile Tip
Ultimate Shear Force	100	-
Shear Stiffness Modulus (Kt)	5000	-
Normal Stiffness Modulus (Kn)	50000	-
Tip Bearing Capacity	-	100
Tip Spring Stiffness	-	50000

The background of the slide features a complex network of interconnected nodes and lines, resembling a mesh or a molecular structure. The nodes are small dark circles, and the lines are thin, light-colored. The overall color scheme transitions from a vibrant green on the left to a warm orange and red on the right, with a yellowish-gold in the center.

GTS NX

New eXperience of Geo-Technical analysis System

Geometry Modeling

MIDAS

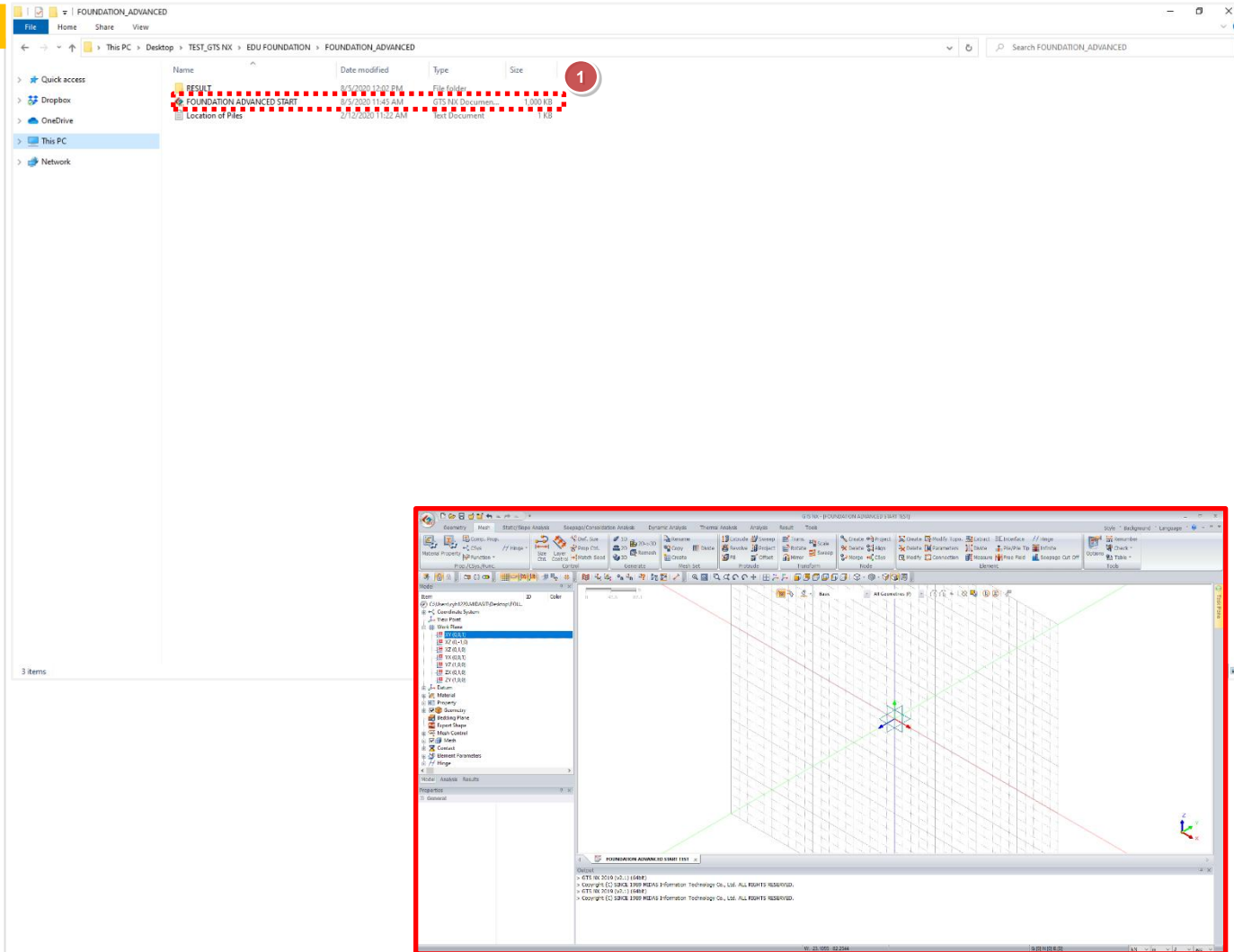
03 Geometry Modeling

Starting

Procedure

- 1 Open the start file

“FOUNDATION ADVANCED START”

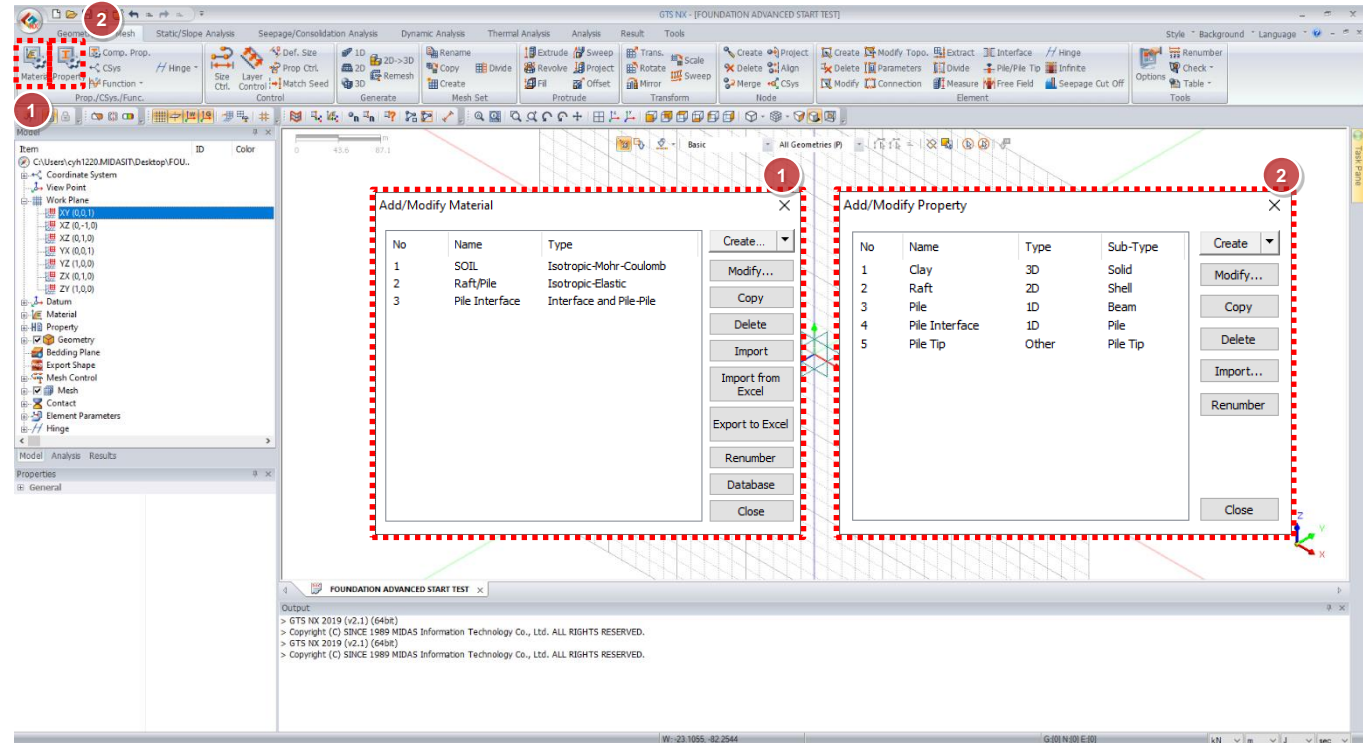


03 Geometry Modeling

Check the properties

Procedure

- 1 Check existing materials
(Mesh > Prop./CSys./Func. > Material)
- 2 Check existing properties
(Mesh > Prop./CSys./Func. > Property)



03 Geometry Modeling

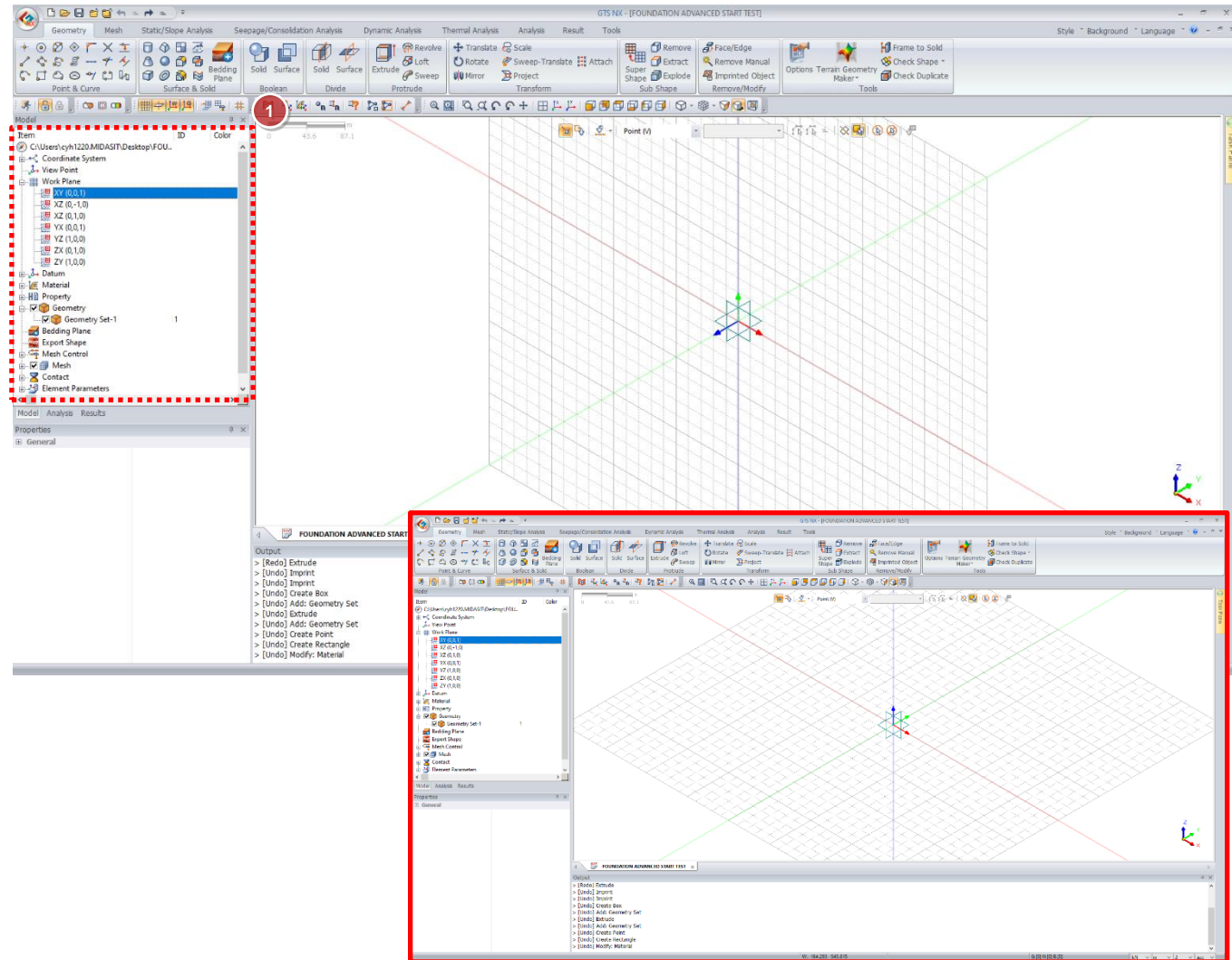
Change Work Plane

Procedure

- 1 Open "Work Plane" tree
Double click "XY(0,0,1)"

[Information]

You can select work plane to draw or import cad on selected plane

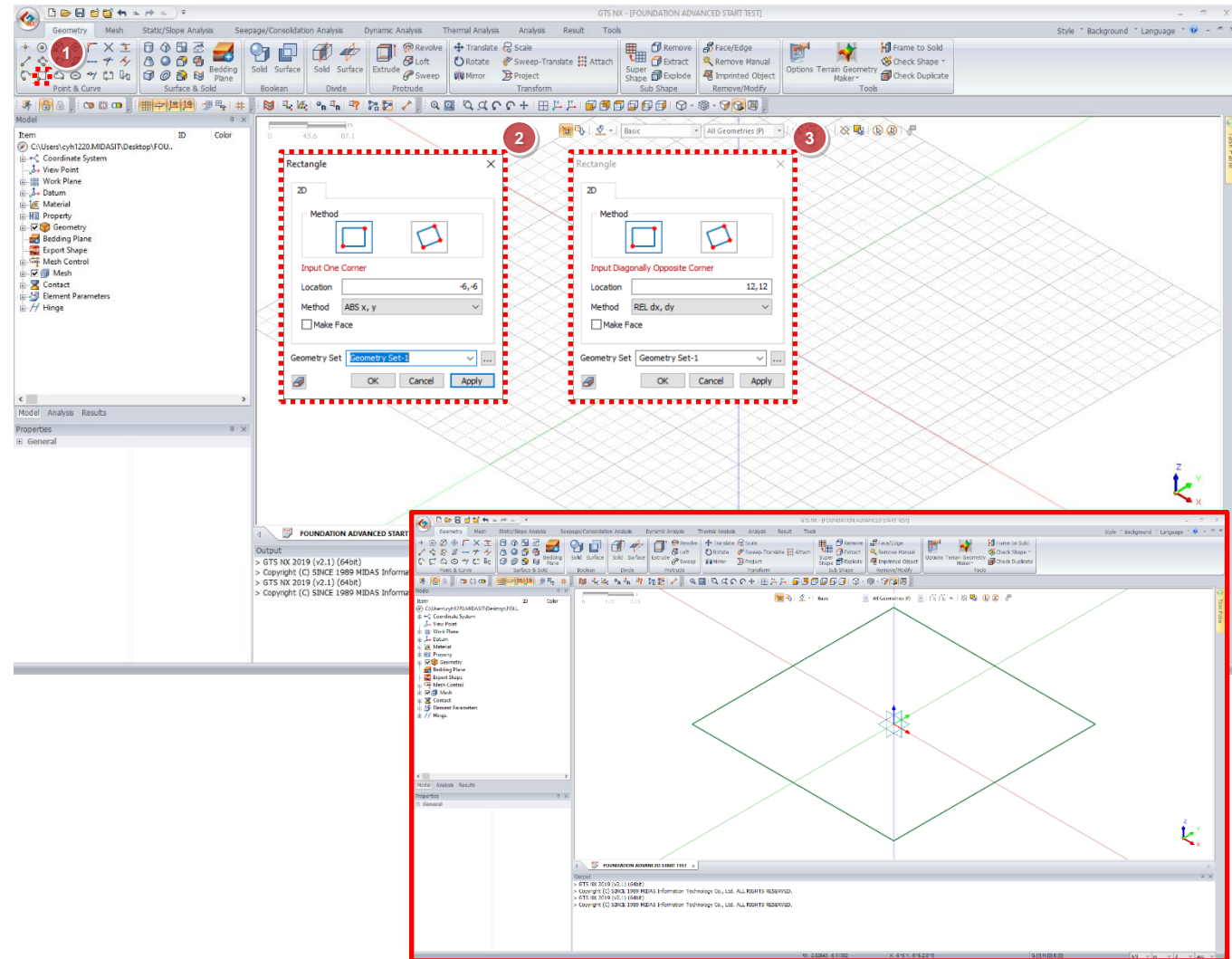


03 Geometry Modeling

Create rectangle for raft

Procedure

- 1 Click "Rectangle"
- 2 Location: -6,-6
Method: ABS x,y
Click "Apply"
- 3 Location: 12,12
Method: REL dx,dy
Click "OK"

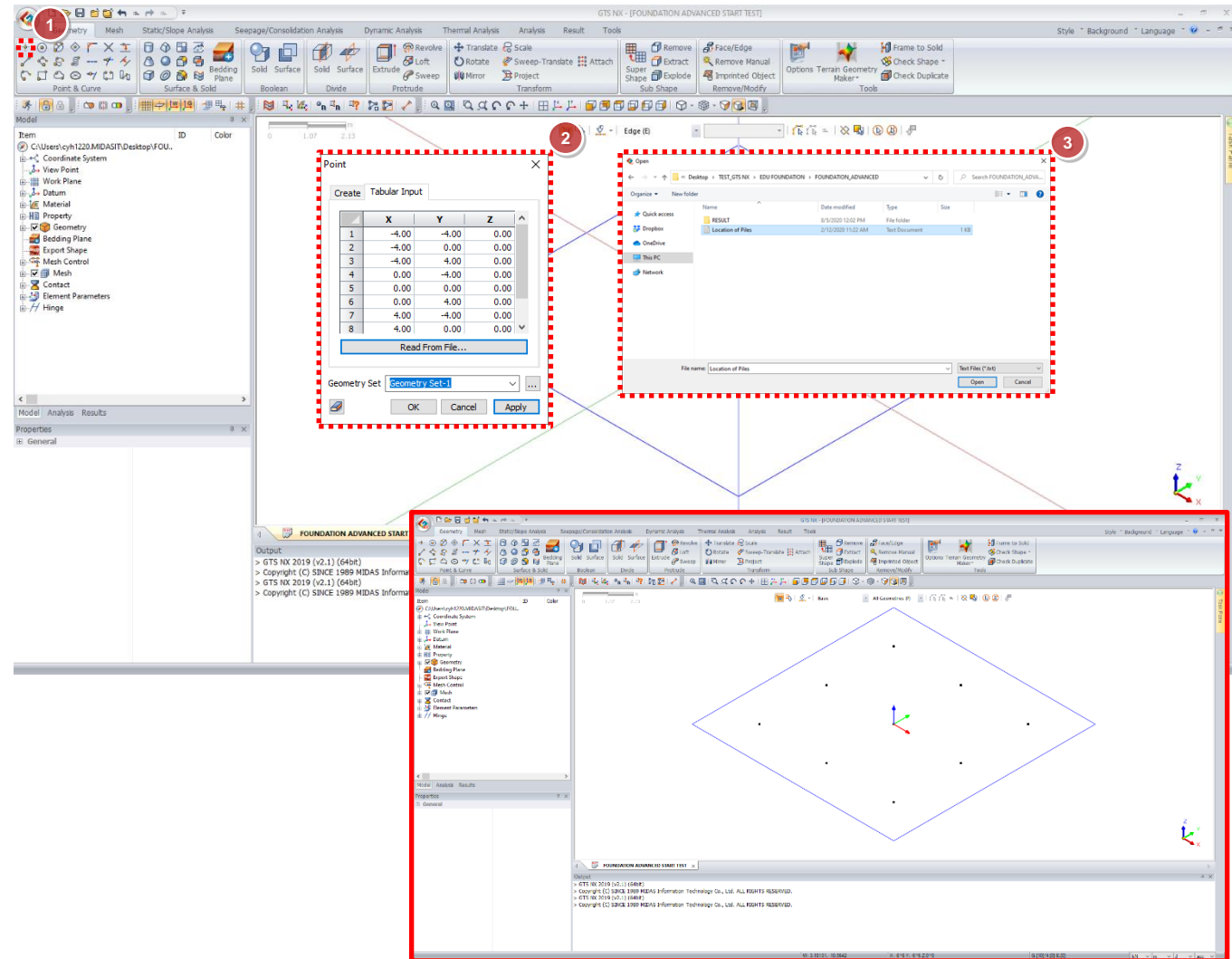


03 Geometry Modeling

Create Pile geometry

Procedure

- 1 Click "Point"
 - 2 Go to "Tabular Input" tab
Click "Read From File..."
 - 3 Select "Location of Piles"
Click "Open"
- Click "OK"

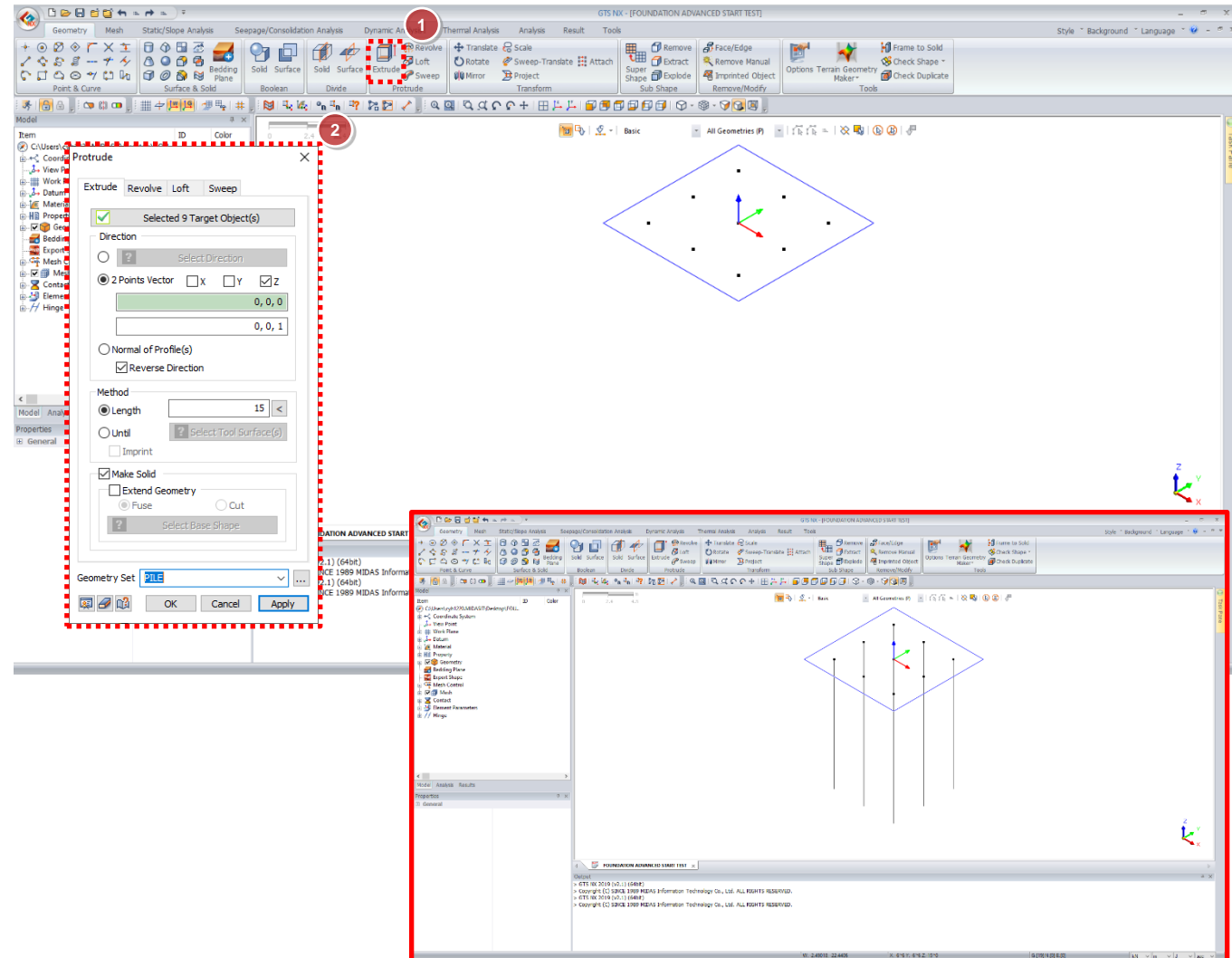


03 Geometry Modeling

Create Pile geometry

Procedure

- 1 Click "Extrude"
- 2 Select Target Object(s)
(9 Points)
Select 2 Points Vector Z only
Check on Reverse Direction
Length: 15
Geometry Set: PILE
Click "OK"

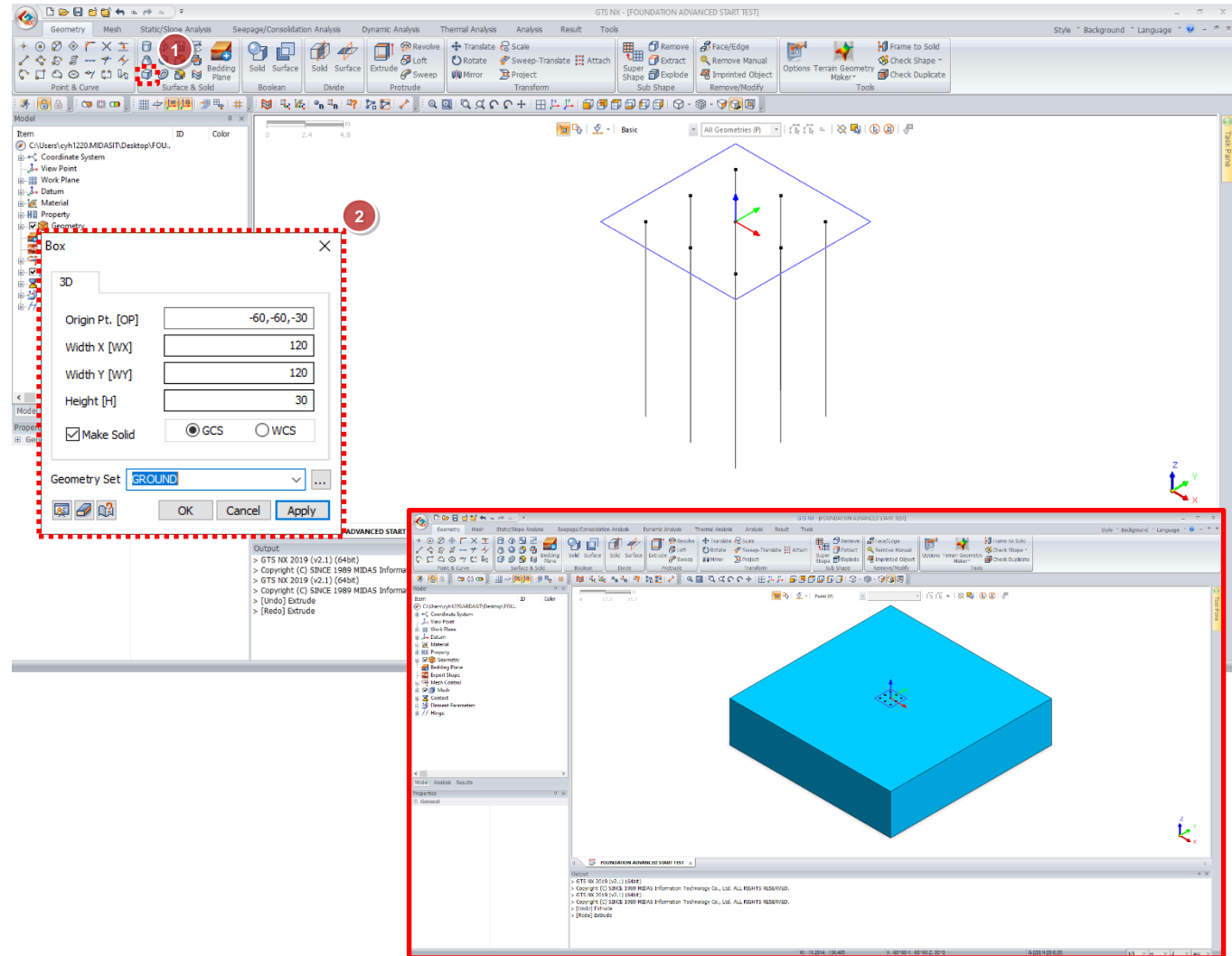


03 Geometry Modeling

Create Ground geometry

Procedure

- 1 Click "Box"
- 2 Origin Pt.: -60,-60,-30
Width X: 120
Width Y: 120
Height: 30
Geometry Set: Ground
Click "OK"

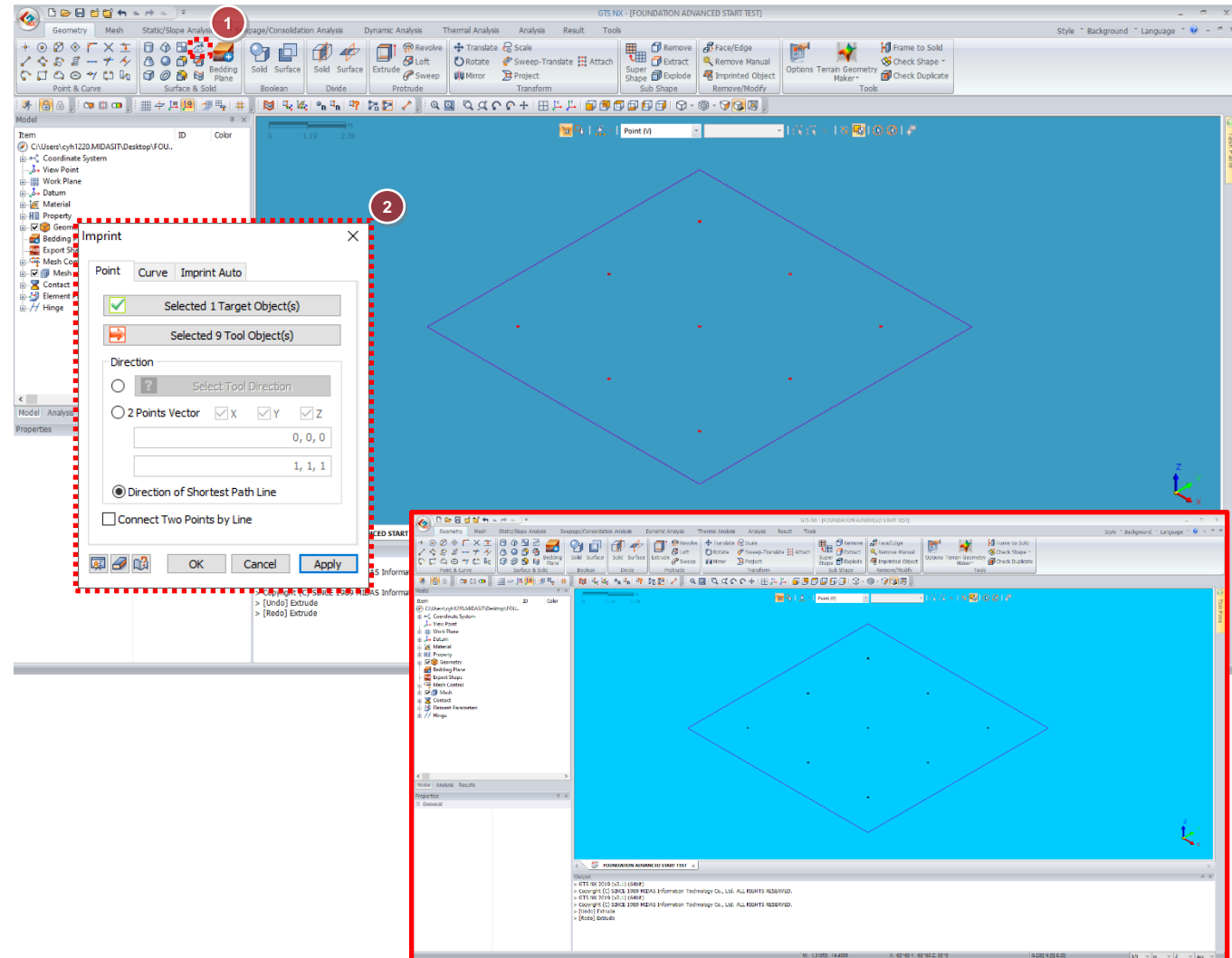


03 Geometry Modeling

Imprint points on ground surface

Procedure

- 1 Click "Imprint"
- 2 Point tab
Select Target Object:
ground surface
Select Tool Object:
point of pile head (9 Nos.)
Select "Direction of Shortest
Path Line"
Click "OK"

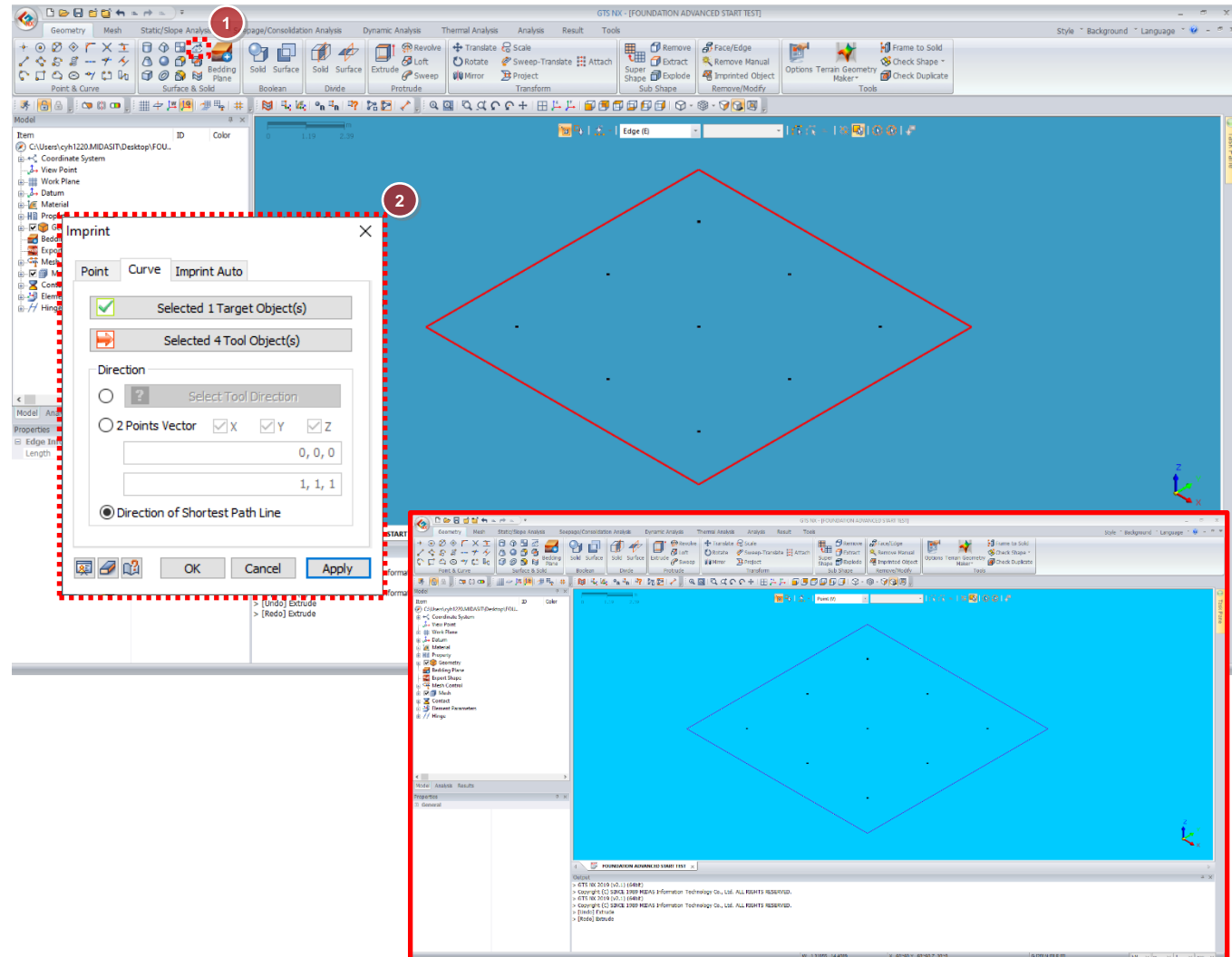


03 Geometry Modeling

Imprint curves on ground surface

Procedure

- 1 Click "Imprint"
- 2 Curve tab
Select Target Object:
ground surface
Select Tool Object:
lines for raft (4 Nos.)
Select "Direction of Shortest
Path Line"
Click "OK"



03 Geometry Modeling

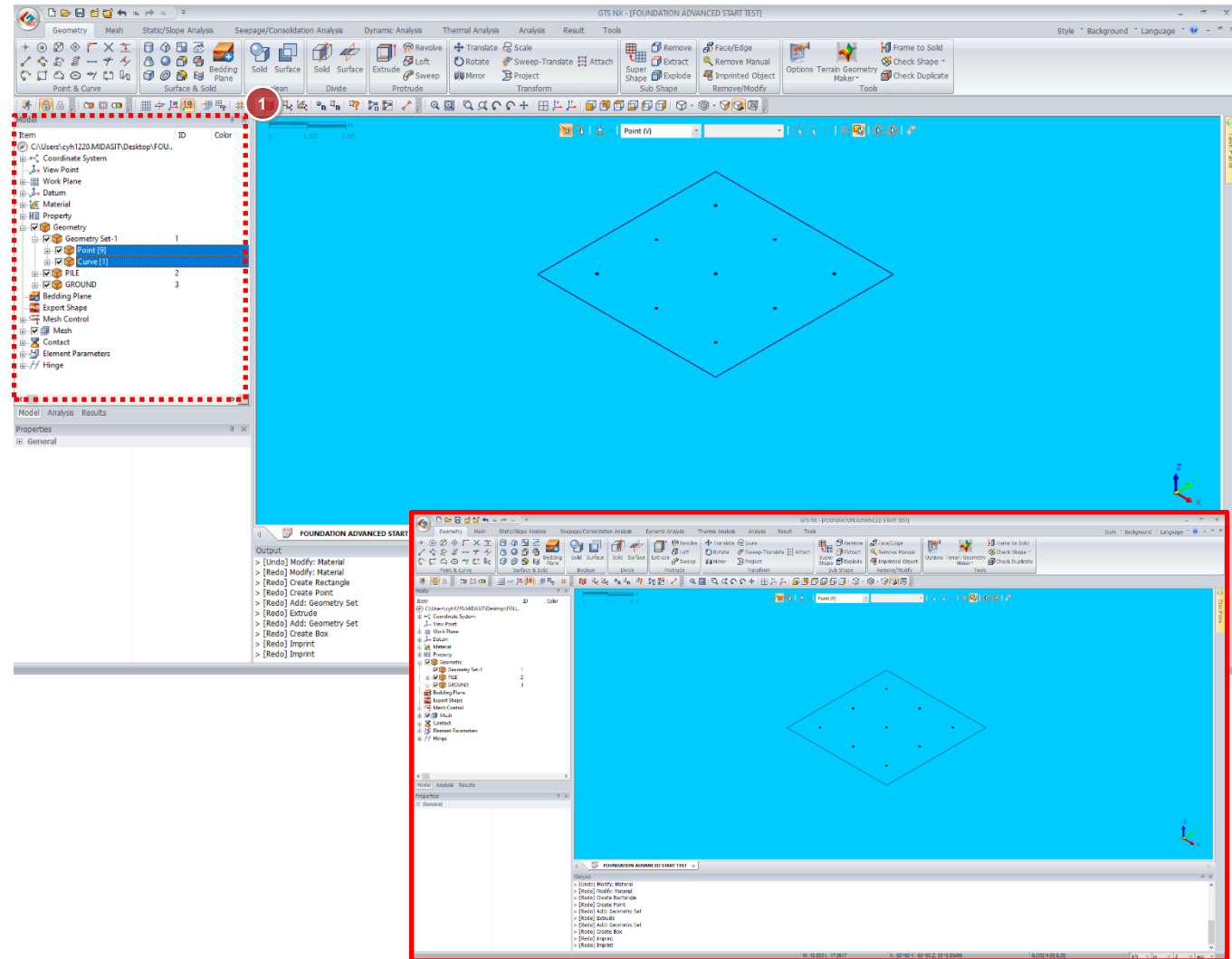
Imprint curves on ground surface

Procedure

- 1 Open Geometry tree
Delete Points (9) and Curve (1)
under Geometry Set-1

[Information]

After imprint stage, lines and points will be remained which are imprinted on the face.

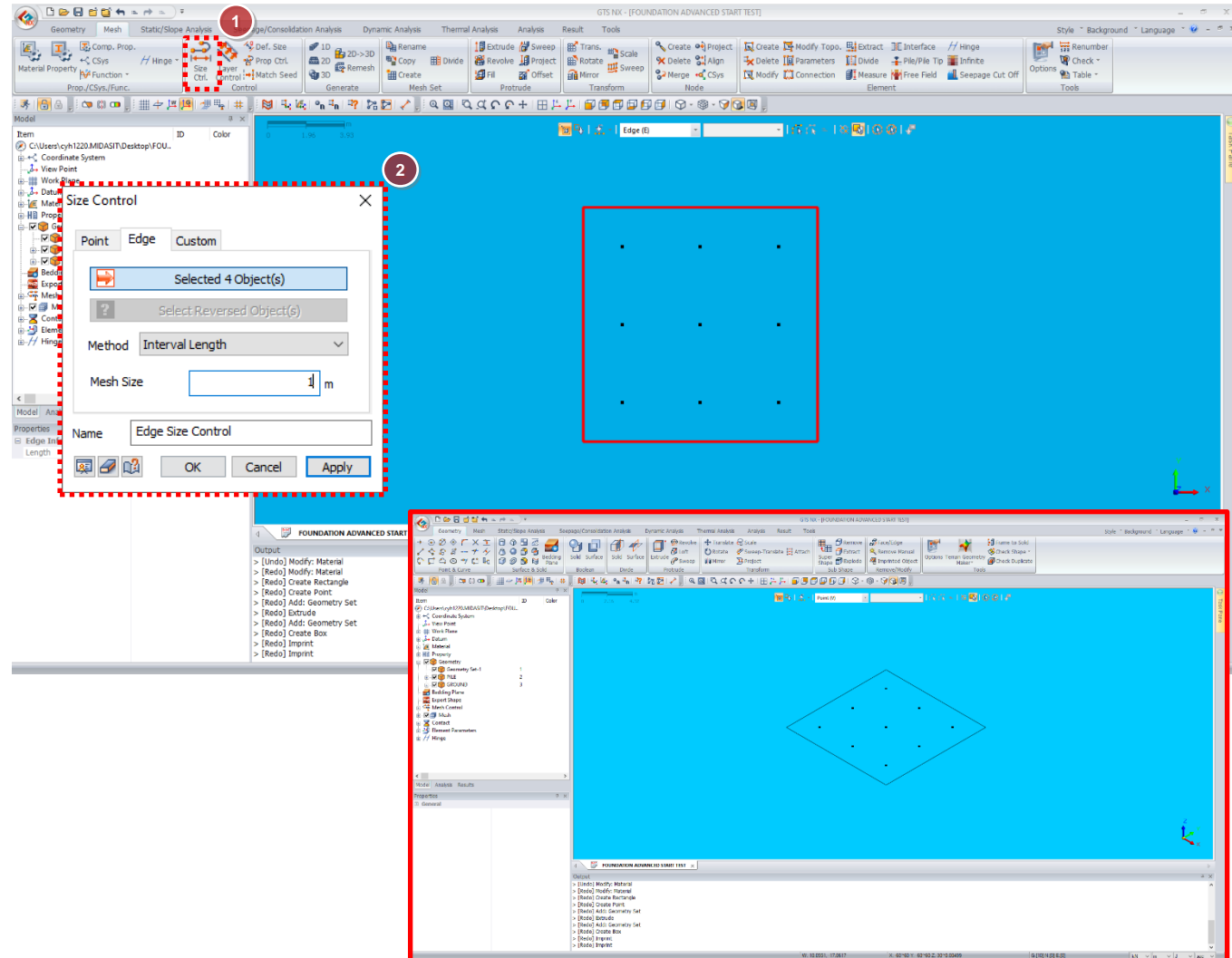


03 Geometry Modeling

Control mesh size

Procedure

- 1 Click "Size Ctrl."
- 2 Edge tab
Select 4 lines from raft
Mesh Size: 1m
Click "OK"



The background of the slide features a complex, interconnected mesh of thin lines and small circular nodes. The mesh is denser on the left side and becomes sparser towards the right. The color of the background transitions from a vibrant green on the left to a warm orange and red on the right, with the mesh lines and nodes appearing in a dark brown or black color.

GTS NX

New eXperience of Geo-Technical analysis System

Mesh Generation

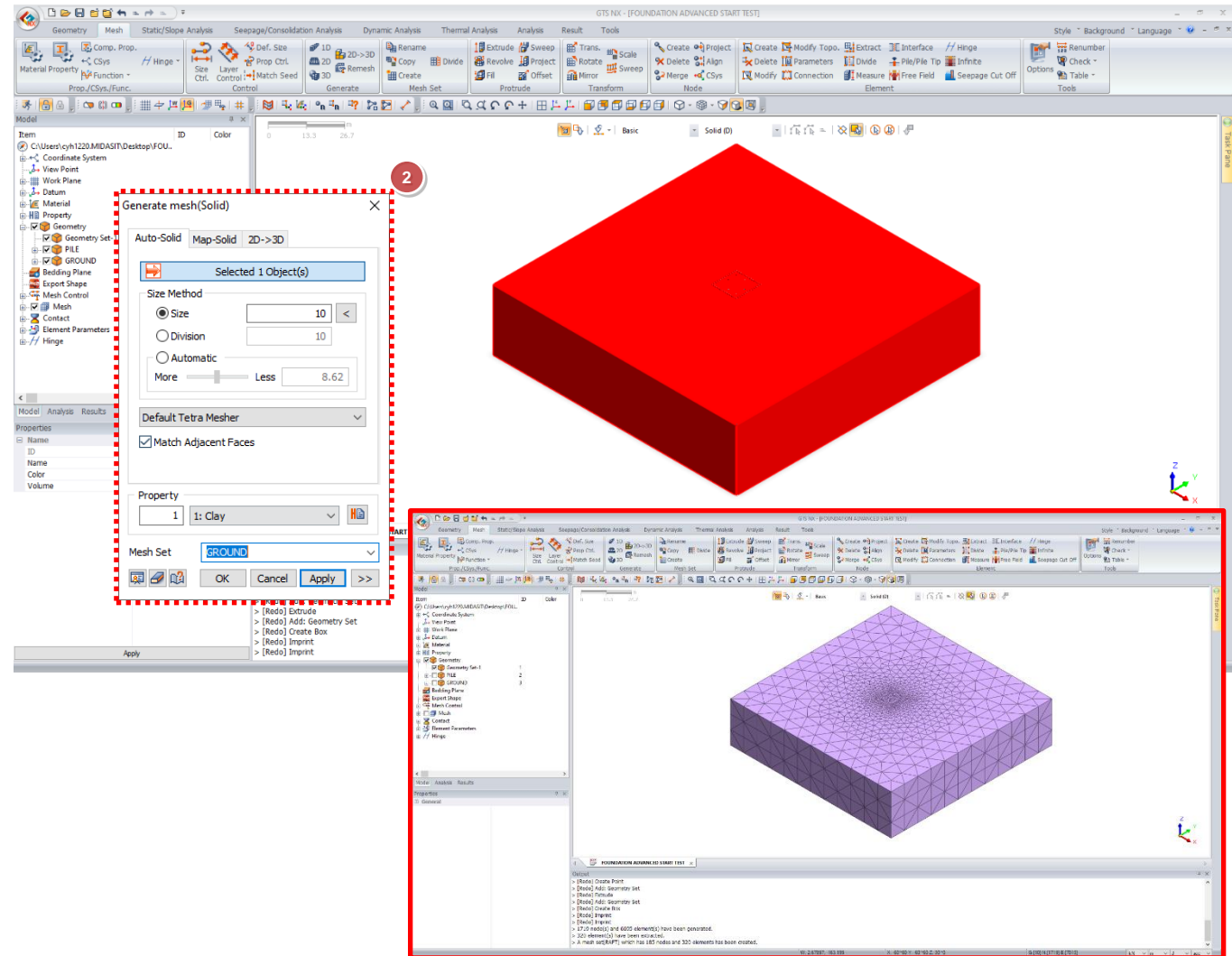
MIDAS

04 Mesh Generation

Generate the mesh for ground

Procedure

- 1 Select Solid
Right click from mouse
Click "Generate Mesh"
- 2 Size Method: 10 m
Mesh Set: GROUND
Click "OK"

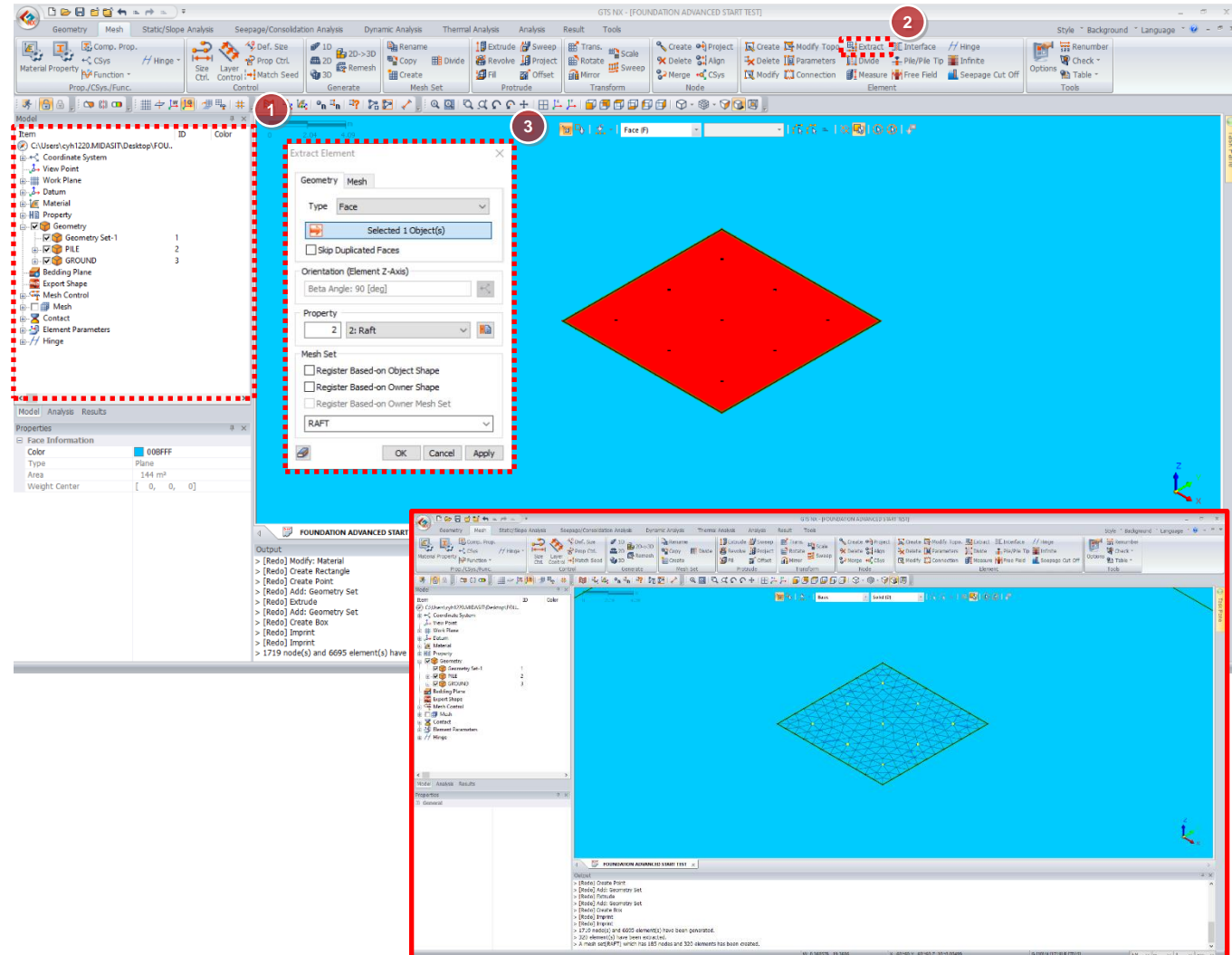


04 Mesh Generation

Generate the mesh for raft

Procedure

- 1 <Geometry Tree>
Show every geometry
- 2 Click "Extract"
- 3 Type: Face
Select face of raft
Mesh Set: RAFT
Click "OK"

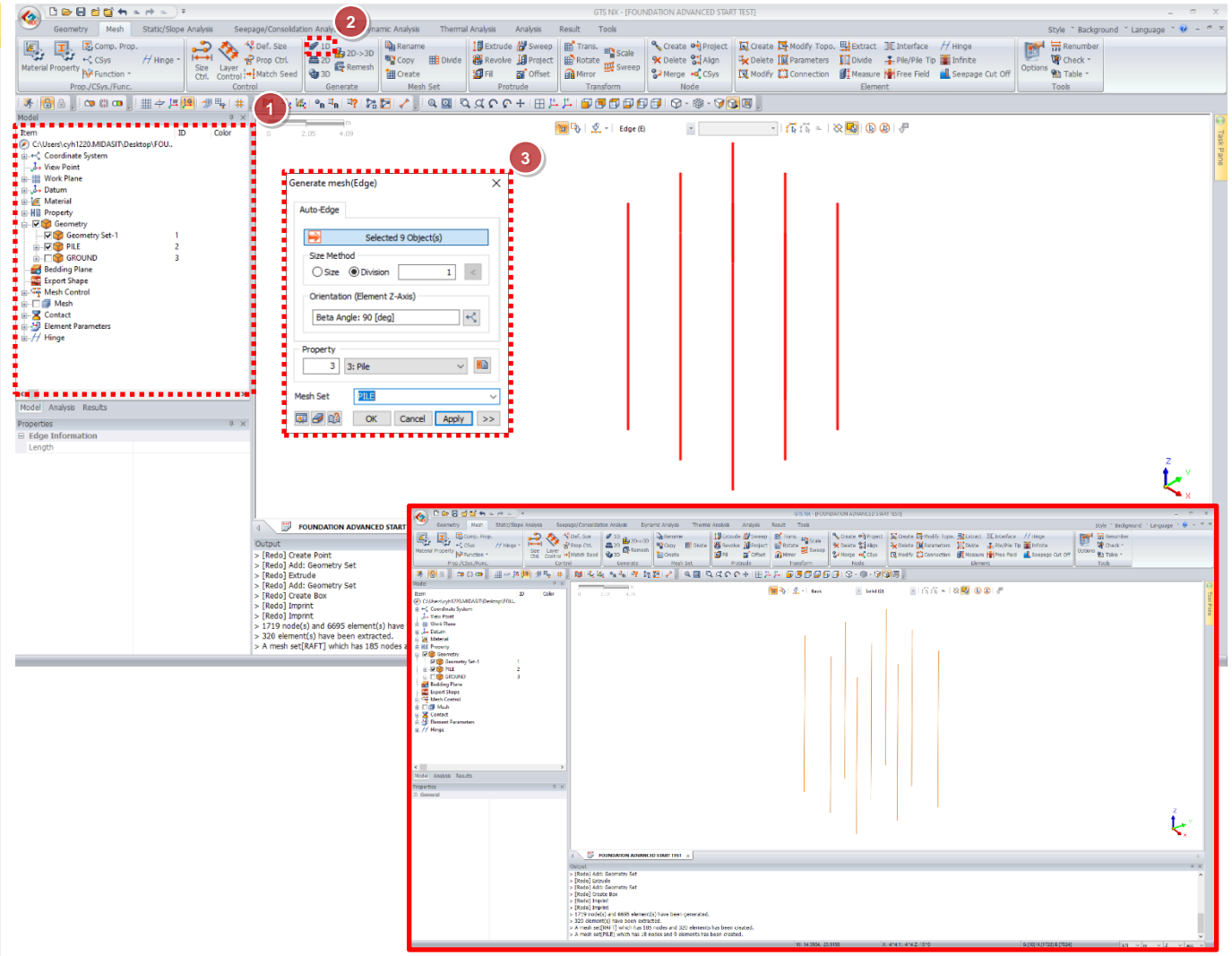


04 Mesh Generation

Generate the mesh for pile

Procedure

- 1 <Geometry Tree>
Show only pile geometry
- 2 Click "1D"
- 3 Division: 1
Property: Pile
Mesh Set: PILE
Click "OK"



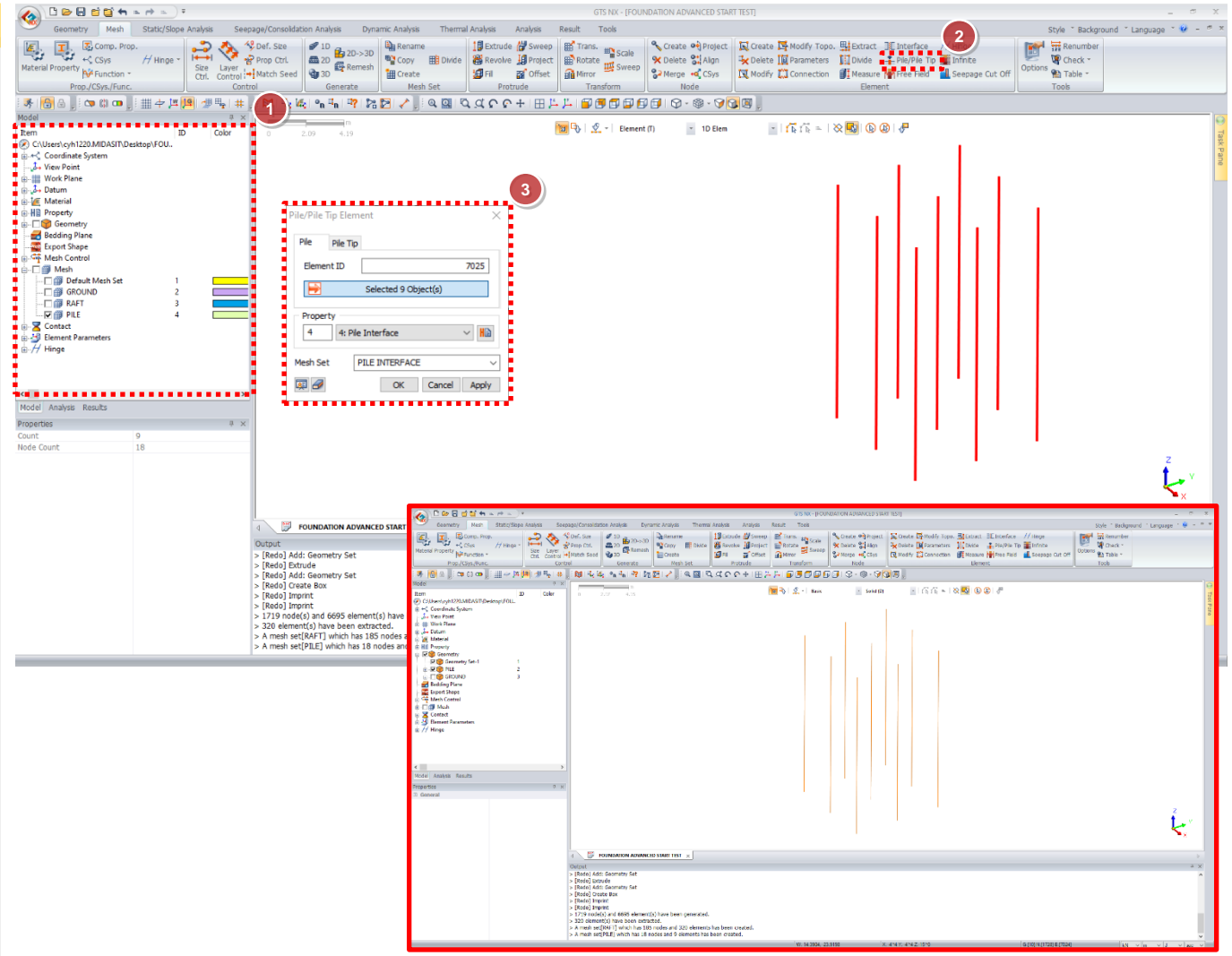
04 Mesh Generation

Generate the mesh for pile interface

Procedure

- 1 <Geometry Tree>
Hide every geometry

<Mesh Tree>
Show only PILE mesh set
- 2 Click "Pile/Pile Tip"
- 3 Select piles (9 Nos.)
Click "Apply"

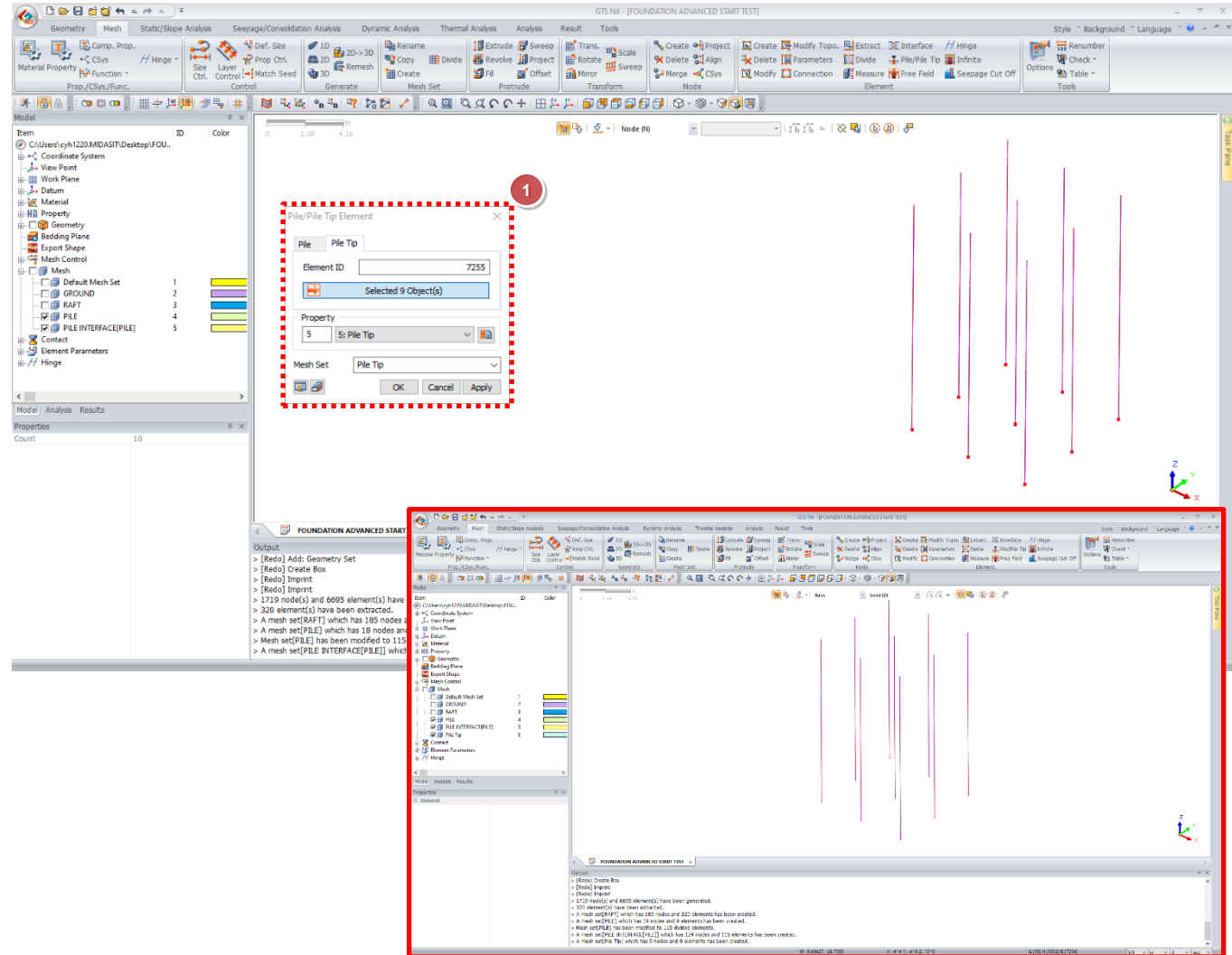


04 Mesh Generation

Generate the mesh for pile tip

Procedure

- 1 Go to Pile Tip tab
Select pile toes (9 Nos.)
Mesh Set: Pile Tip
Click "OK"



Procedure

-
- The screenshot displays the GTS NX software interface. The 'Node Control' dialog box is open, showing 'Selected 18 Object(s)' and 'Tolerance: 1e-005'. The 'FOUNDATION ADVANCED START' model is visible in the background, showing a green mesh structure with red nodes and purple lines representing piles. The 'Output' window shows the results of the meshing process.
- Output:**
- > [Redo] Create Box
 - > [Redo] Import
 - > [Redo] Import
 - > 1719 node(s) and 6695 element(s) have been extracted.
 - > A mesh set[RAFT] which has 185 nodes and 222 element(s) have been created.
 - > A mesh set[PILE] which has 18 nodes and 2 element(s) have been created.
 - > Mesh set[PILE] has been modified to 115 nodes and 2 element(s).
 - > A mesh set[PILE INTERFACE[PILE]] which has 9 nodes and 2 element(s) have been created.
 - > A mesh set[PILE TIP] which has 9 nodes and 2 element(s) have been created.
 - > [Undo] [Redo] merged.

The background of the slide features a complex network diagram. It consists of numerous small, dark grey circular nodes connected by thin, light grey lines. These lines form a web-like structure that fills the entire frame. The background color is a gradient, transitioning from a light green on the left to a bright yellow in the center, and finally to a deep orange-red on the right. The network diagram is overlaid on this gradient, with the lines and nodes appearing darker in the yellow and orange areas and lighter in the green areas.

GTS NX

New eXperience of Geo-Technical analysis System

Load & Boundary Condition

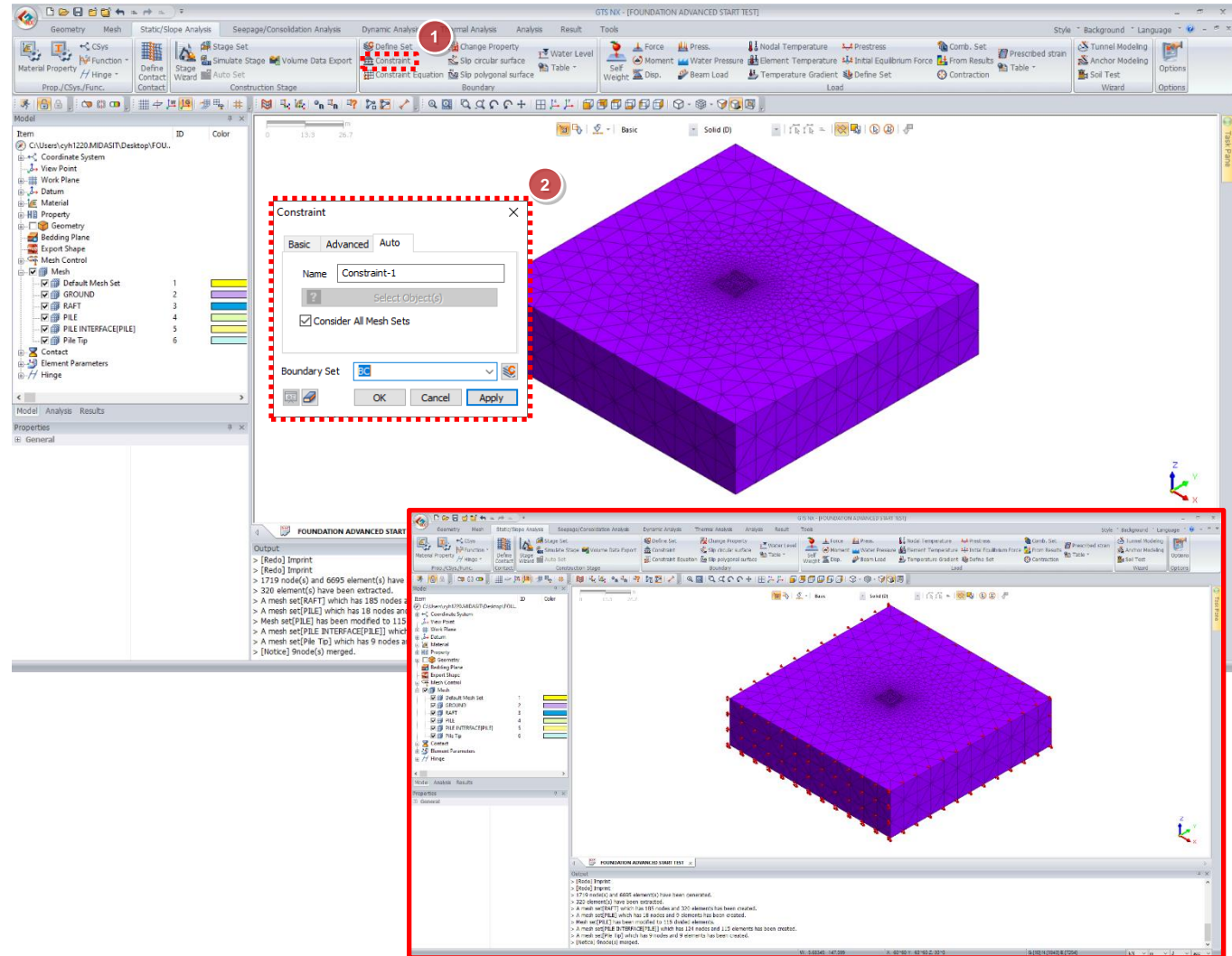
MIDAS

05 Load & Boundary Condition

Make boundary condition to ground

Procedure

- 1 Click "Constraint"
- 2 Go to "Auto" tab
Boundary Set name "BC"
Click "OK"

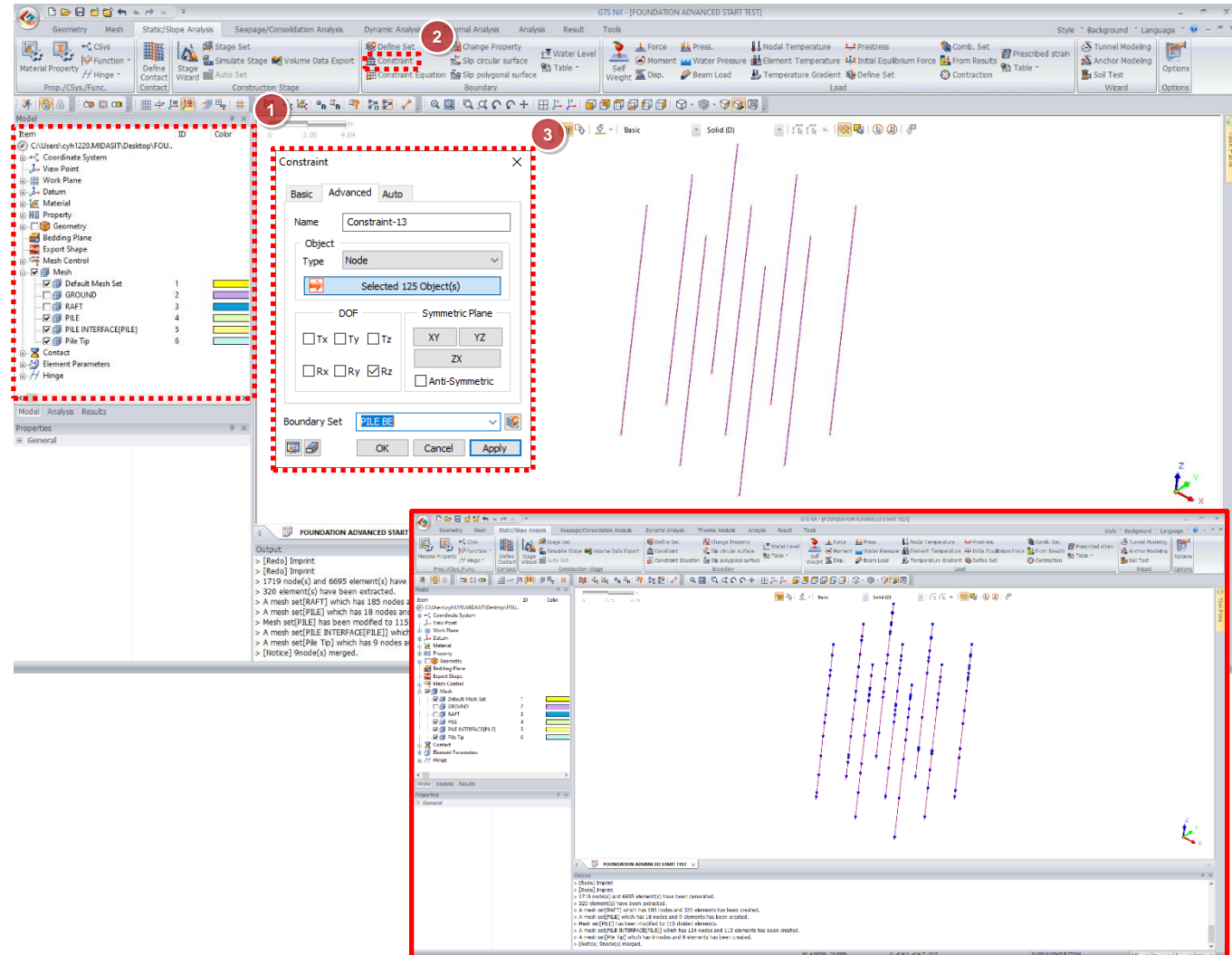


05 Load & Boundary Condition

Make boundary condition to piles

Procedure

- 1 <Geometry Tree>
Hide every geometry
- 2 <Mesh Tree>
Show Pile / Pile Interface /
Pile Tip
- Click "Constraint"
- Go to "Advanced" tab
Select every piles (Ctrl+a)
Check on "Rz"
Boundary Set: PILE BC
Click "OK"

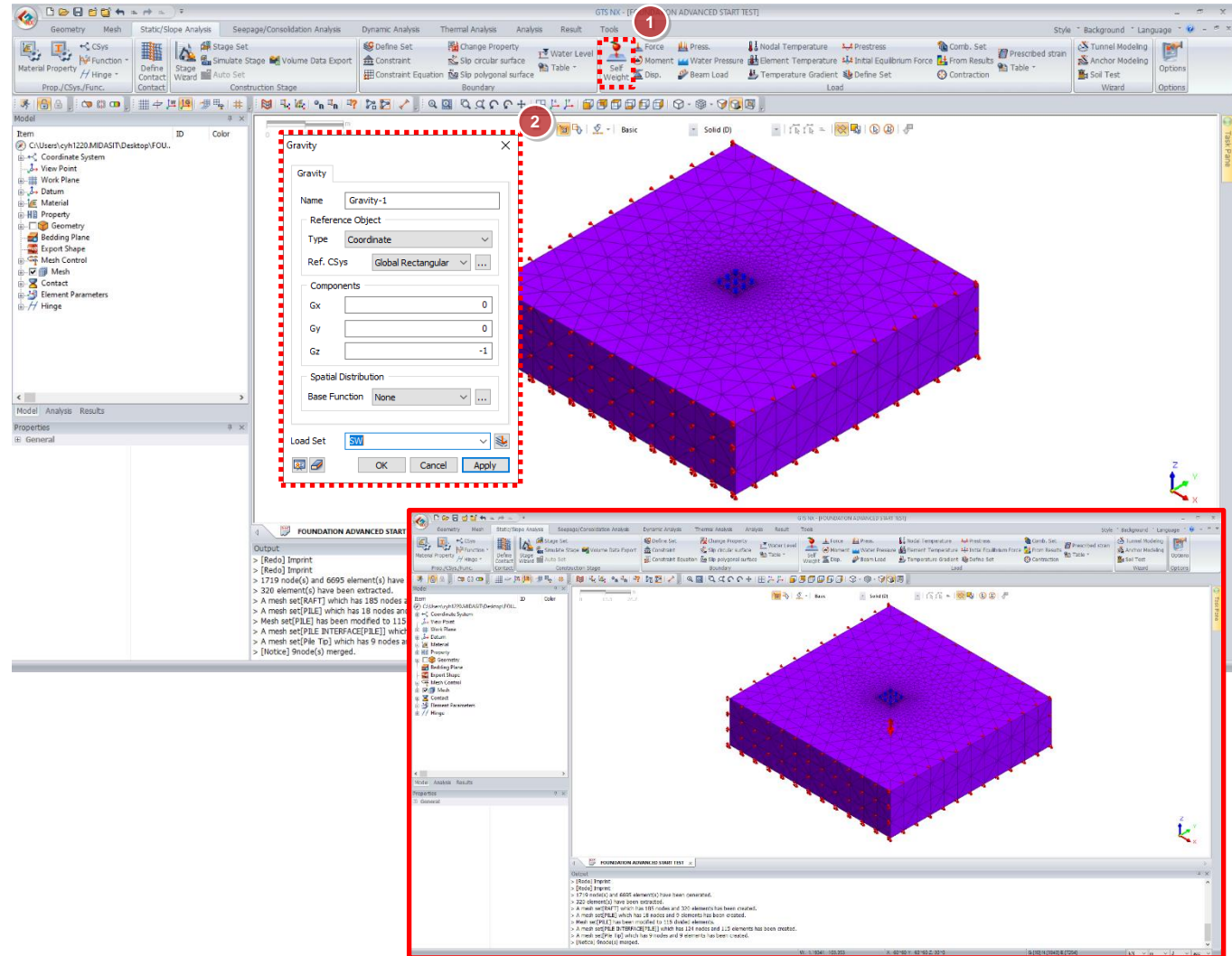


05 Load & Boundary Condition

Make self weight

Procedure

- 1 Click "Self Weight"
- 2 Load Set name "SW"
Click "OK"

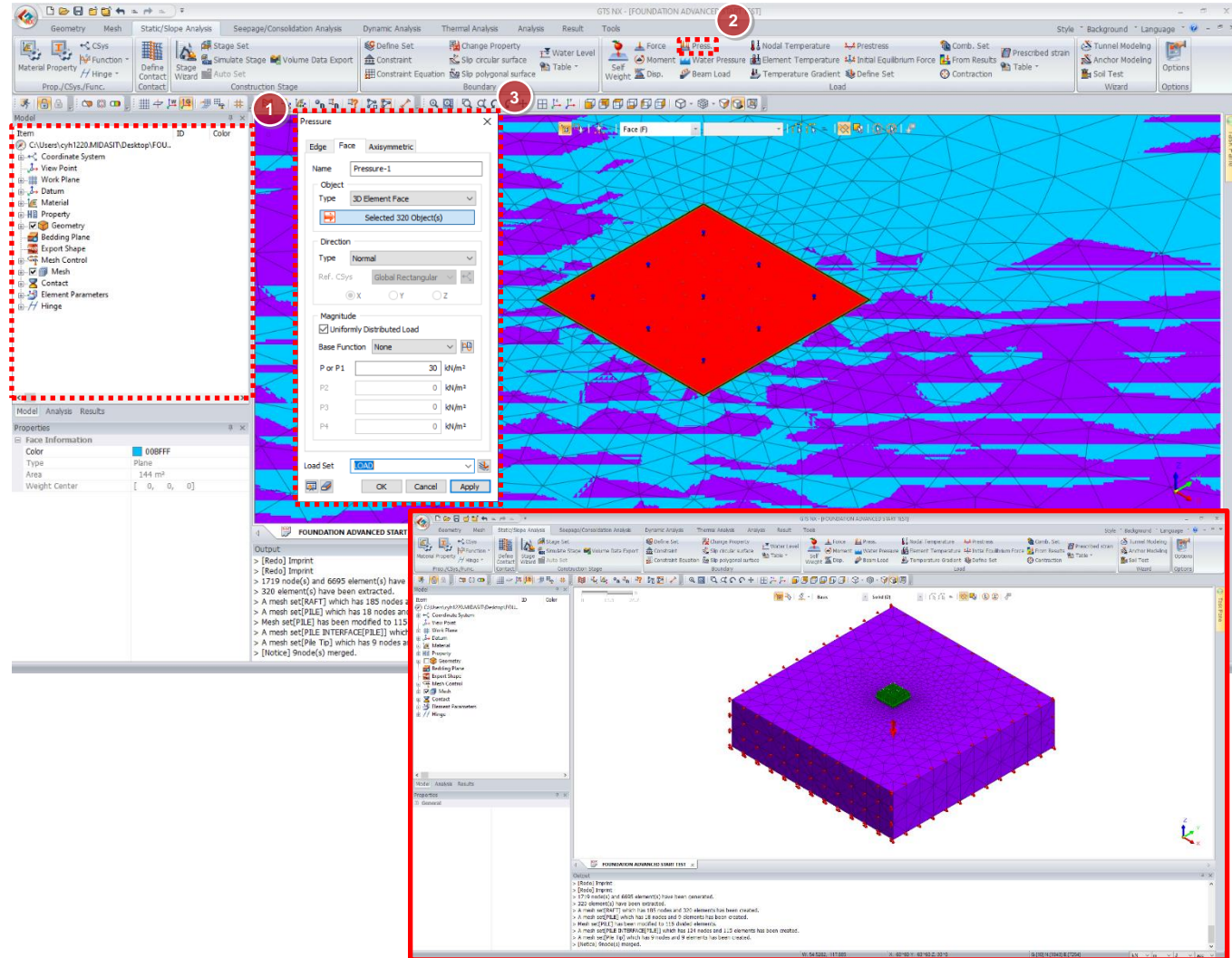


05 Load & Boundary Condition

Make surcharge

Procedure

- 1 <Geometry Tree>
Show every geometry
- <Mesh Tree>
Show every mesh
- 2 Click "Press."
- 3 Go to "Face" tab
Object type "3D Element Face"
Selection method change to face (F)
Select raft part
P or P1: 30
Load Set: LOAD
Click "OK"



The background of the slide features a complex network of thin, dark lines connecting numerous small, dark circular nodes. This network is overlaid on a color gradient that transitions from a light green on the left to a bright yellow in the center, and finally to a deep orange-red on the right. The overall effect is a sense of interconnectedness and digital technology.

GTS NX

New eXperience of Geo-Technical analysis System

Define Analysis Stage

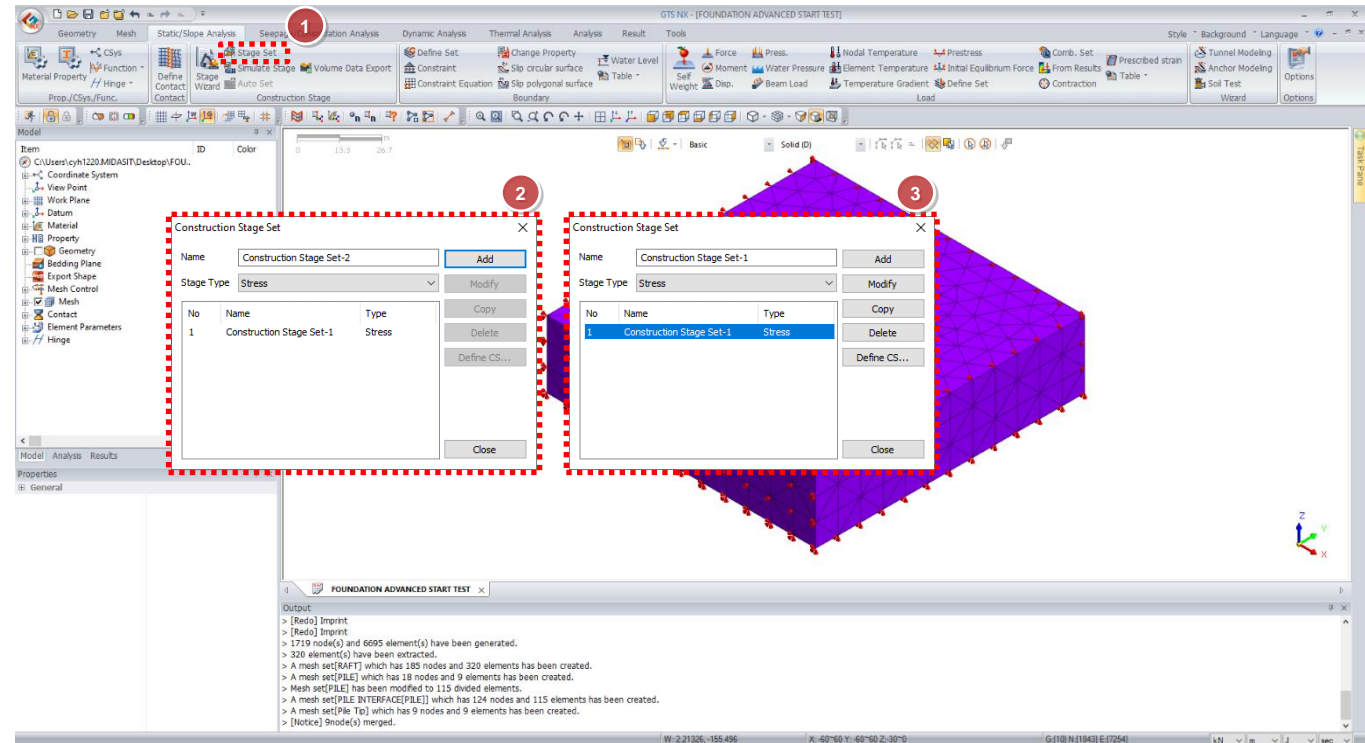
MIDAS

06 Define Analysis Stage

Define stage type

Procedure

- 1 Click "Stage Set"
- 2 Stage Type
"Stress"
Click "Add"
- 3 Select created stage set
Click "Define CS..."



06 Define Analysis Stage

Initial Stage

Procedure

Stage Name "INITIAL"

<Activate>
GROUND
BC
SW

<Deactivate>
-

<Water Level For Global>
-3 m

Check on "Clear Displacement"

Click "Save"

Click "New"

[Information]
If you want to define flat water level, you can just give value for height which is follow global coordinate.

Define Construction Stage

Construction Stage Set Name

Construction Stage Set-1

Stage ID

1: INITIAL

Move to Previous

Move to Next

Stage Name

INITIAL

New

Insert

Delete

Stage Type

Stress

Set Data

Activated Data

Deactivated Data

Sort By

Name

Show Data

All

Save

Close

Mesh

Default Mesh Set

GROUND

PILE

PILE INTERFACE[PILE]

Pile Tip

RAFT

Boundary Condition

BC

PILE BC

Static Load

LOAD

SW

Contact

Mesh

GROUND

Boundary Condition

BC

Static Load

SW

Contact

Mesh

Boundary Condition

Static Load

Contact

Analysis Control...

Output Control...

Initial Condition

☒ Define Water Level For Global

-3

m

None

...

☐ Define Water Level For Mesh Set

Input Water Level...

☐ LDF...

☒ Clear Displacement

☐ Slope Stability(SRM)

06 Define Analysis Stage

Initial Stage

Procedure

Stage Name "PILED RAFT"

<Activate>

PILE

PILE INTERFACE

PILE TIP

RAFT

PILE BC

<Deactivate>

-

Check on "Clear Displacement"

Click "Save"

Click "New"

Define Construction Stage

Construction Stage Set Name: Construction Stage Set-1

Stage ID: 2: PILED RAFT Move to Previous Move to Next

Stage Name: PILED RAFT New Insert Delete

Stage Type: Stress

Set Data	Activated Data	Deactivated Data
<ul style="list-style-type: none">Mesh<ul style="list-style-type: none">Default Mesh SetGROUNDPILEPILE INTERFACE[PILE]Pile TipRAFTBoundary Condition<ul style="list-style-type: none">BCPILE BCStatic Load<ul style="list-style-type: none">LOADSWContact	<ul style="list-style-type: none">Mesh<ul style="list-style-type: none">PILEPILE INTERFACE[PILE]Pile TipRAFTBoundary Condition<ul style="list-style-type: none">PILE BCStatic LoadContact	<ul style="list-style-type: none">Mesh<ul style="list-style-type: none">Boundary ConditionStatic LoadContact

Sort By: Name Show Data: All

Save Close

Analysis Control... Output Control...

Initial Condition

☐ Define Water Level For Global 0 m None ...

☐ Define Water Level For Mesh Set Input Water Level...

☐ LDF...

☒ Clear Displacement

☐ Slope Stability(SRM)

06 Define Analysis Stage

Initial Stage

Procedure

Stage Name "LOAD"

<Activate>
LOAD

<Deactivate>
-

Click "Save"

Click "Close"

Define Construction Stage

Construction Stage Set Name

Construction Stage Set-1

Stage ID

3: LOAD

Move to Previous

Move to Next

Stage Name

LOAD

New

Insert

Delete

Stage Type

Stress

Set Data

Activated Data

Deactivated Data

Sort By

Name

Show Data

All

Save

Close

Mesh

Default Mesh Set

GROUND

PILE

PILE INTERFACE[PILE]

Pile Tip

RAFT

Boundary Condition

BC

PILE BC

Static Load

LOAD

SW

Contact

Mesh

Boundary Condition

Static Load

LOAD

Contact

Mesh

Boundary Condition

Static Load

Contact

Analysis Control...

Output Control...

Initial Condition

Define Water Level For Global

0 m

None

...

Define Water Level For Mesh Set

Input Water Level...

LDF...

Clear Displacement

Slope Stability(SRM)

The background of the slide features a complex network of interconnected nodes and lines, resembling a mesh or a molecular structure. The nodes are small dark circles, and the lines are thin, light-colored. The overall color scheme transitions from a vibrant green on the left to a warm orange and red on the right, with a yellowish center. The network pattern is more dense on the left and becomes sparser towards the right.

GTS NX

New eXperience of Geo-Technical analysis System

Analysis Case

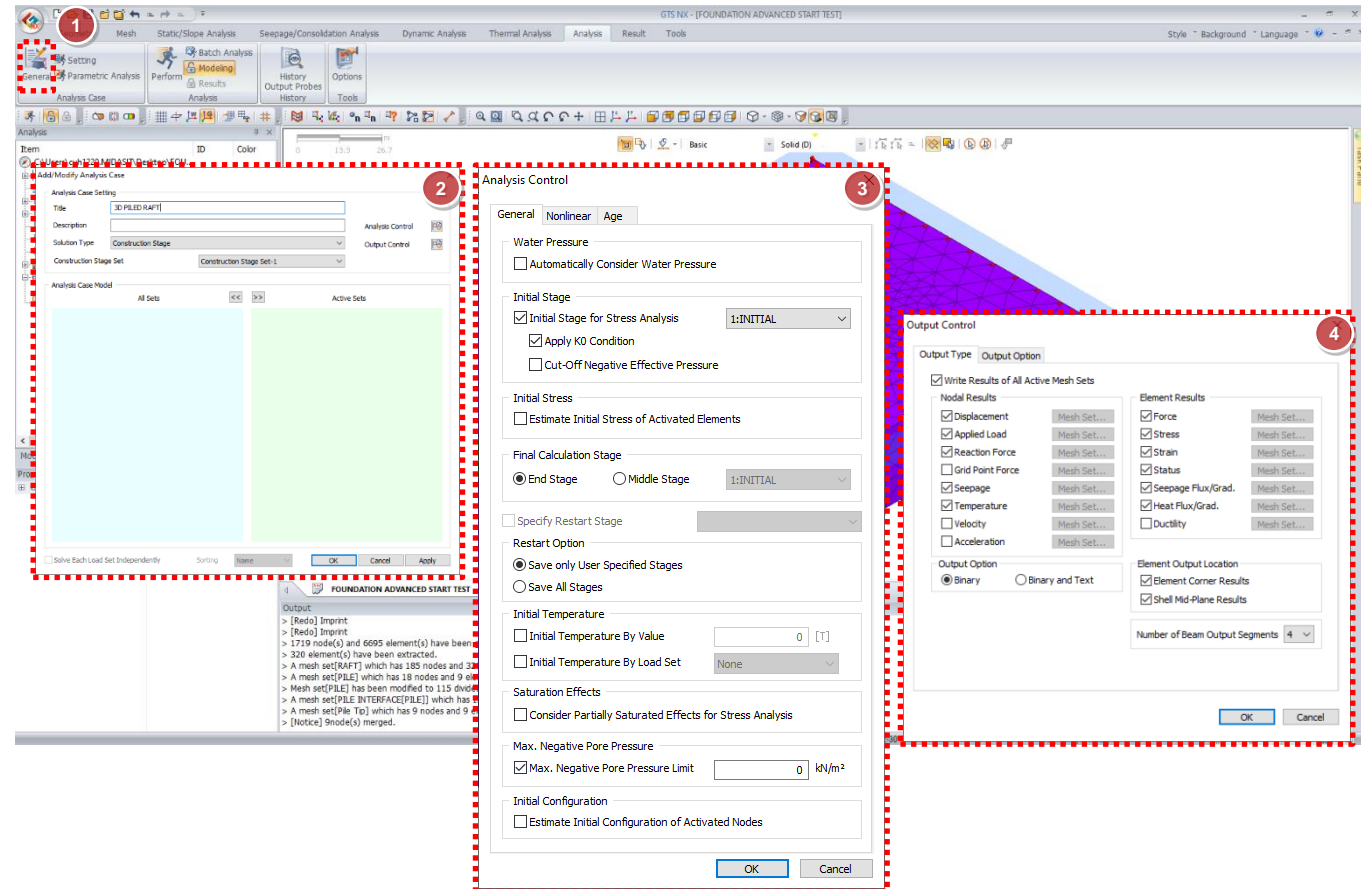
MIDAS

07 Analysis Case

Define stage type

Procedure

- 1 Click "General"
 - 2 Title: 3D PILED RAFT
Construction Stage Set:
Construction Stage Set-1
Click "Analysis Control"
 - 3 General tab
Check on "Initial Stage for..."
Check on "Apply K0 Condition"
Click "OK"
 - 4 Click "Output Control"
Check on "Strain"
Click "OK"
- Click "OK"

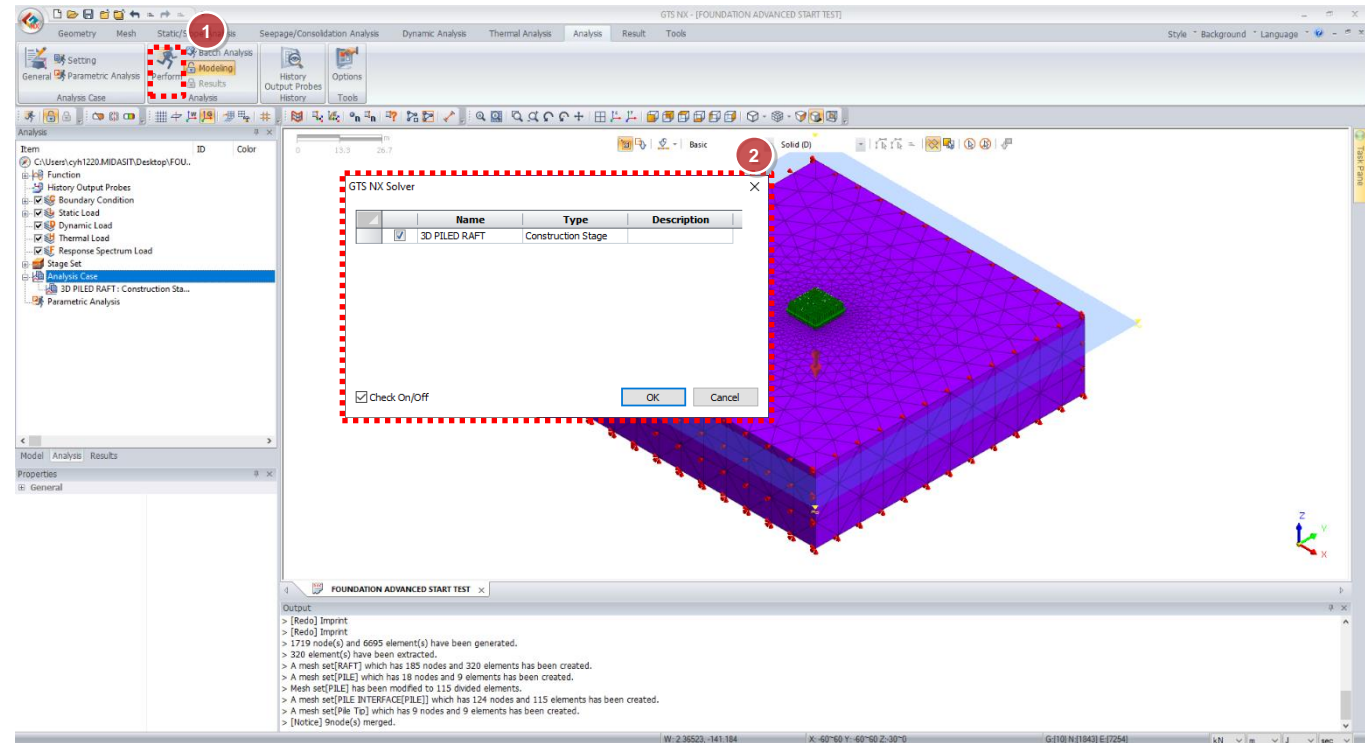


07 Analysis Case

Perform the analysis

Procedure

- 1 Click "Perform"
- 2 Check on 3D Raining Effect
Click "OK"



The background of the slide features a complex network of interconnected nodes and lines, resembling a mesh or a molecular structure. The nodes are small dark circles, and the lines are thin, light-colored. The overall color scheme transitions from a vibrant green on the left to a warm orange and red on the right, with a yellowish-green in the center.

GTS NX

New eXperience of Geo-Technical analysis System

Result Checking

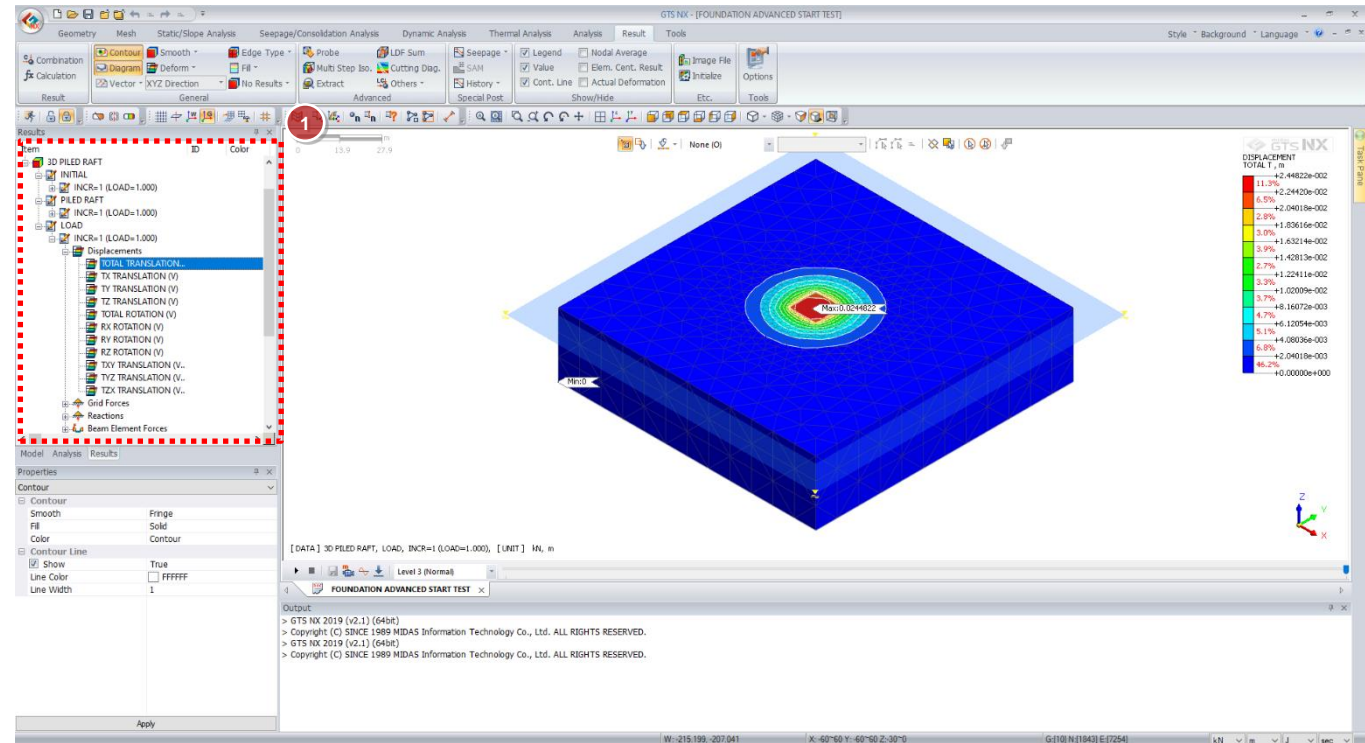
MIDAS

08 Result Checking

Total Displacement

Procedure

- 1 Displacement > TOTAL TRANSLATION



08 Result Checking

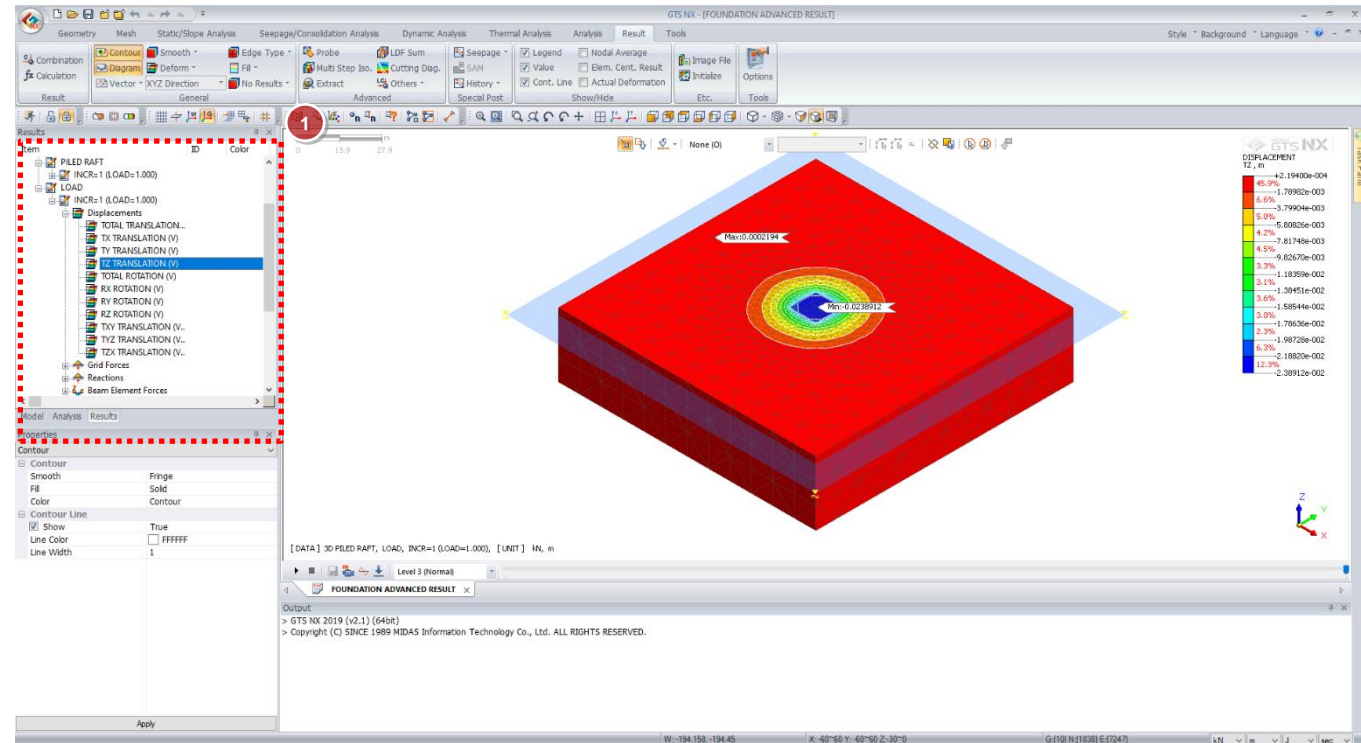
Settlement of Ground

Procedure

- 1 Displacement > TZ
TRANSLATION(V)

[Information]

Please show only ground mesh set



08 Result Checking

Settlement of Ground with clipping plane

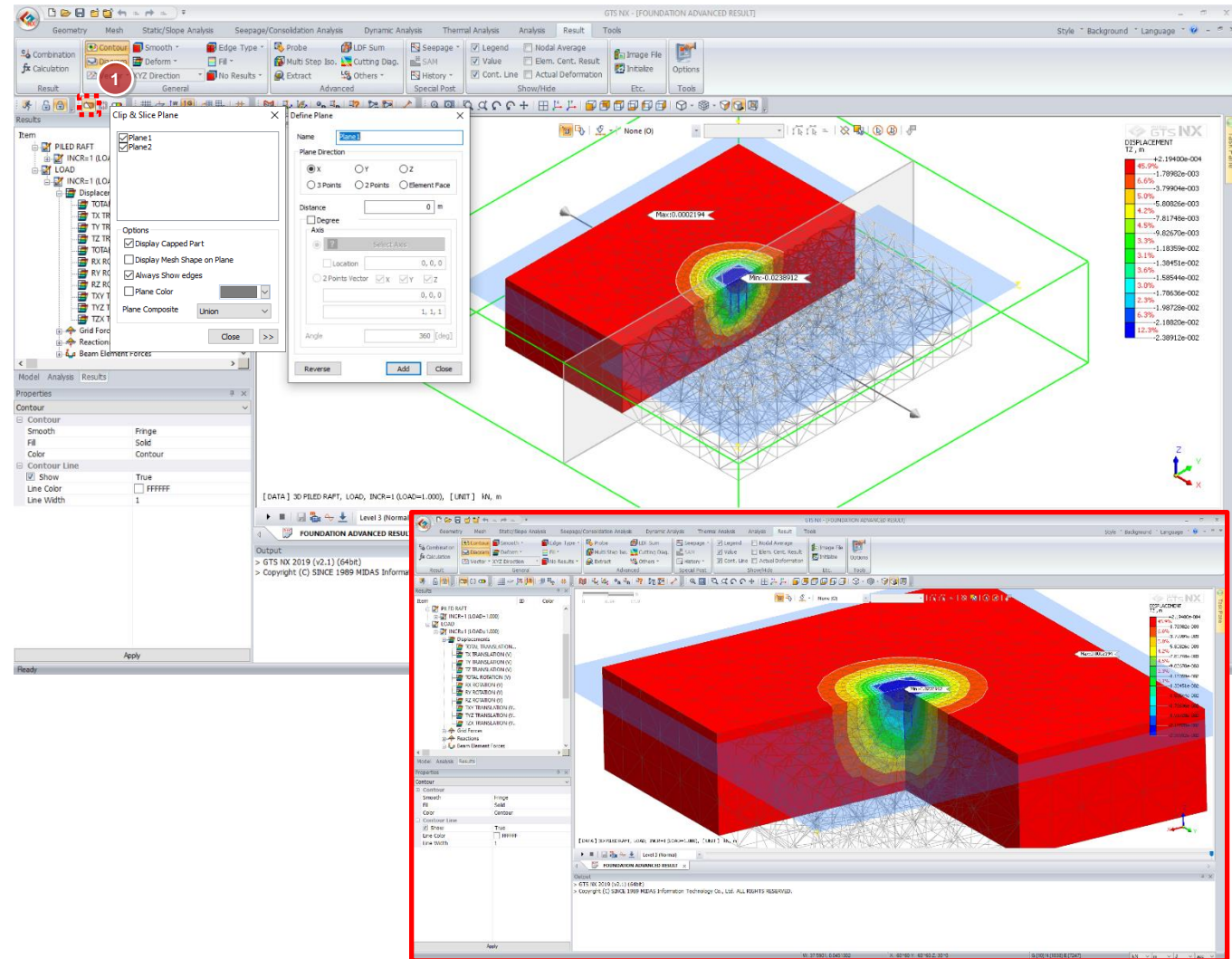
Procedure

1 Click "Clipping Plane"

Select "x" Direction
Click "Add"

Select "Y" Direction
Click "Add"
Click "Close"

Plane Composite: "Union"
Click "Close"



08 Result Checking

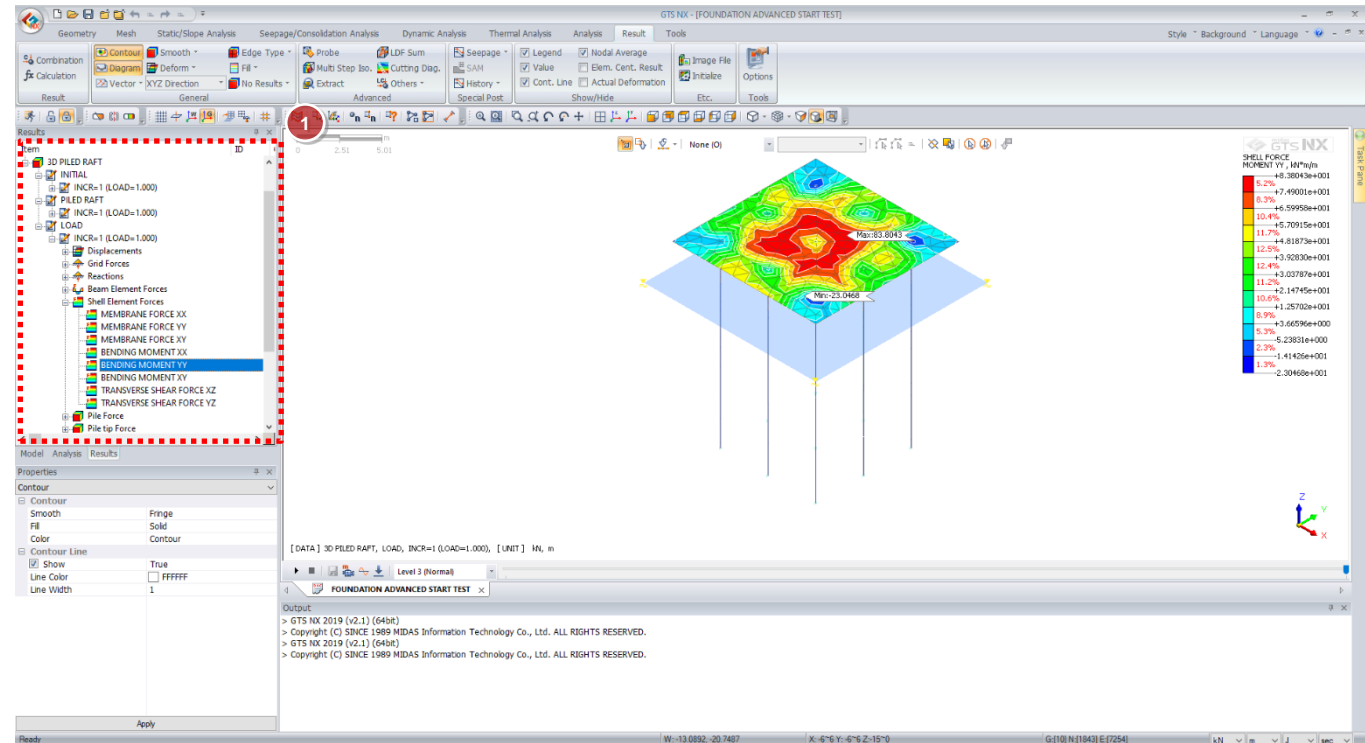
Bending moment from raft

Procedure

1 Shell Element Forces > BENDING MOMENT

[Information]

Please show raft/pile/pile interface/pile tip mesh

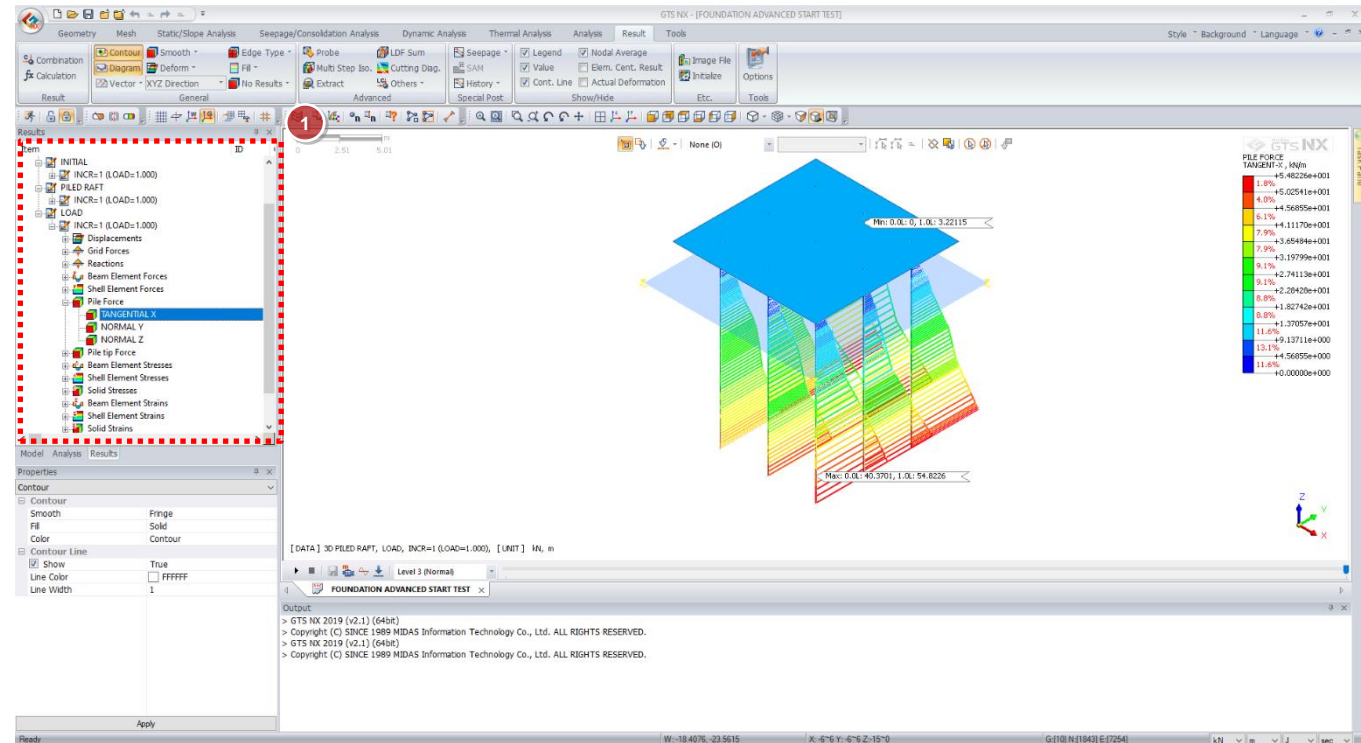


08 Result Checking

Shaft resistance from piles

Procedure

- 1 Pile Force > TANGENTIAL X

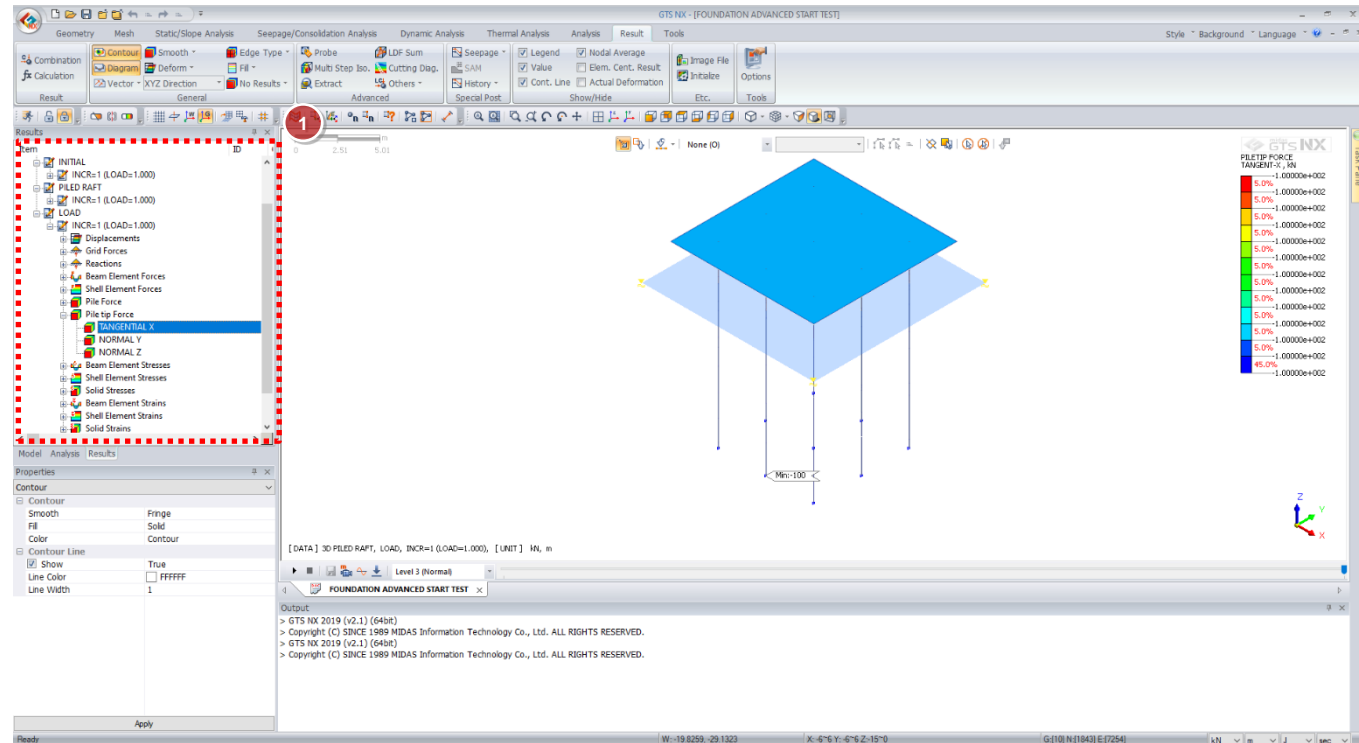


08 Result Checking

Tip bearing from piles

Procedure

- 1 Pile Tip Force > TANGENTIAL X

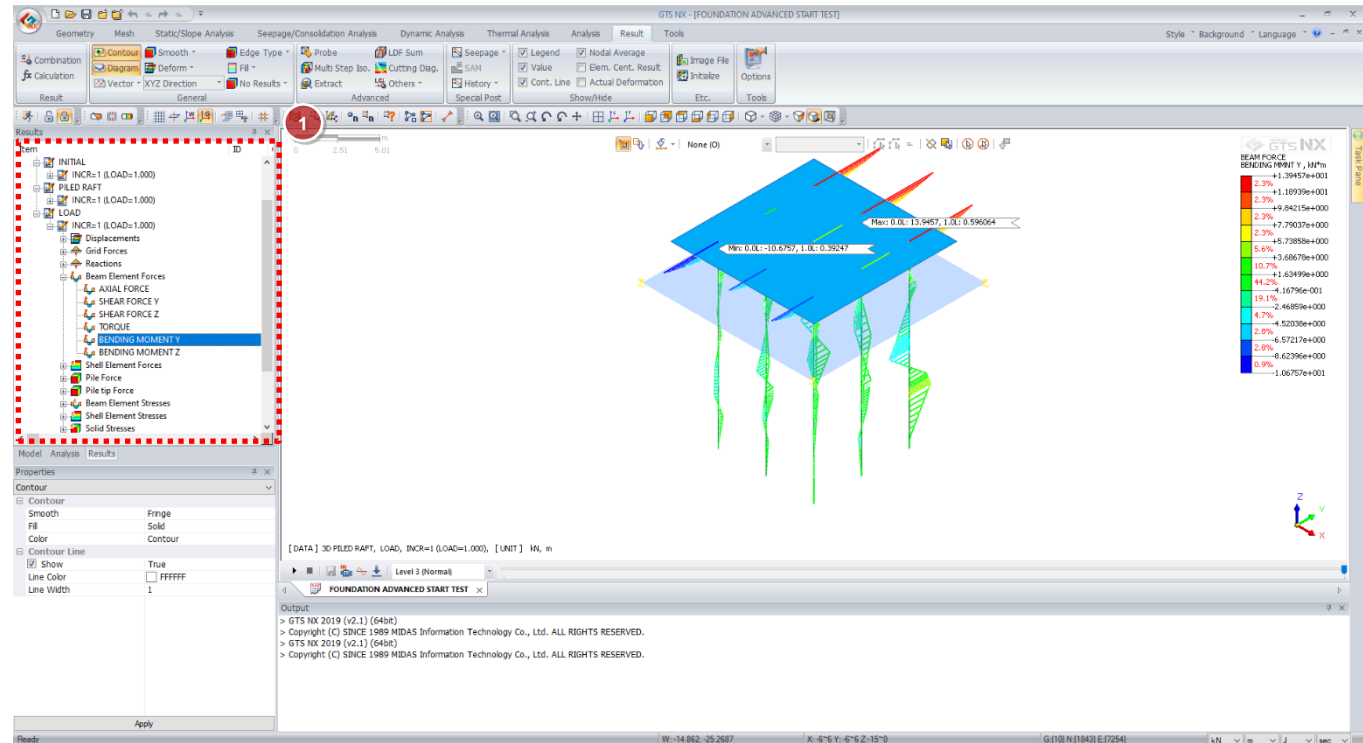


08 Result Checking

Bending moment of piles

Procedure

- 1 Beam Element Forces > BENDING MOMENT Y



The background of the slide features a complex network of thin, dark lines connecting numerous small, dark circular nodes. This pattern is overlaid on a color gradient that transitions from a light green on the left to a bright yellow in the center, and finally to a deep orange-red on the right. The overall effect is a sense of interconnectedness and digital technology.

GTS NX

New eXperience of Geo-Technical analysis System

Thank you!

The MIDAS logo is located in the bottom right corner. It consists of the word "MIDAS" in a bold, white, sans-serif font. Above the letters "I" and "D" is a white, stylized arc that resembles a bridge or a structural element, which is part of the company's branding.

MIDAS