GTS NX

New eXperience of Geo-Technical analysis System

Earth Retaining Stabilizing System

MIDAS

01 Overview

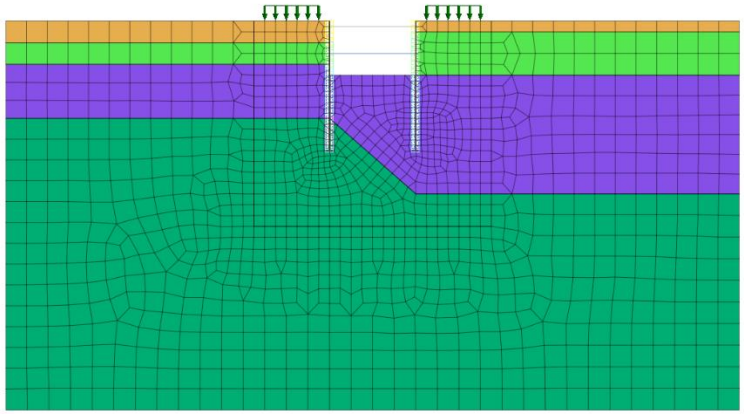
GTS NX

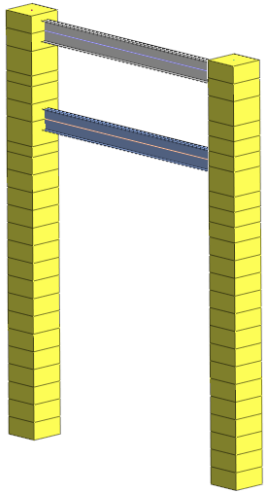
Procedure

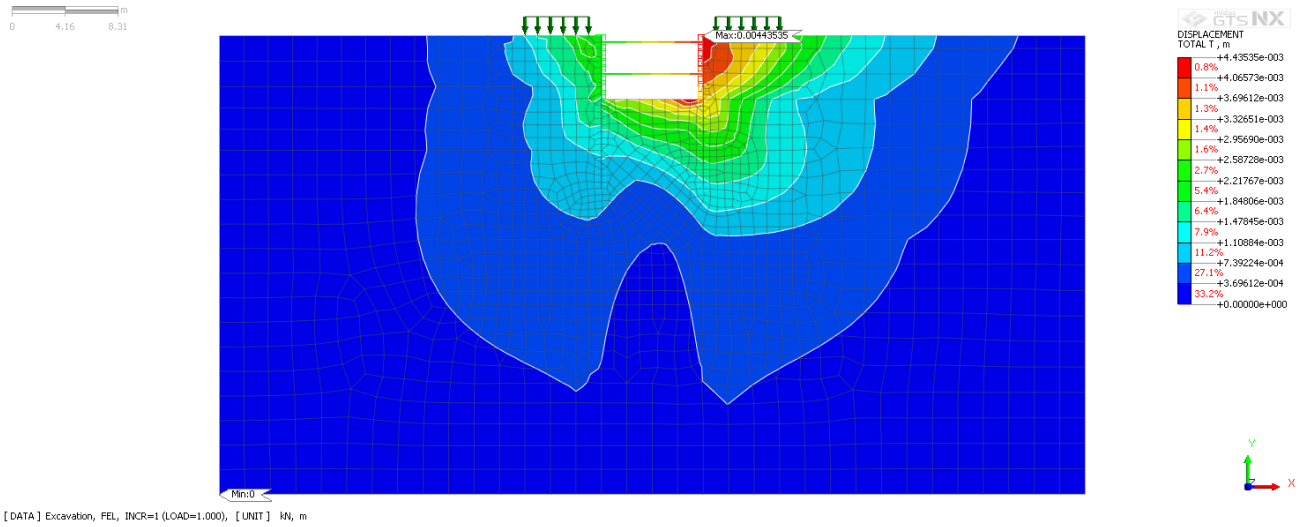
• This tutorial is aiming on performing the analysis with 3 stages of excavation including retaining wall and strutting.

• Surcharge and undrained condition are considered in this analysis.

• This example was prepared based on the most general excavation work in the real practice.







GTS NX

Ground

[unit : kN, m]

Name	Fill	Fluvial Clay	Old Alluvium (C)	Old Alluvium (A)
Material	Isotropic	Isotropic	Isotropic	Isotropic
Model Type	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb
General				
Elastic Modulus (E) [kN/m^2]	10,000	13,000	133,333	400,000
Poisson's Ratio (v)	0.25	0.25 (0.495)	0.25	0.25
Unit Weight (γ) [kN/m^3]	18	19	20	21
Ko	0.5	1.0	0.5	0.5
Porous				
Unit Weight (Saturated) [kN/m^3]	18	19	20	21
Drainage Parameters	Drained	Undrained	Drained	Drained
Non-Linear				
Cohesion (c) [kN/m^2]	1	40	5	20
Frictional Angle (Φ) [deg]	30	0	30	35

GTS NX

Structure

[unit : kN, m]

Name	Conc’	Steel
Material	Isotropic	Isotropic
Model Type	Elastic	Elastic
Elastic Modulus (E) [kN/m^2]	28,000,000	205,000,000
Poisson’s Ratio (v)	0.15	0.15
Unit Weight (γ) [kN/m^3]	24	74

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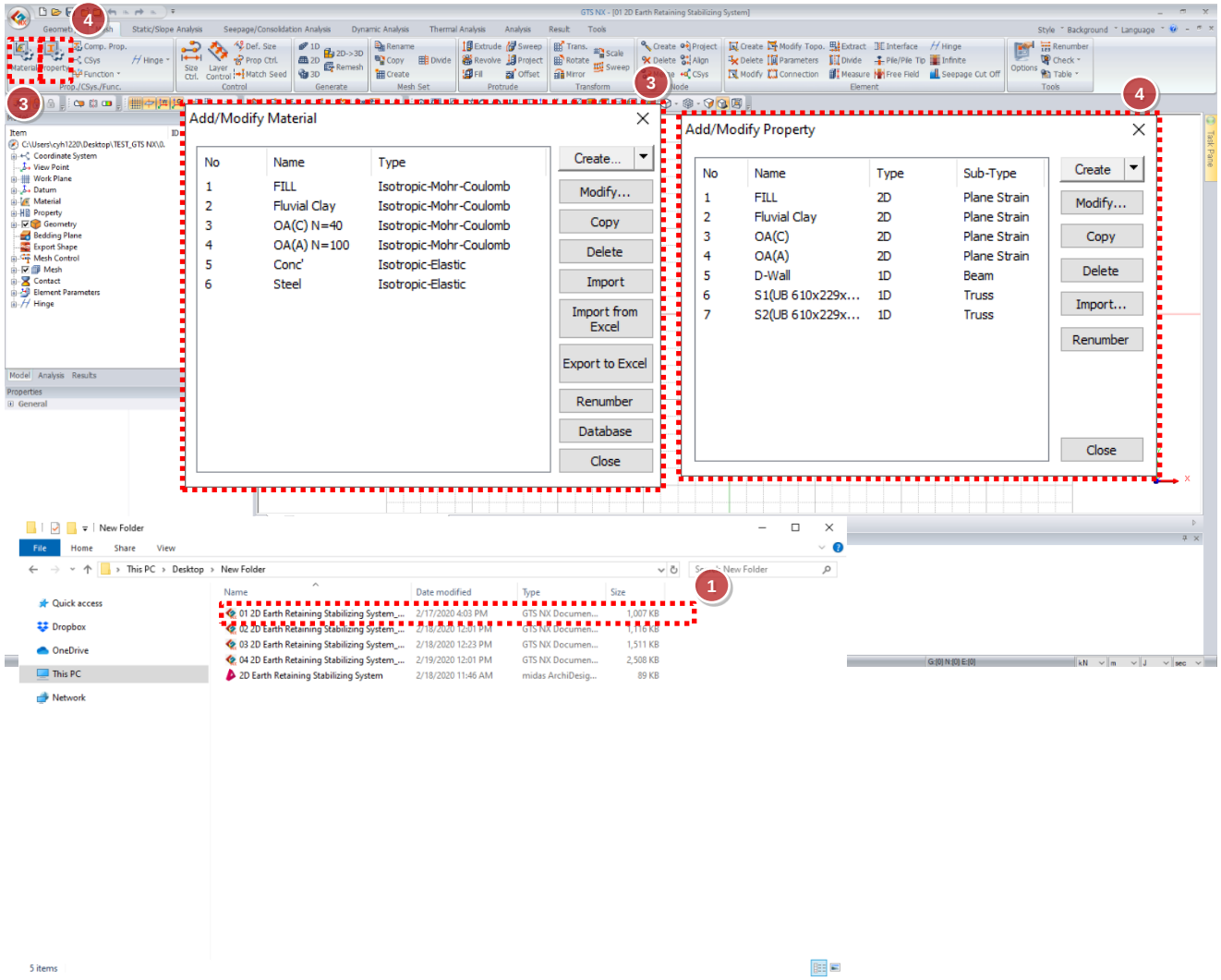
Procedure

1. Open [2D Earth Retaining Stabilizing System_Start] file
2. Save as another folder (Ctrl + Shift + s)
3. Check existing materials
   (Mesh > Prop./CSys./Func. > Material)
4. Check existing properties
   (Mesh > Prop./CSys./Func. > Property)



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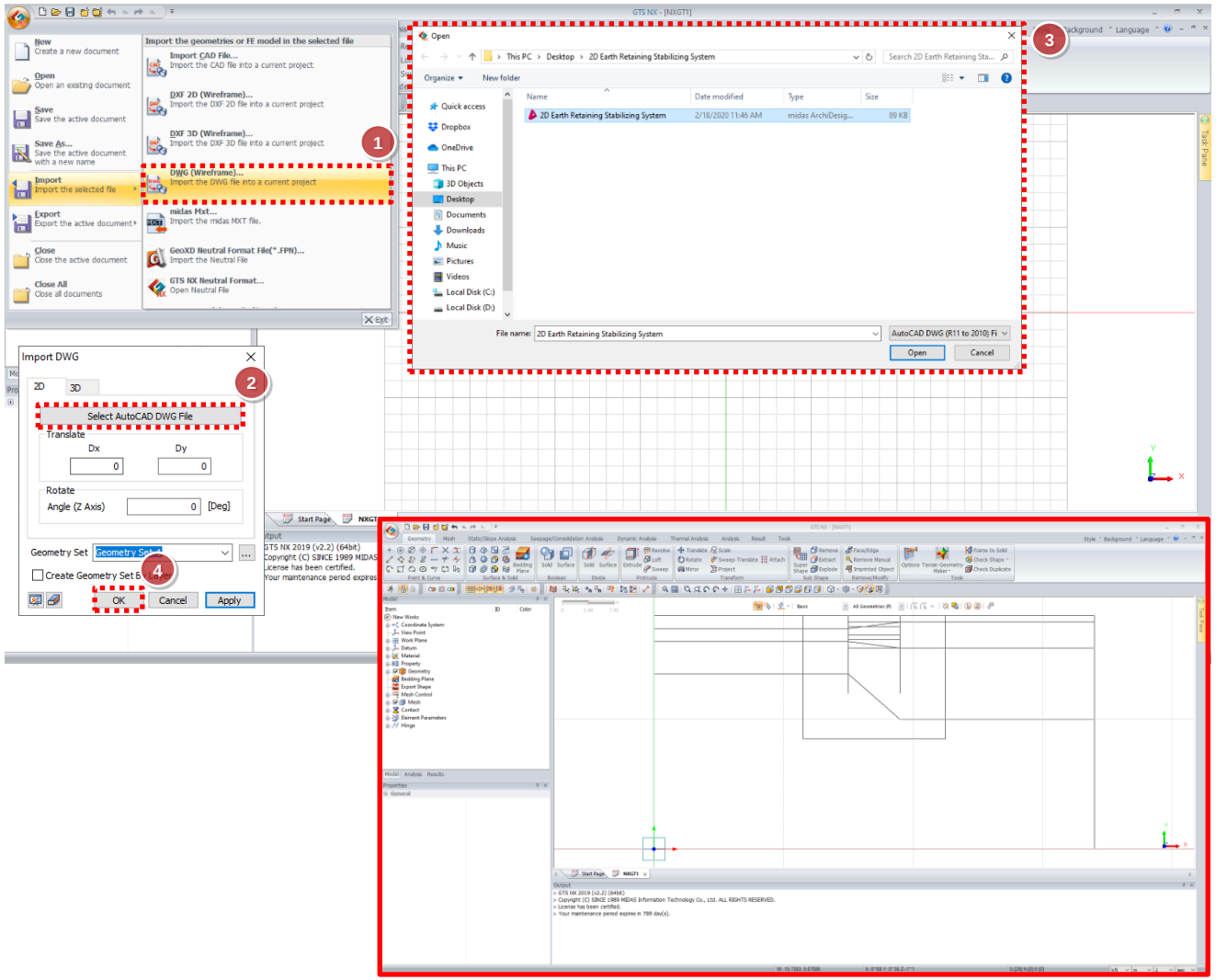
Procedure

1. Click [DWG(Wireframe)]
   (File > Import > DWG (Wireframe))
2. Click [Select AutoCAD DWG File]
3. Select “2D Earth Retaining Stabilizing System”
   Click [Open]
4. Click [OK]



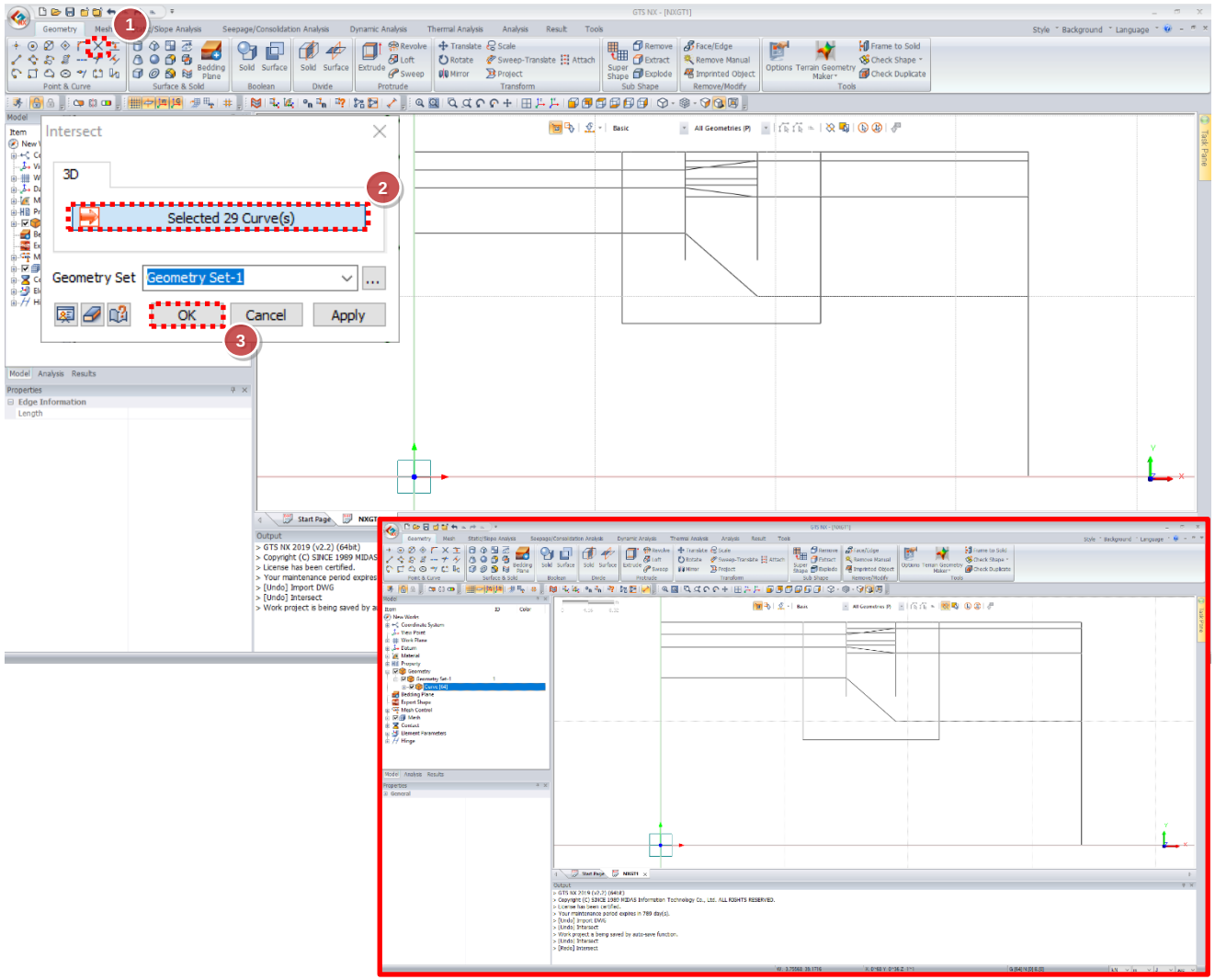
Procedure

1. Click [Intersect]
   (Geometry > Point & Curve > Intersect)

2. Click [Select Curve(S)]
   (29 curves)
   Select All lines (Ctrl + a)

3. Click [OK]

•Check the curves are divided to 64 curves



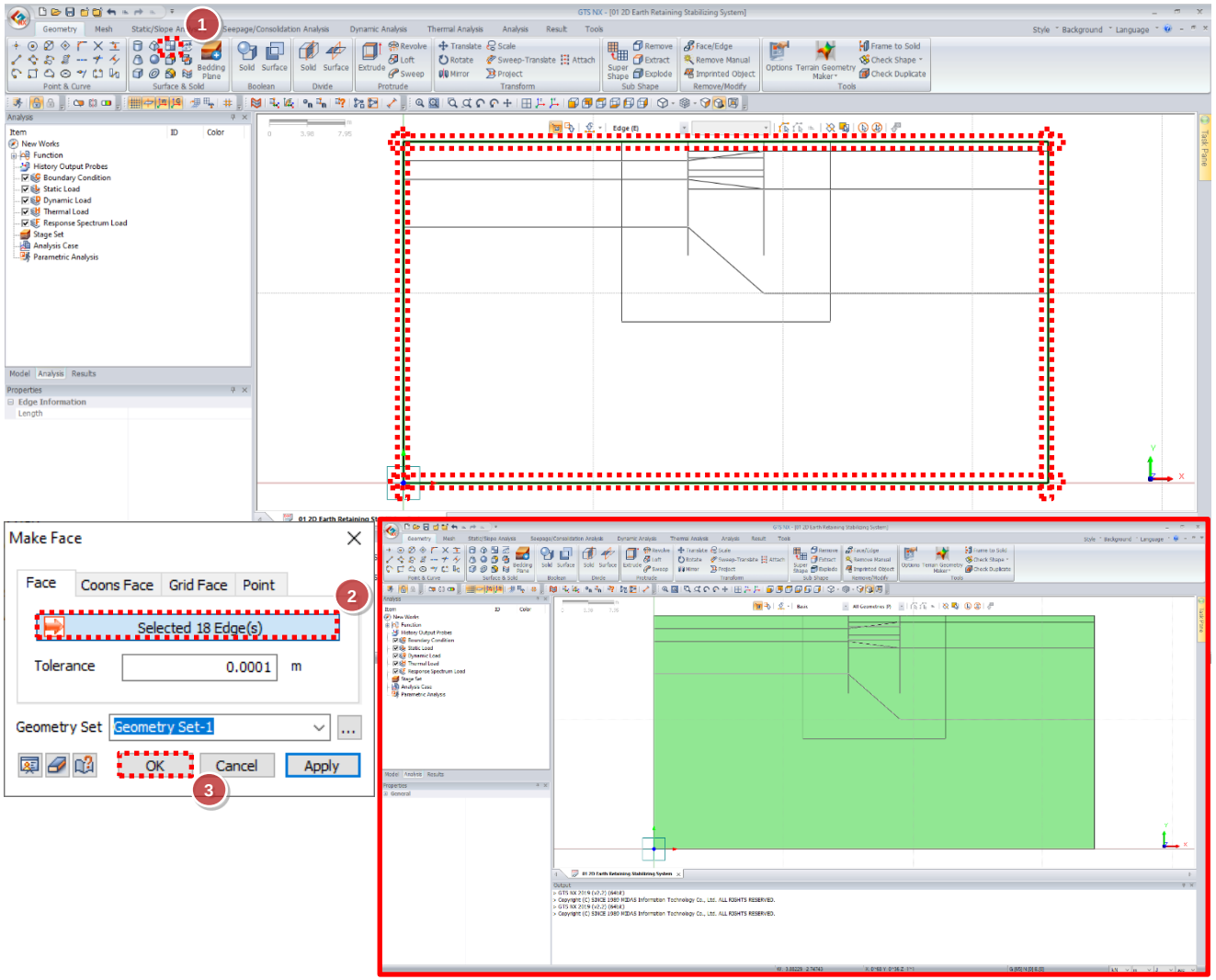
Procedure

1. Click [Make Face]
   (Geometry > Surface & Solid)

2. Click [Select Edge(S)]
   Select outer lines
   (18 edges)

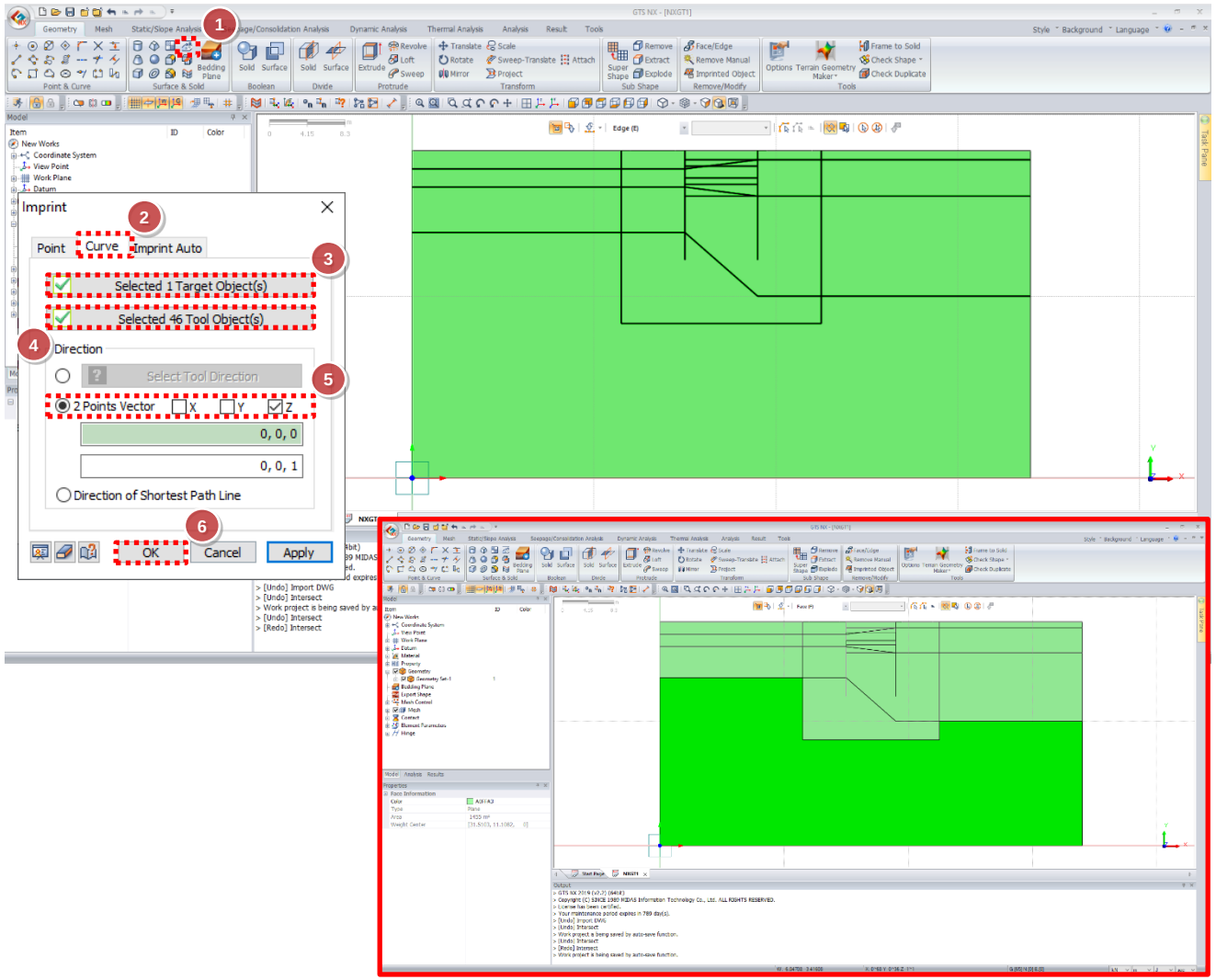
3. Click [OK]

•Check the curves are divided to 64 curves



Procedure

1. Click [Imprint]
   (Geometry >Surface & Solid > Imprint)
2. Move to [Curve] tab
3. Select Area (Ctrl + a)
   (1 area)
4. Select inner curves
   (46 curves)
5. Click [2 Points Vector] and “check on z direction” only
6. Click [OK]



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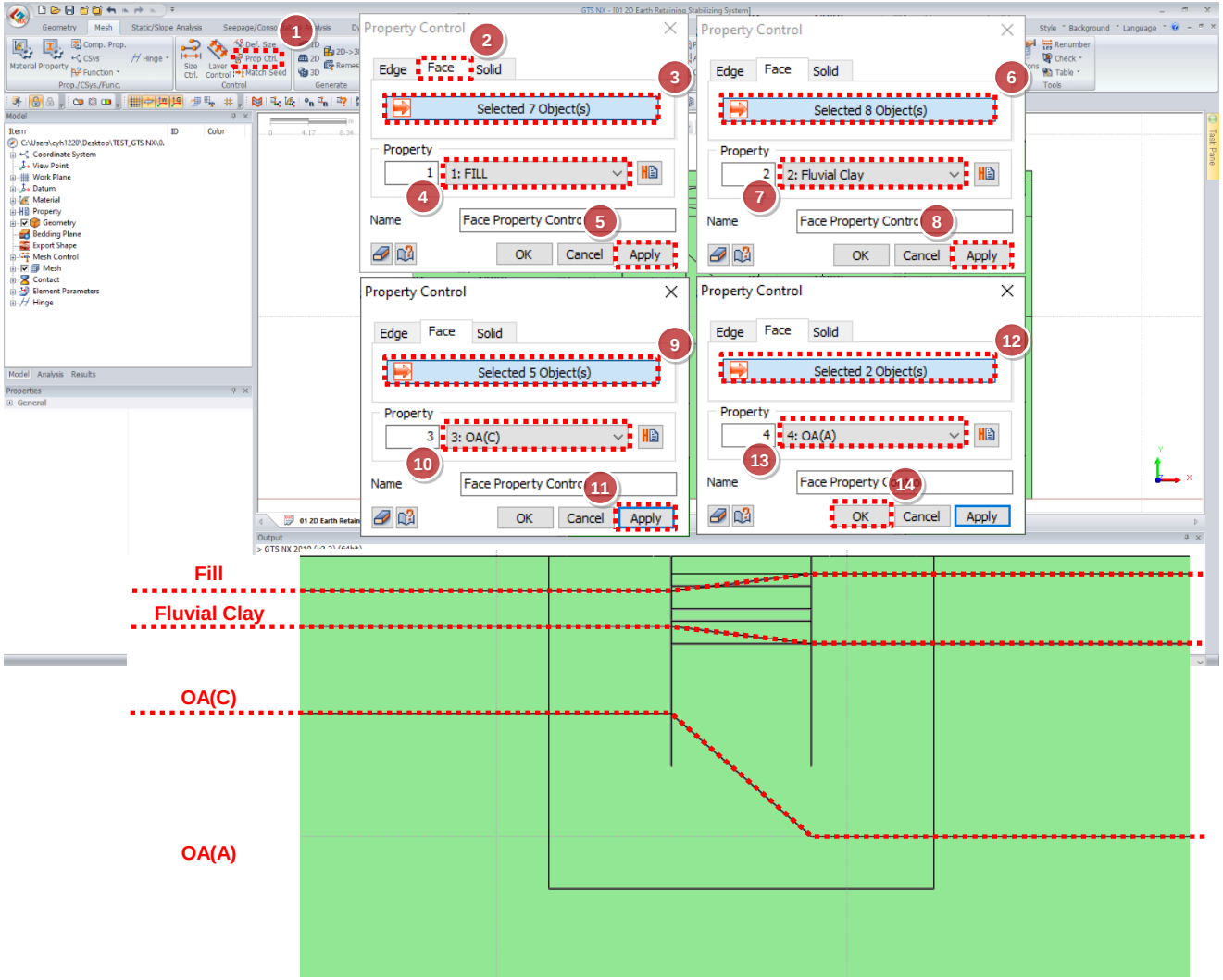
Procedure

1. Click [Prop Ctrl.]
2. Move to [Face] tab
3. Select faces for Fill layer
4. Change property to “Fill”
5. Click [Apply]

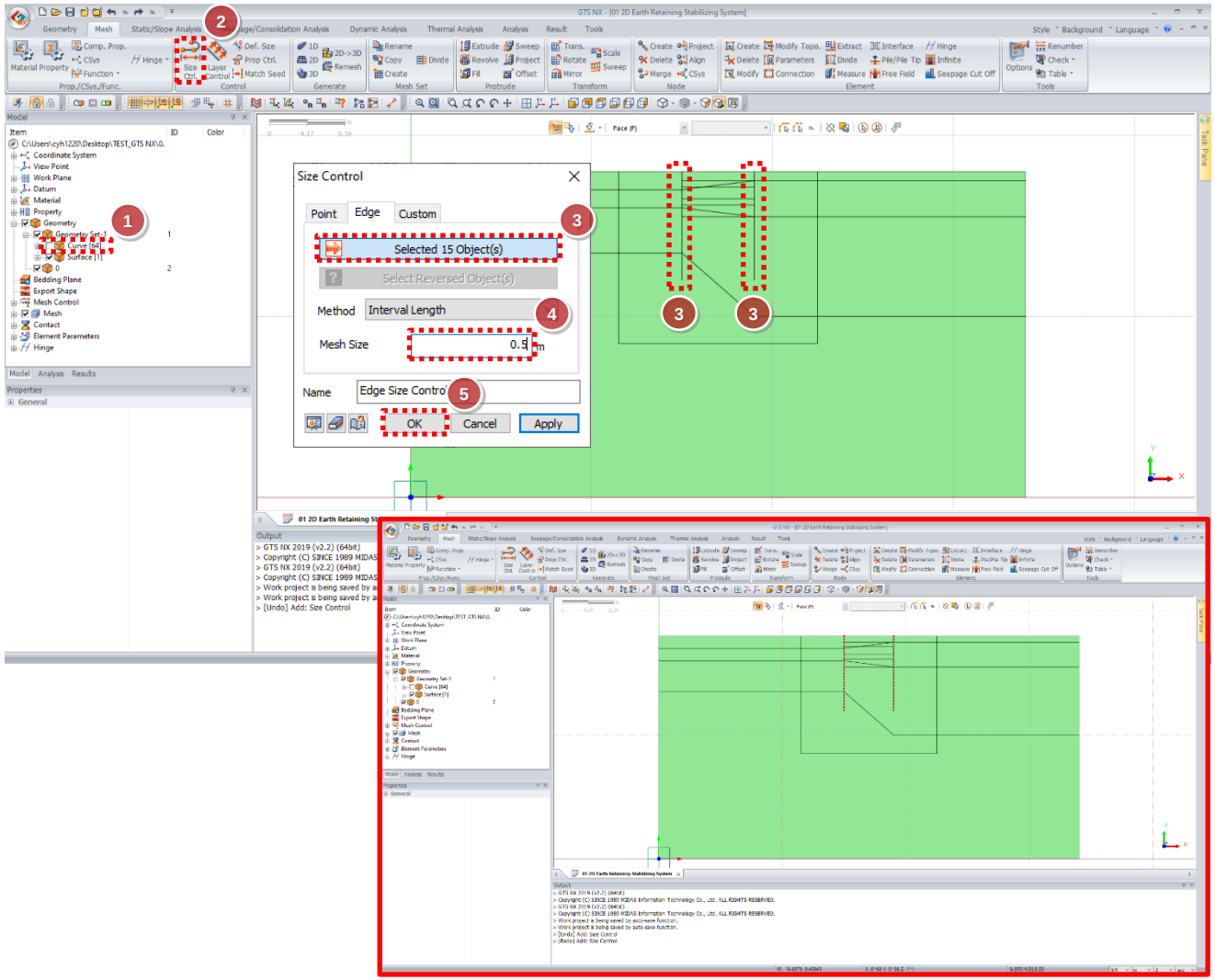
• Do it repeatedly step 3 to step 5 until step 13

14. Click [OK]



Procedure

1. Check off “Curve [64]” under Geometry tree
2. Click [Size Ctrl.]
   (Mesh > Control > Size Ctrl.)
3. Select edges of retaining wall part
   (15 edges)
4. Mesh Size: 0.5m
5. Click [OK]



04 Mesh Generation

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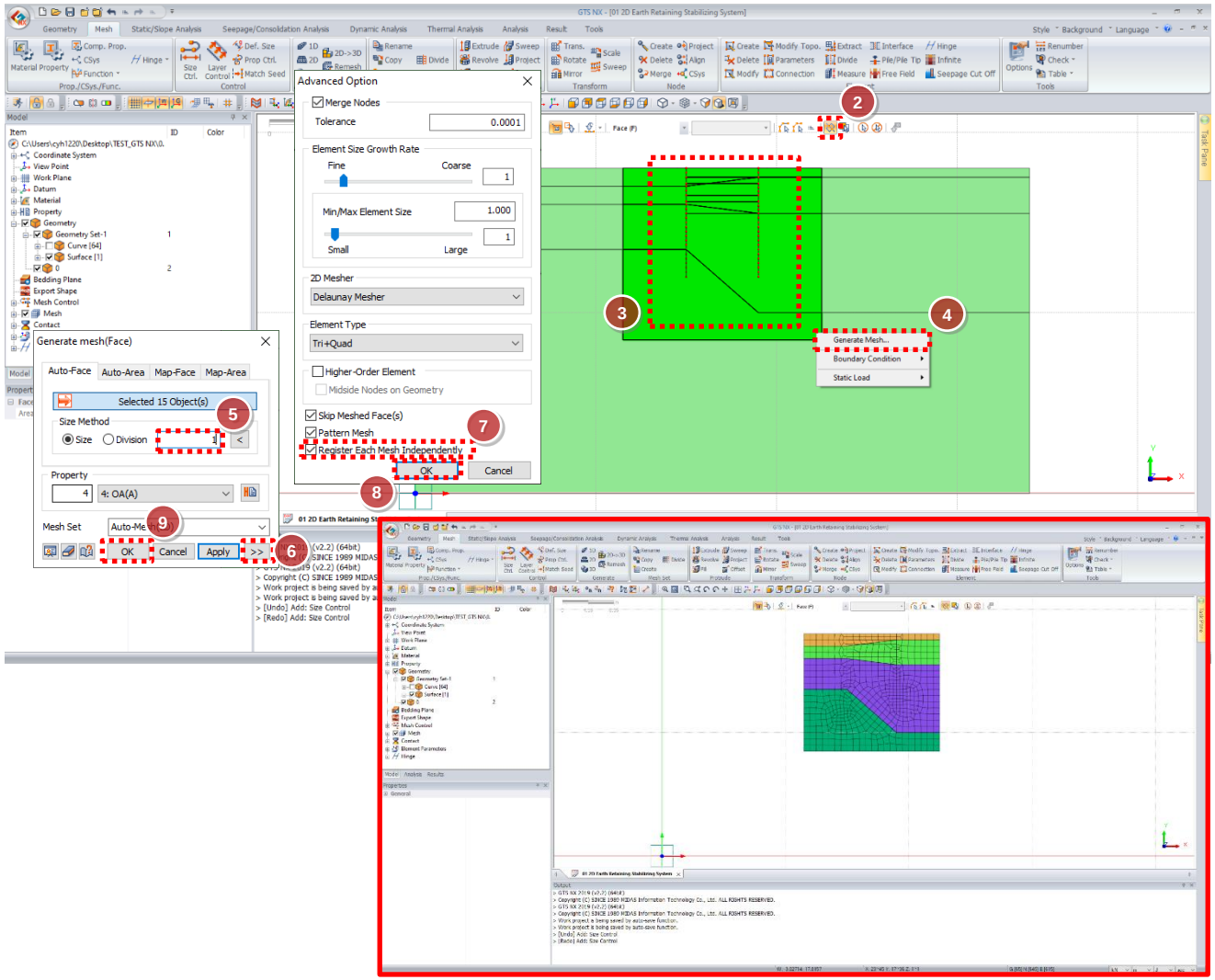
Procedure

1. Press “F” to change select method to face
2. Turn on “intersect”
3. Select faces
   (15 faces)
4. Right Click on the selected face and Click [Generate Mesh]
5. Size: 1
6. Click [>>]
7. Check on “Register Each Mesh Independently”
8. Click [OK]
9. Click [OK]

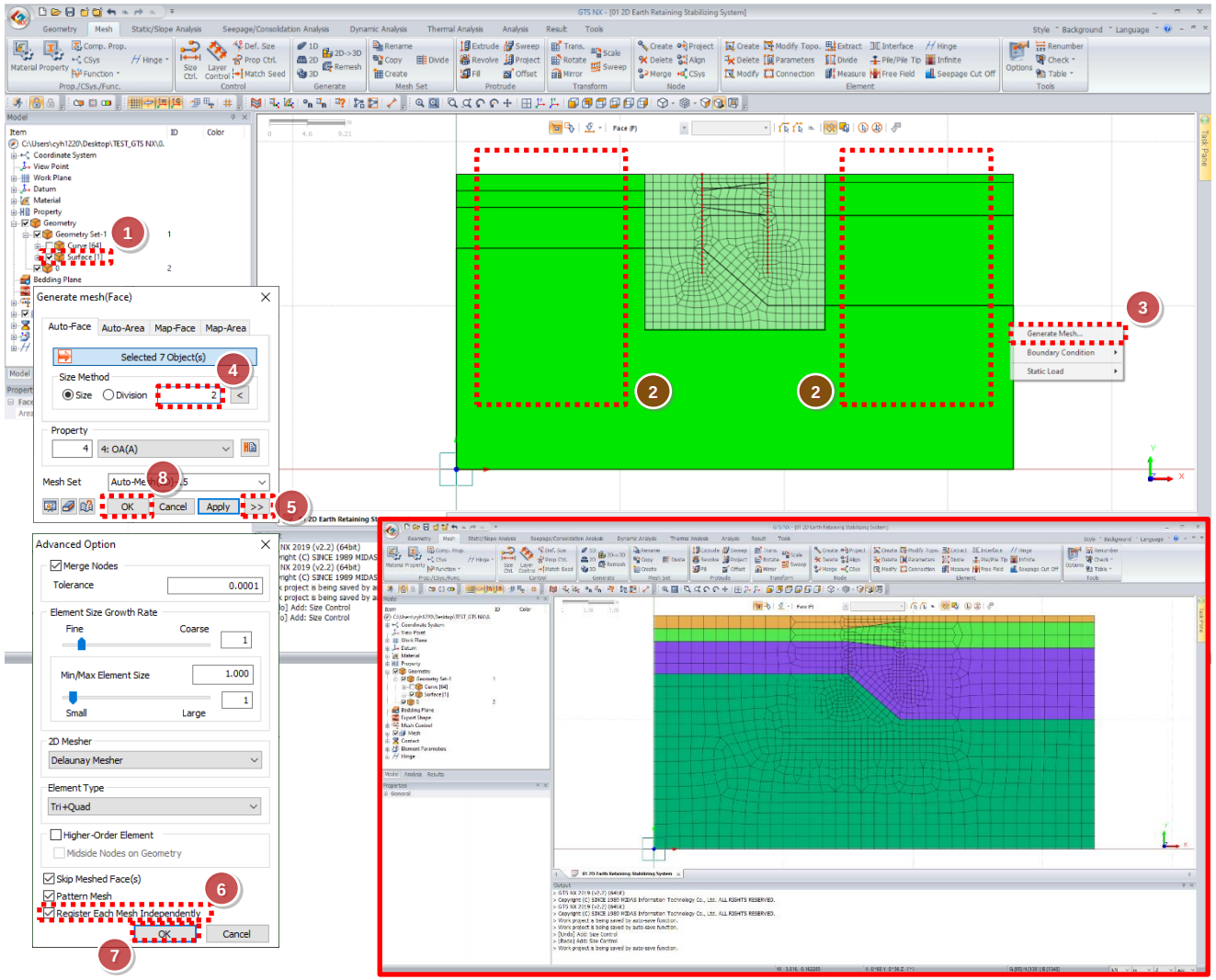


04 Mesh Generation

GTS NX

Procedure

1. Check off “Surface [1]” and check on “Surface [1]” under Geometry tree
2. Select faces
   (7 faces)
3. Right Click on the selected face and Click [Generate Mesh]
4. Size: 2
5. Click [>>]
6. Check on “Register Each Mesh Independently”
7. Click [OK]
8. Click [OK]

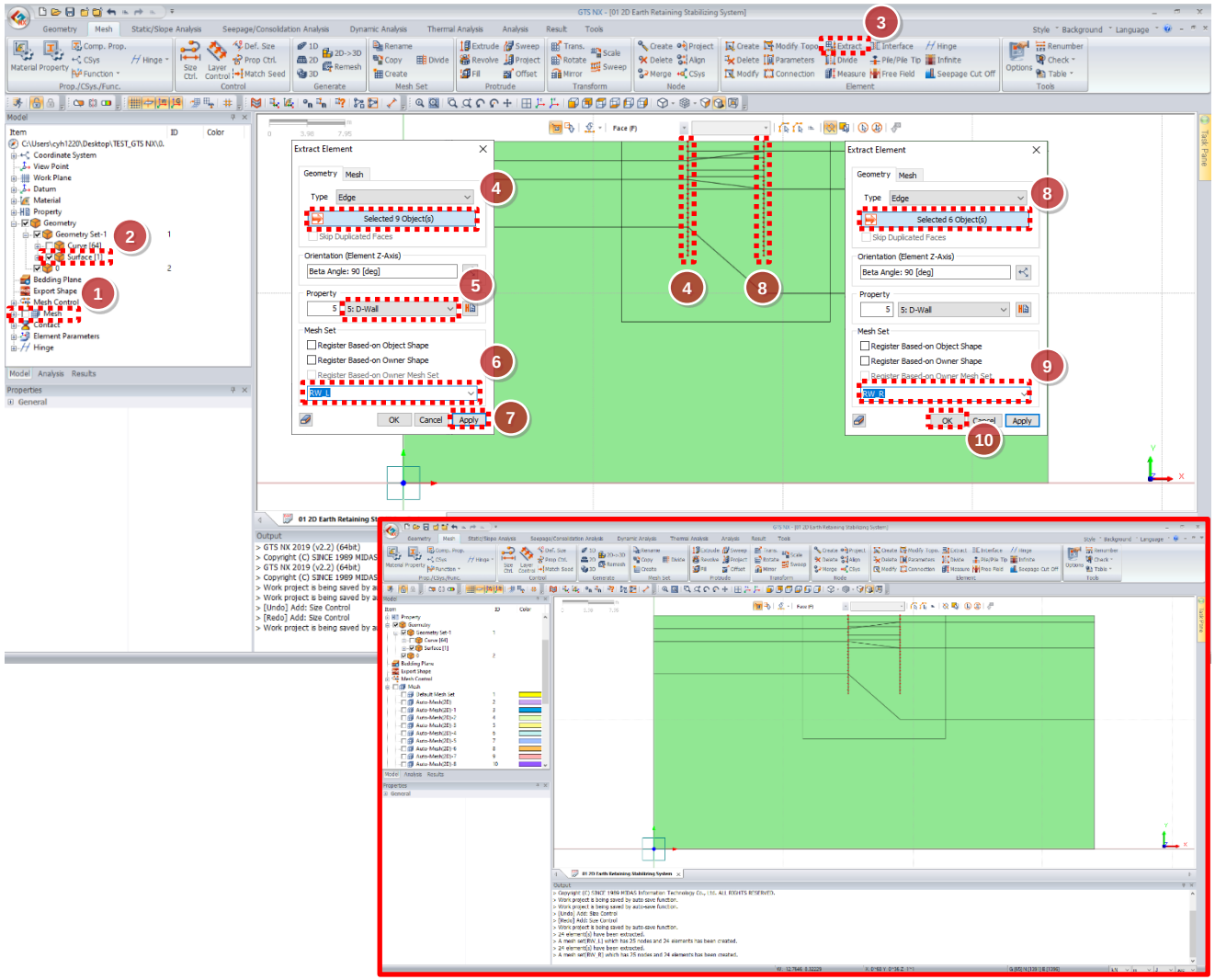


04 Mesh Generation

GTS NX

Procedure

1. Check off “Mesh”
2. Check off “Surface [1]” and check on “Surface [1]” under Geometry tree
3. Click [Extract] (Mesh > Element > Extract)
4. Select edges of left wall (9 edges)
5. Change property to “D-Wall”
6. Mesh set name: RW_L
7. Click [Apply]
8. Select edges of right wall (6 edges)
9. Mesh set name: RW_R
10. Click [OK]



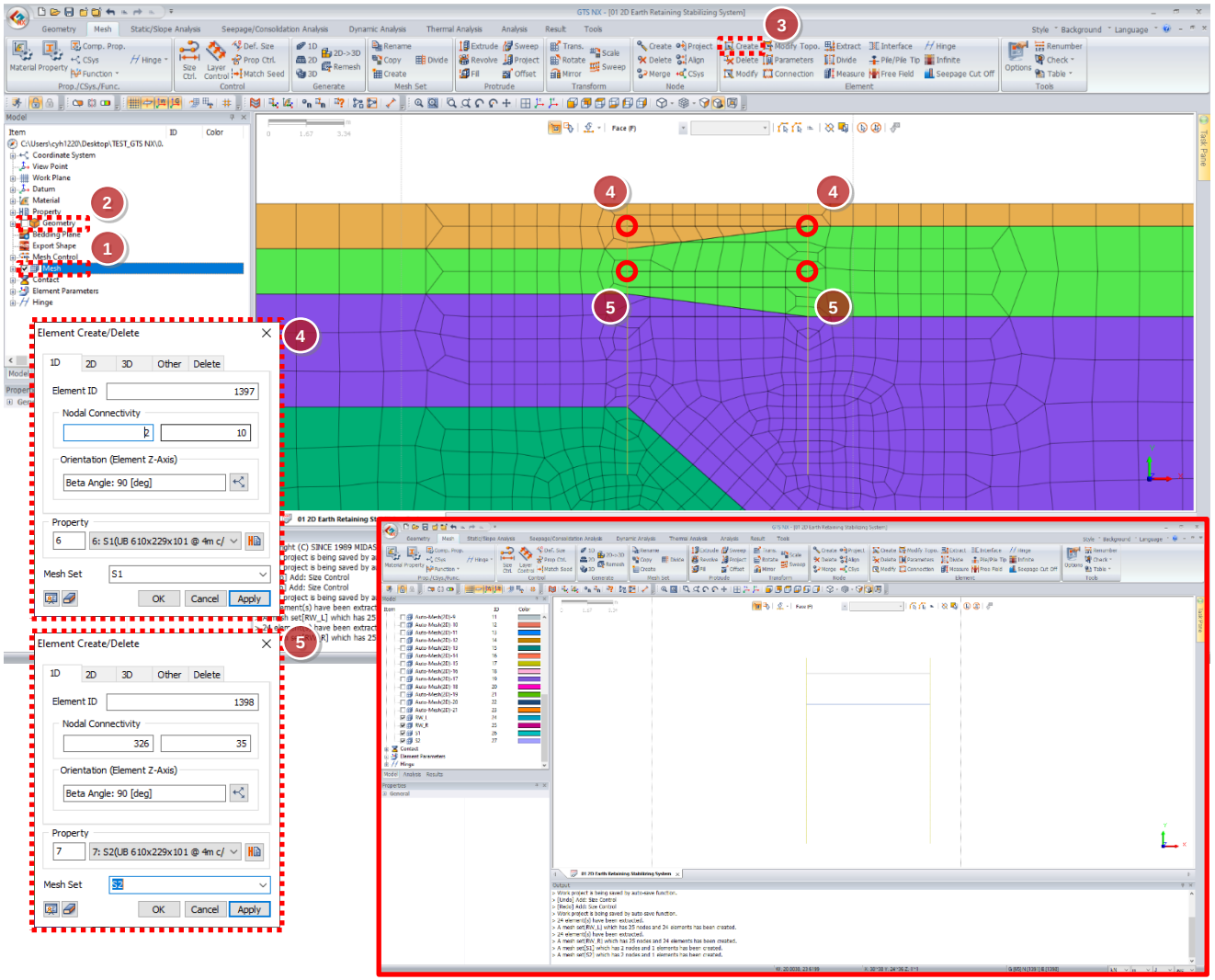
04 Mesh Generation

GTS NX

Procedure

1. Check on “Mesh”
2. Check off “Geometry”
3. Click [Create]
   (Mesh > Element > Create)
4. Change property to “S1”
   Click start and end points
   Mesh set: S1
   Click [Apply]
5. Change property to “S2”
   Click start and end points
   Mesh set: S2
   Click [OK]

• Check with mesh tree, Check on only RWs, S1 and S2.

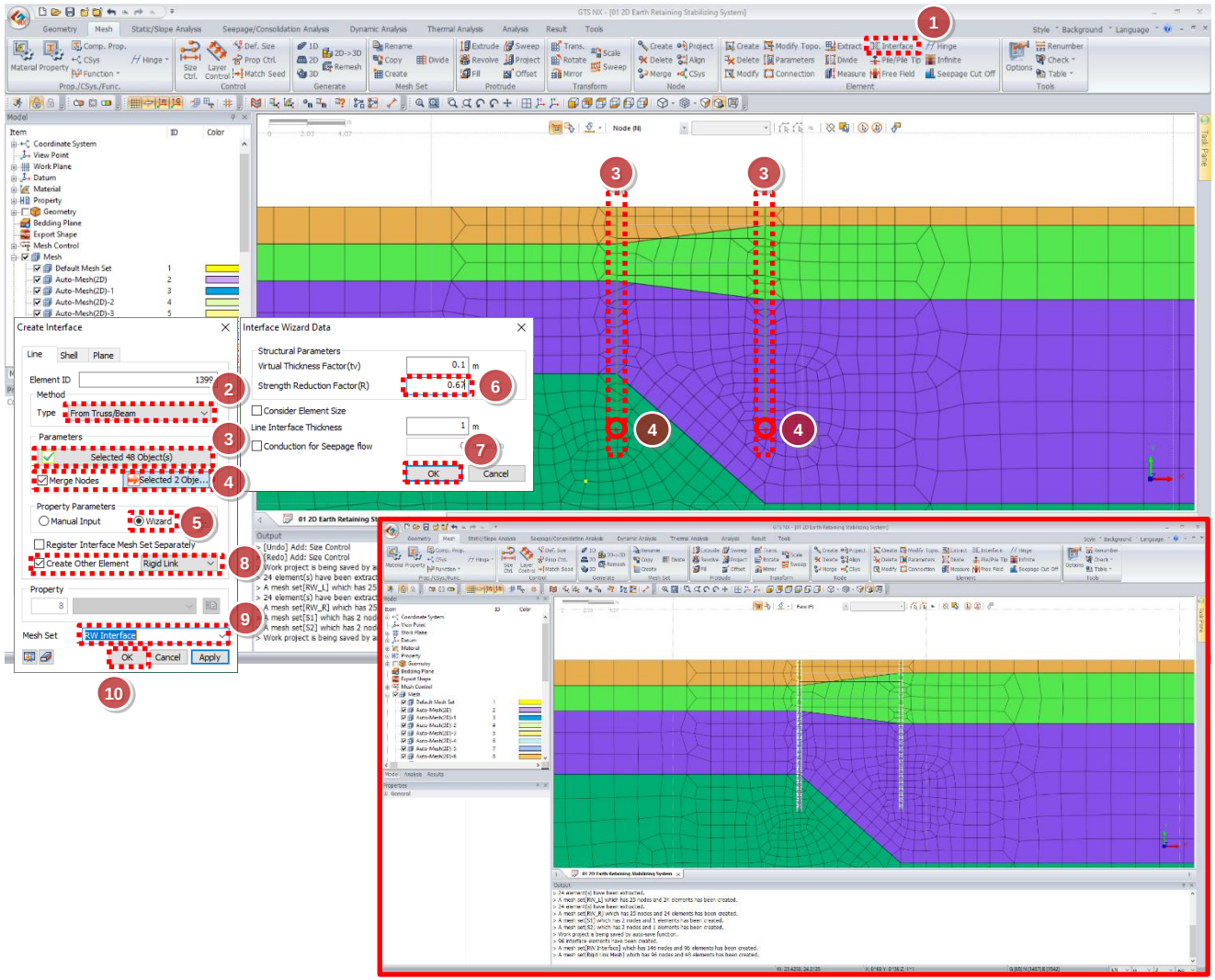


04 Mesh Generation

GTS NX

Procedure

1. Click [Interface]
   (Mesh > Element > Interface)
2. Type: From Truss/Beam
3. Select RWs
   (48 objects)
4. Check on “Merge Nodes”
   Select end points of RWs
   (2 points)
5. Check on “Wizard”
6. Strength Reduction Factor: 0.67
7. Click [OK]
8. Check on “Create Other Element”
   Select “Rigid Link”
9. Mesh set: RW Interface
10. Click [OK]



05 Load & Boundary Condition

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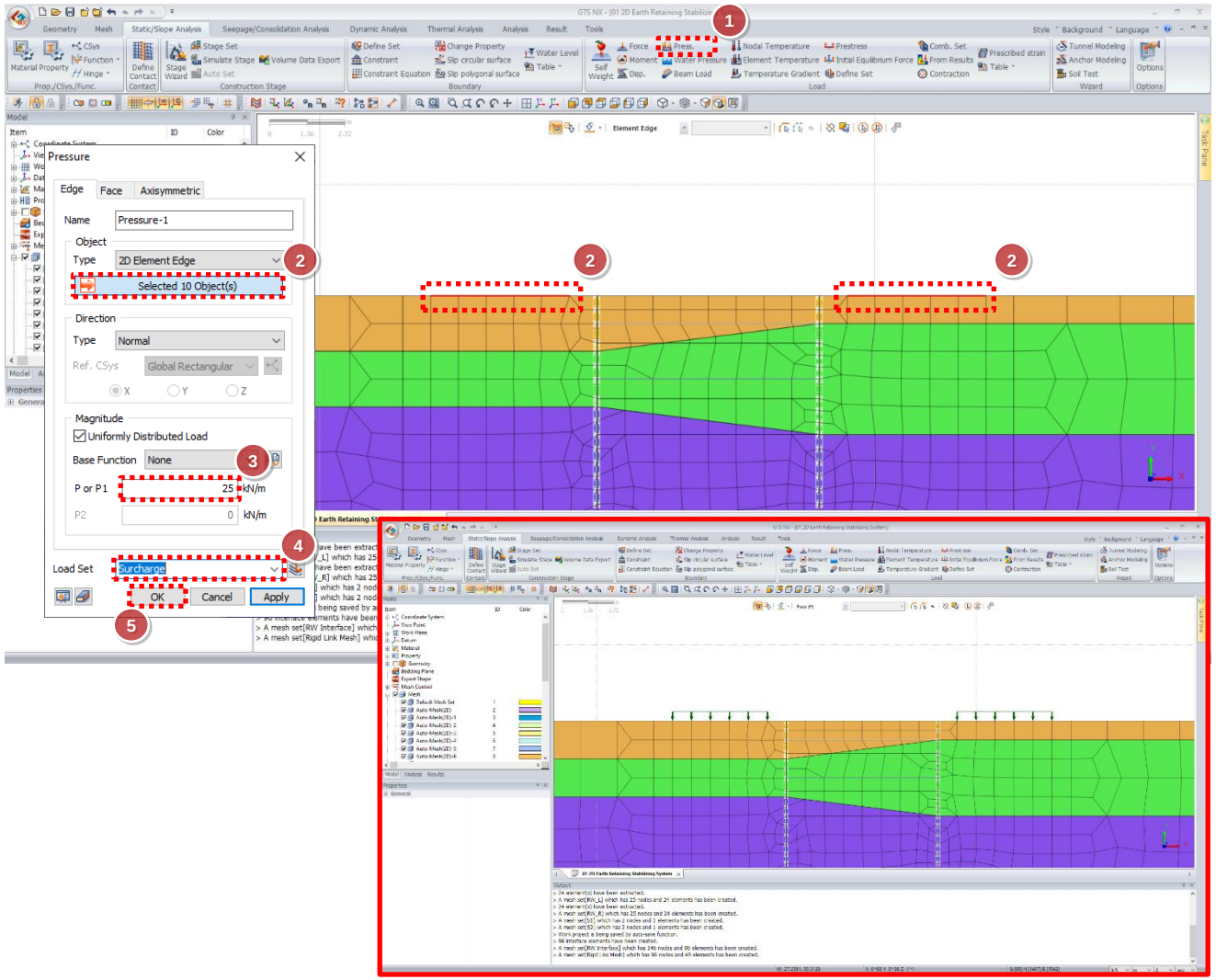
Procedure

1. Click [Press.]
   (Static/Slope Analysis > Load > Press.)
2. Select Surcharge parts
   (10 objects)
3. P or P1: 25
4. Load Set: Surcharge
5. Click [OK]



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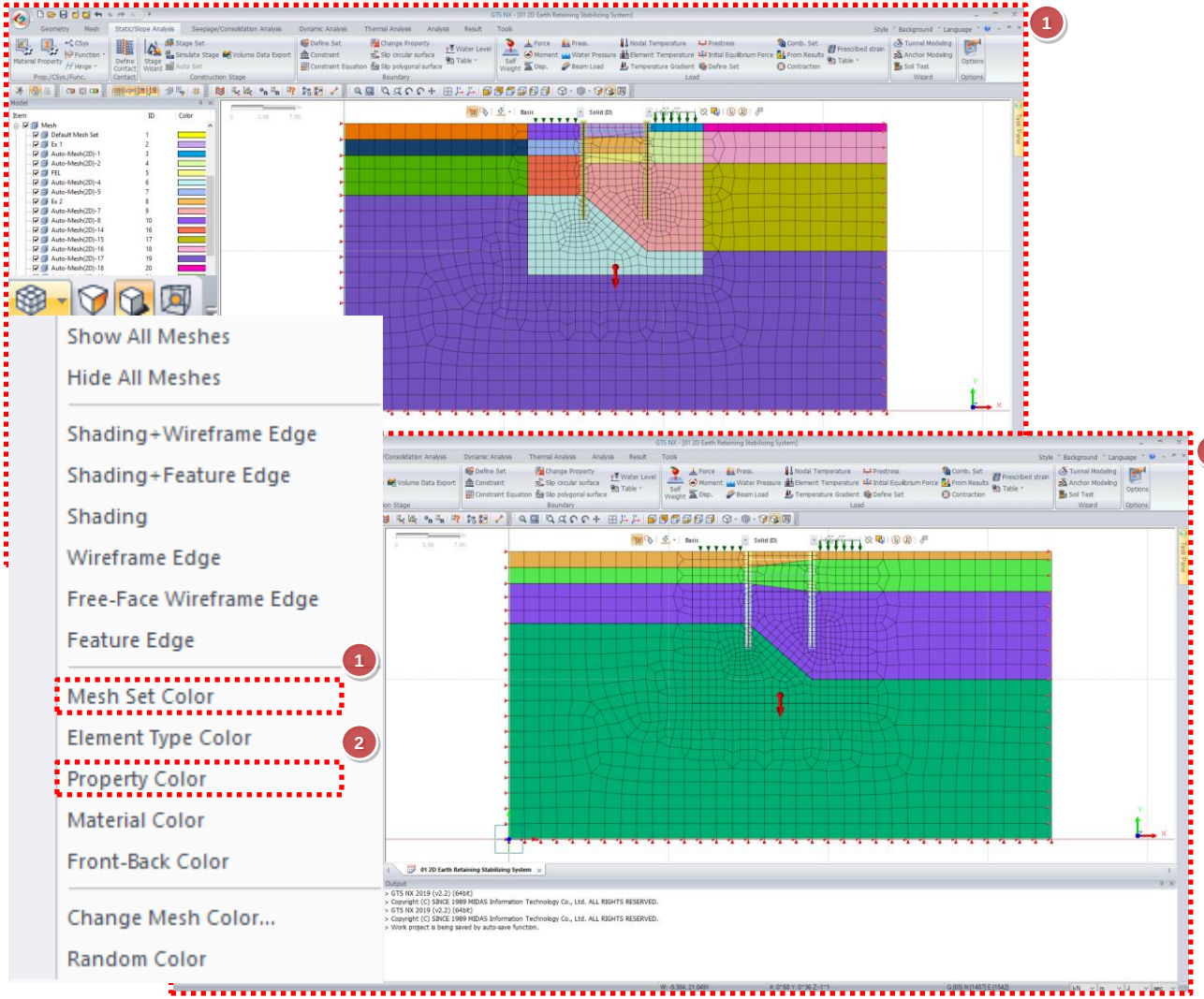
Procedure

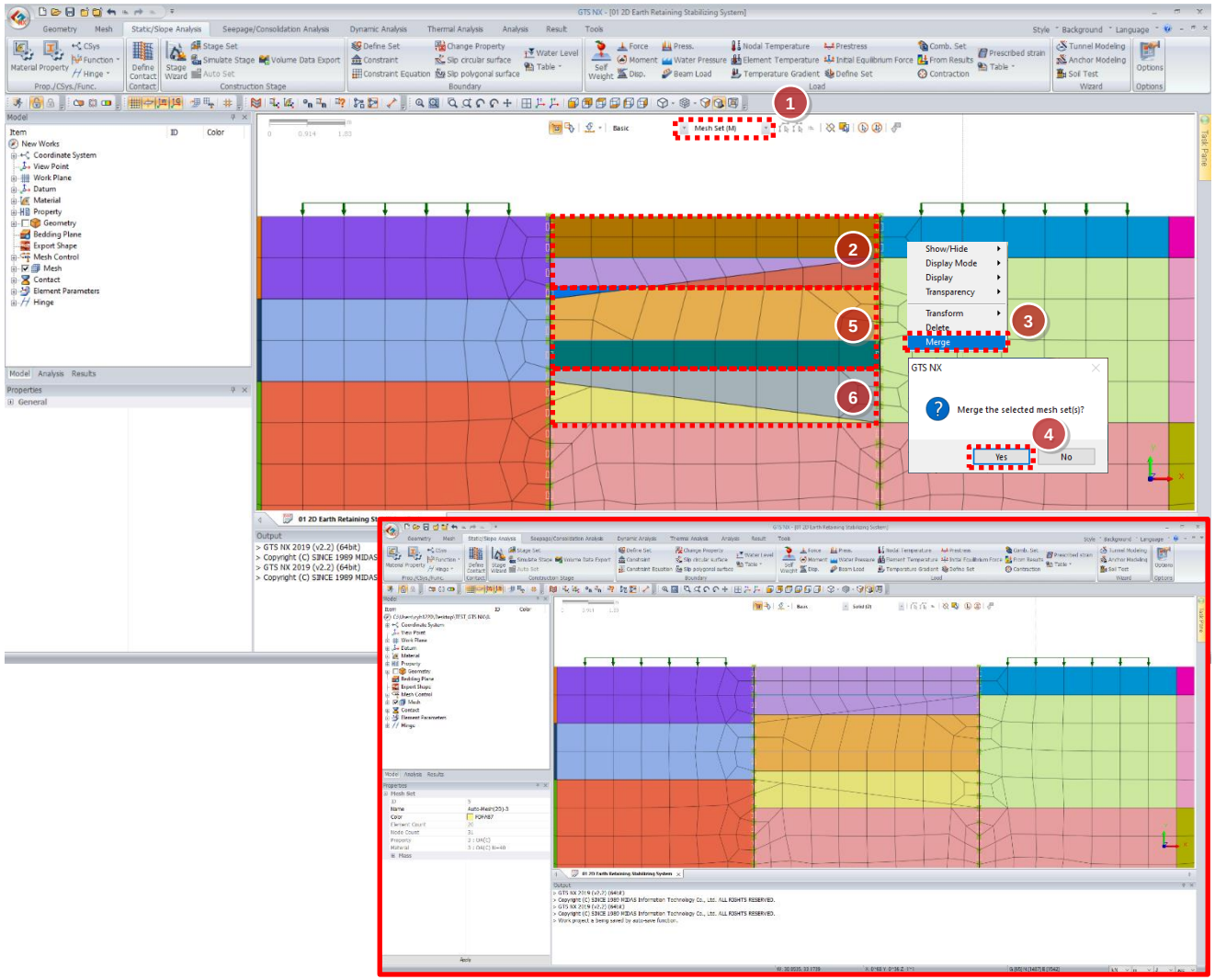
- Using “Display Mode” to select “Mesh Set Color” or “Property Color”



05 Load & Boundary Condition

Procedure

1. Press “M” key to change selection method to Mesh Set
2. Select 1st excavation part
3. Right Click and Click [Merge]
4. Click [OK]
5. Select 2nd excavation part
   Do it repeatedly step 3 and 4
6. Select final excavation level part
   Repeat step 3 and 4



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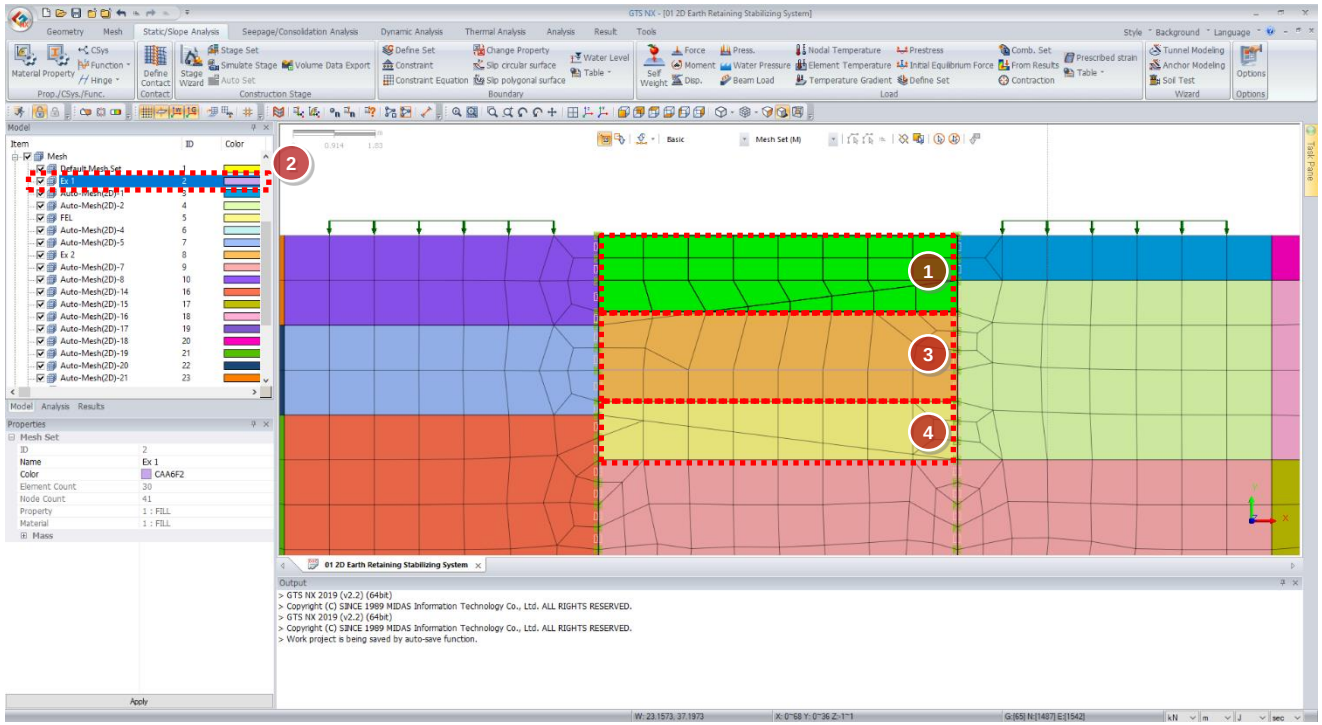
Procedure

1. Select 1st excavation part
2. Press “F2” key to change mesh set name under mesh tree
   Name: Ex 1
3. Repeat step 1&2
   Name: Ex 2
4. Repeat step 1&2
   Name: FEL

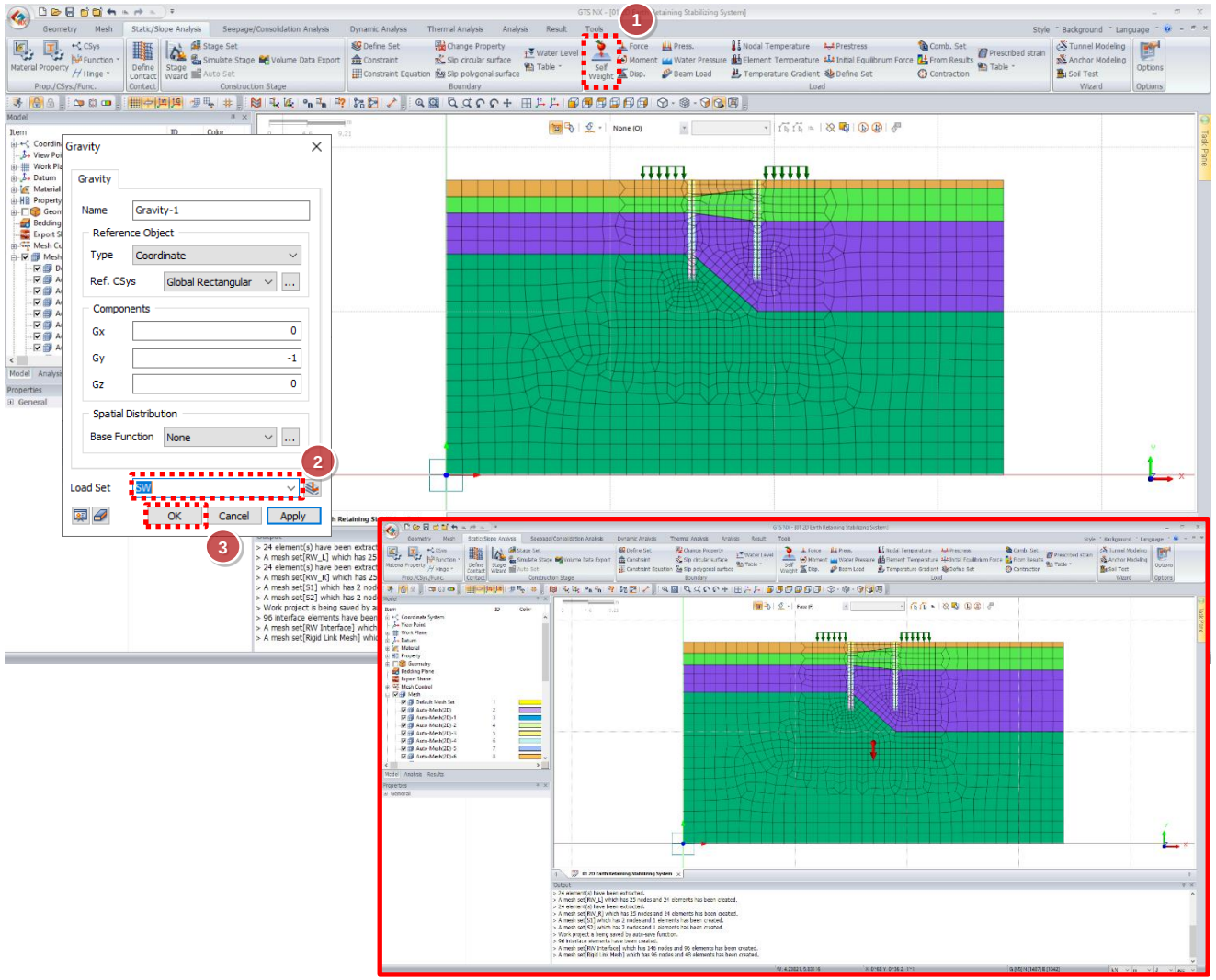


05 Load & Boundary Condition

GTS NX

Procedure

1. Click [Self Weight]
   (Static/Slope Analysis > Load > Self Weight)
2. Load Set: SW
3. Click [OK]

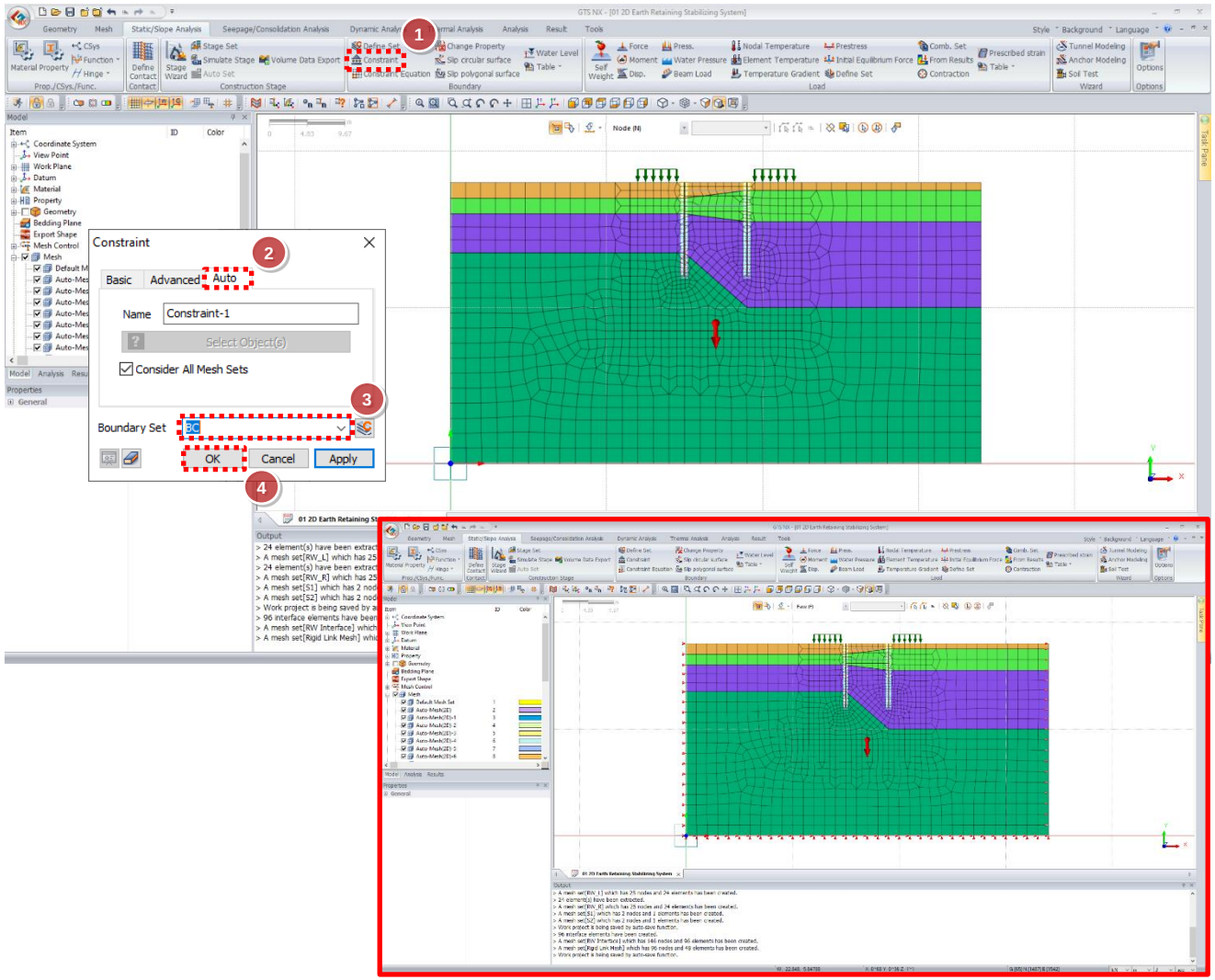


05 Load & Boundary Condition

GTS NX

Procedure

1. Click [Constraint]
   (Static/Slope Analysis > Boundary > Constraint)
2. Move to “Auto”
3. Boundary Set: BC
4. Click [OK]



05 Load & Boundary Condition

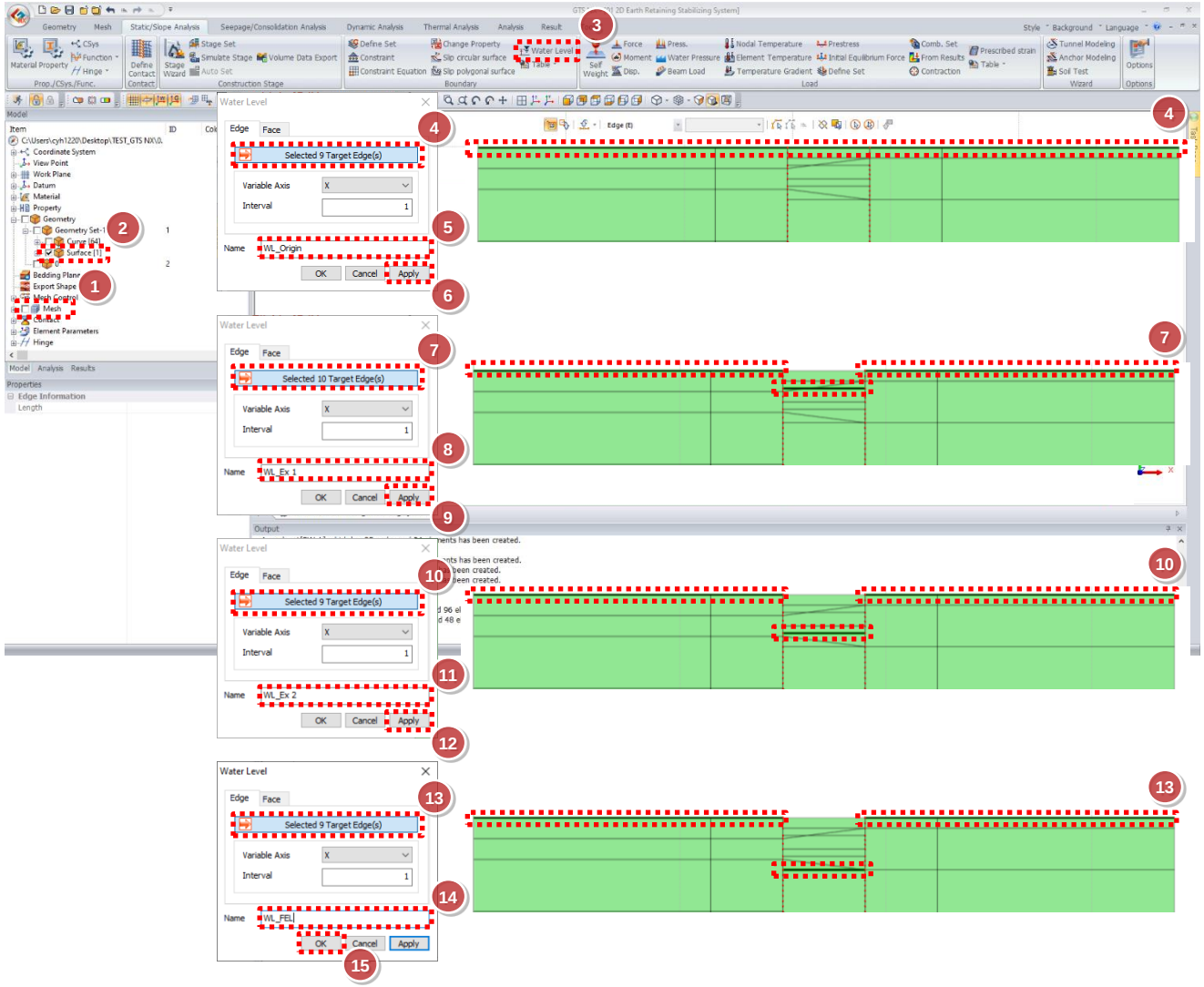
GTS NX

Procedure

1. Check off “Mesh”
2. Check on “Surface [1]”
3. Click [Water Level]
   (Static/Slope Analysis > Boundary > Water Level)
4. Select water level lines
5. Name: WL_Origin
6. Click [Apply]

• Repeat step 4 to step 6 until step 14

15. Click [OK]



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Thank you!

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New eXperience of Geo-Technical analysis System

Earth Retaining Stabilizing System

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01 Overview

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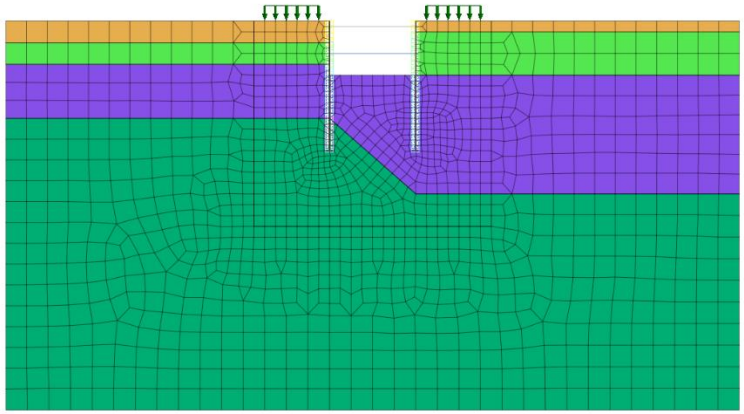

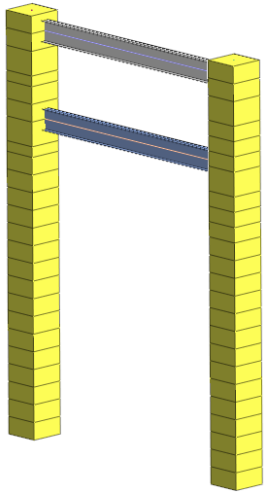

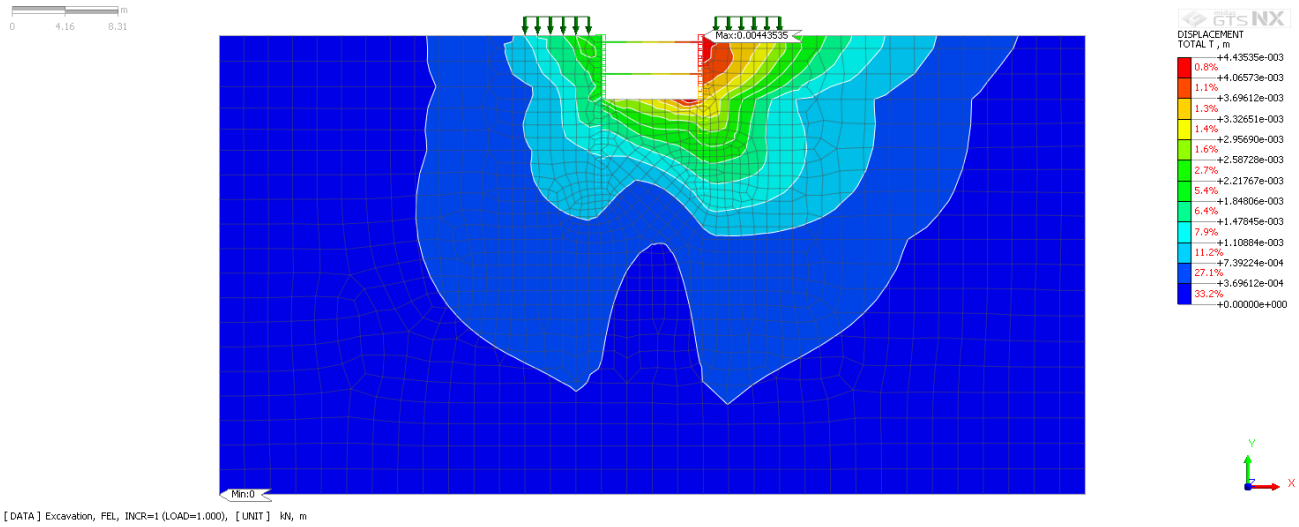

GTS NX

Ground

[unit : kN, m]

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Unit Weight (γ) [kN/m^3]	18	19	20	21
Ko	0.5	1.0	0.5	0.5
Porous				
Unit Weight (Saturated) [kN/m^3]	18	19	20	21
Drainage Parameters	Drained	Undrained	Drained	Drained
Non-Linear				
Cohesion (c) [kN/m^2]	1	40	5	20
Frictional Angle (Φ) [deg]	30	0	30	35

GTS NX

Structure

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Name	Conc’	Steel
Material	Isotropic	Isotropic
Model Type	Elastic	Elastic
Elastic Modulus (E) [kN/m^2]	28,000,000	205,000,000
Poisson’s Ratio (v)	0.15	0.15
Unit Weight (γ) [kN/m^3]	24	74

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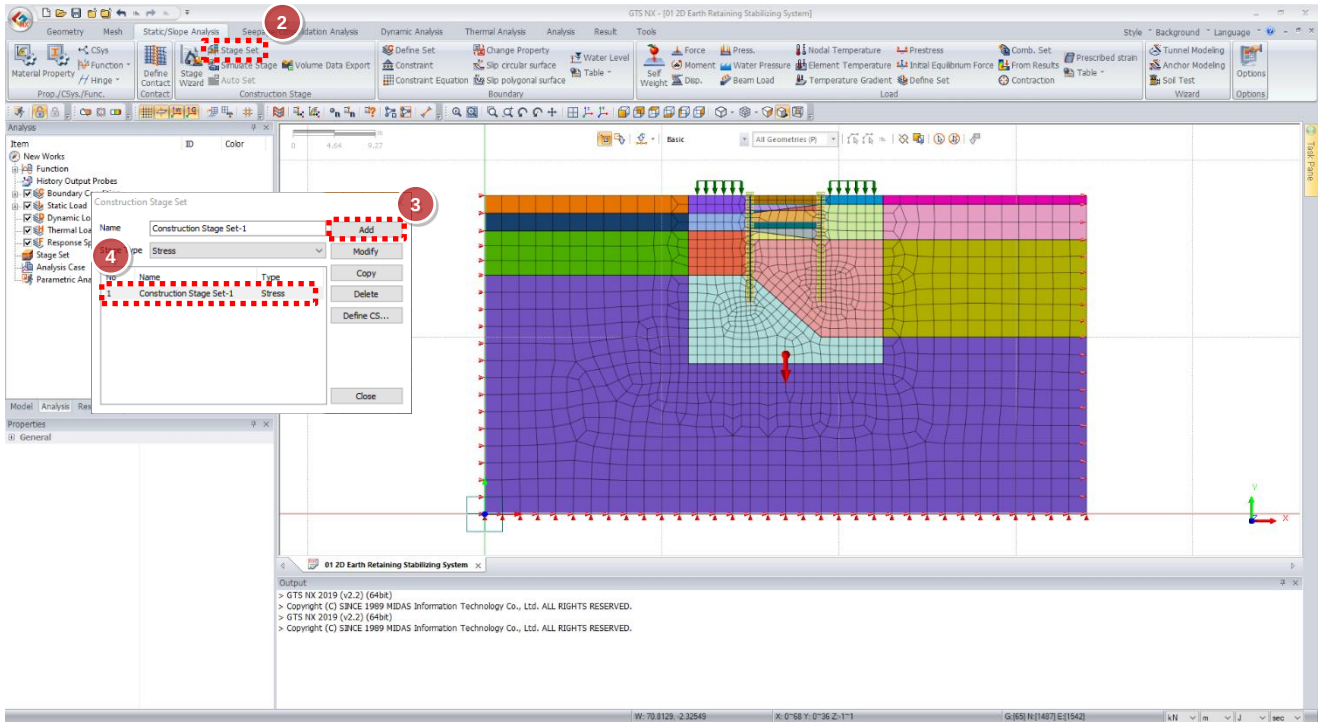
Procedure

1. Check off geometry and check on mesh
2. Click [Stage Set]
   (Static/Slope Analysis > Construction Stage > Stage Set)
3. Click [Add]
4. Double click [Construction stage set-1]



06 Analysis Setting

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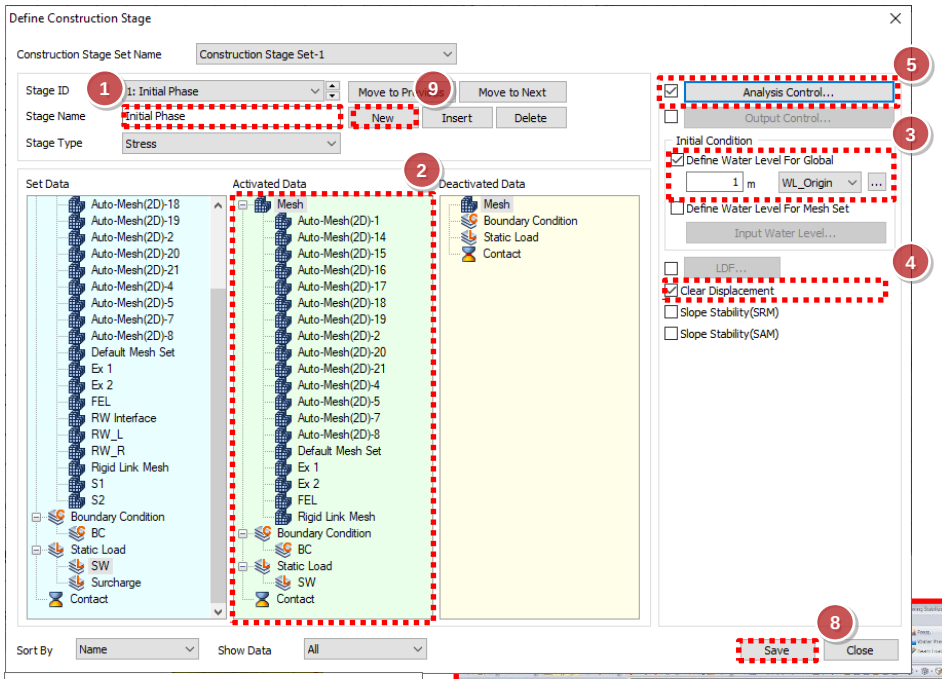
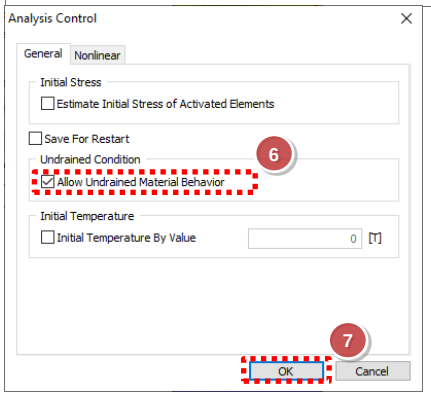
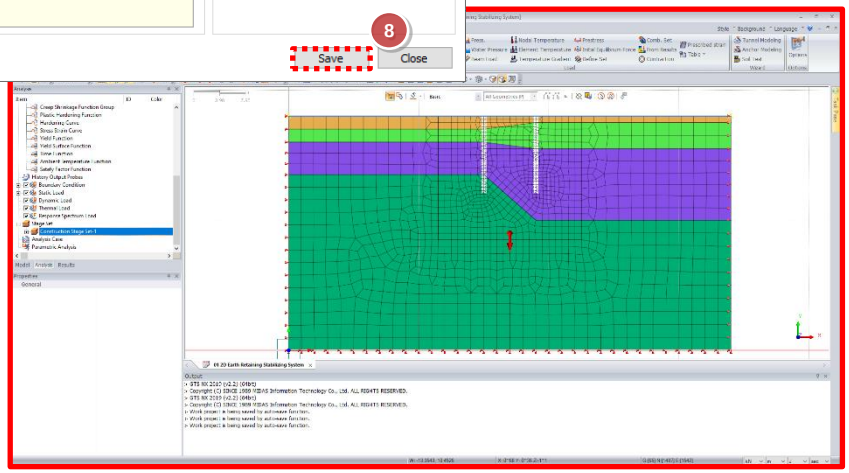
Procedure

1. Stage Name:
   Initial Phase
2. Move(Drag & Drop) the Data from “Set Data” to “Activated Data” as shown in figure
3. Check on “Define Water Level For Global”
   Key in “1m”
   Select “WL_Origin”
4. Check on “Clear Displacement”
5. Check on “Analysis Control” and Click “Analysis Control”
6. Check on “Allow Undrained Material Behavior”
7. Click [OK]
8. Click [Save]
9. Click [New]

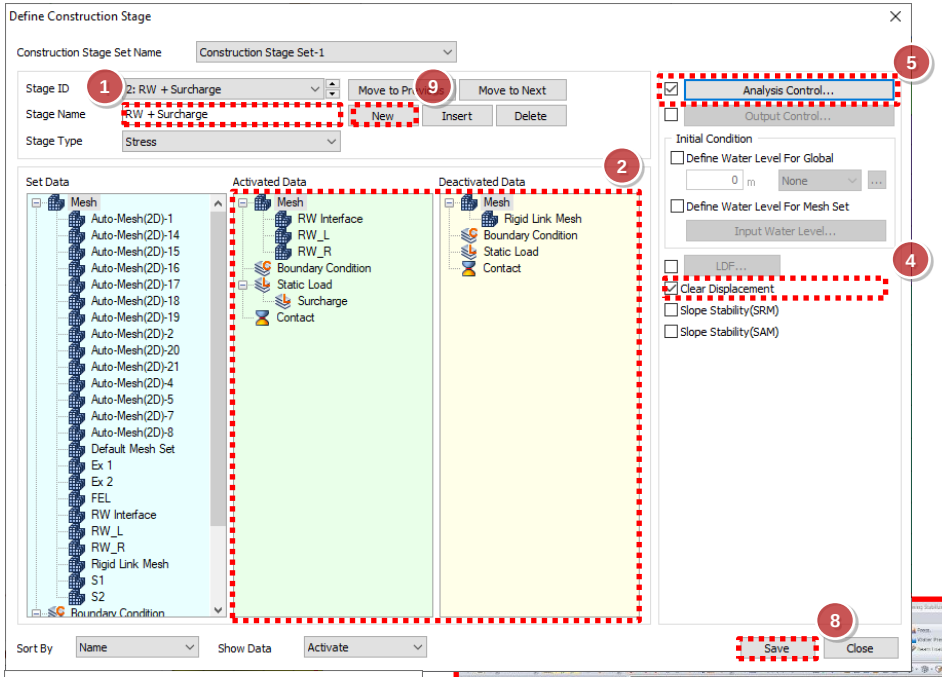


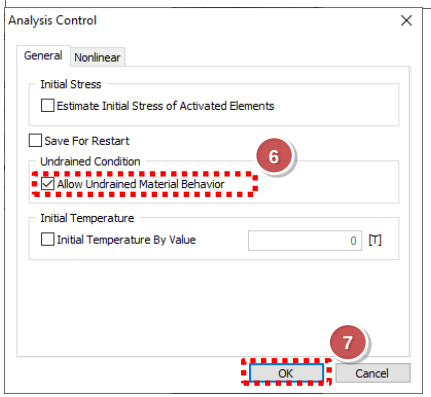


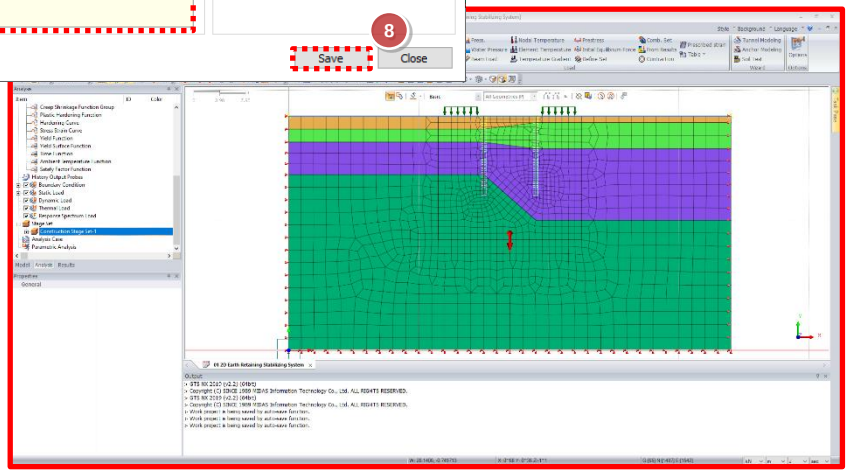


Procedure

1. Stage Name:
   RW + Surcharge
2. Move(Drag & Drop) the Data from “Set Data” to “Activated Data” and “Deactivated Data” as shown in figure
3. Check on
   “Clear Displacement”
4. Check on “Analysis Control” and Click “Analysis Control”
5. Check on “Allow Undrained Material Behavior”
6. Click [OK]
7. Click [Save]
8. Click [New]





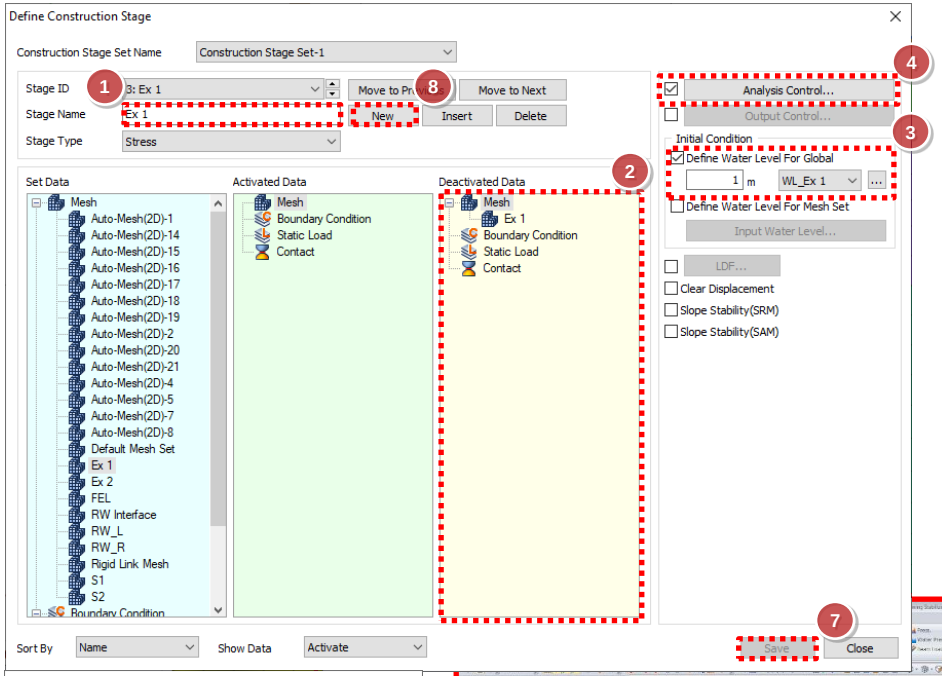


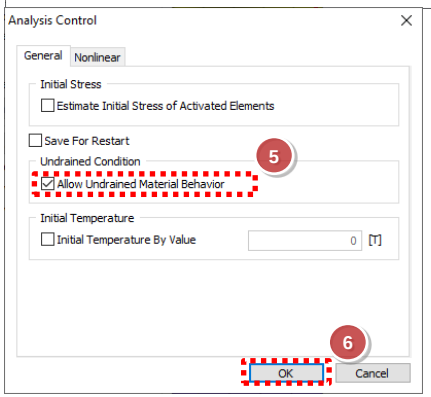
06 Analysis Setting

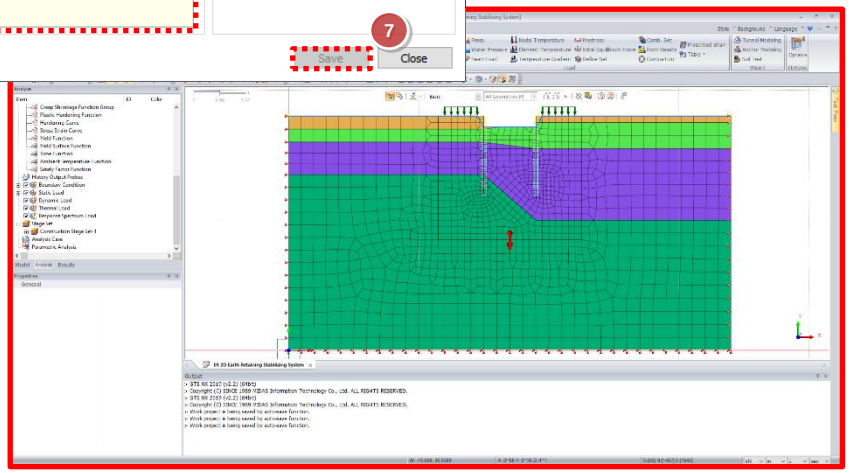
GTS NX

Procedure

1. Stage Name:
   Ex 1
2. Move(Drag & Drop) the Data from “Set Data” to “Deactivated Data” as shown in figure
3. Check on “Define Water Level For Global”
   Key in “1m”
   Select “WL_Ex 1”
4. Check on “Analysis Control” and Click “Analysis Control”
5. Check on “Allow Undrained Material Behavior”
6. Click [OK]
7. Click [Save]
8. Click [New]

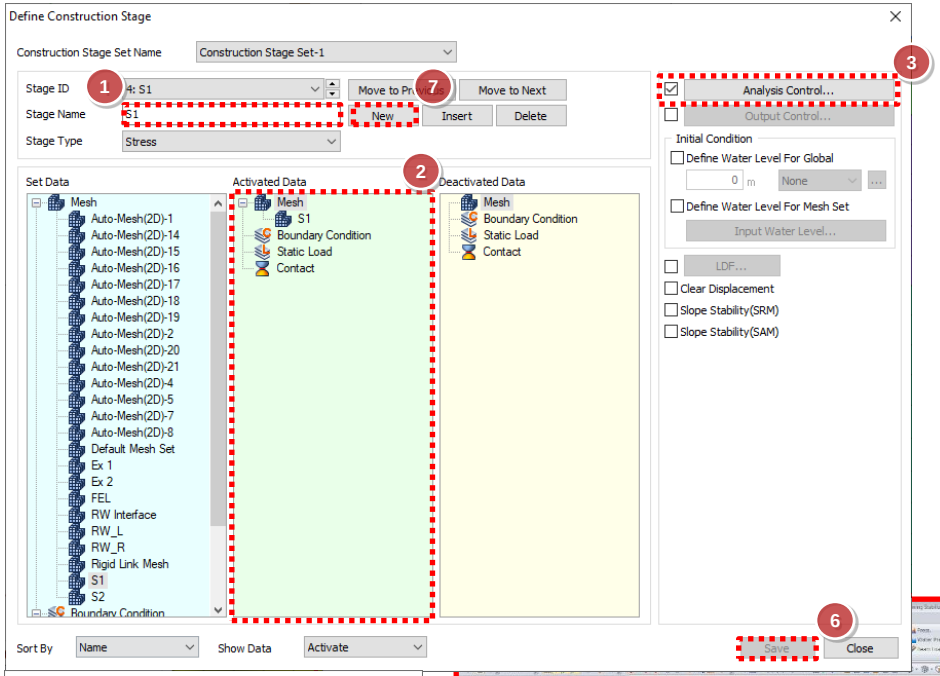


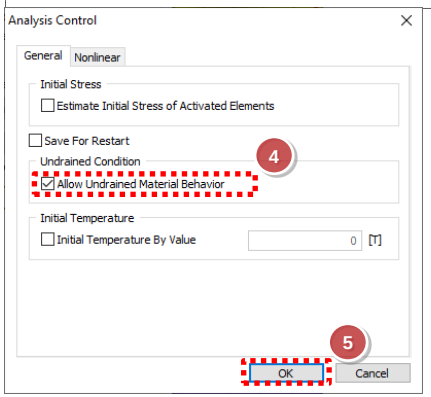


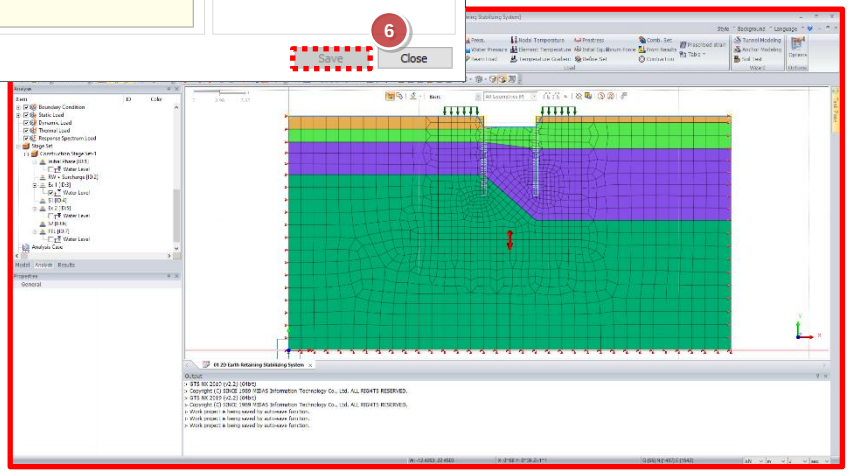


Procedure

1. Stage Name:
   S1
2. Move(Drag & Drop) the Data from “Set Data” to “Activated Data” as shown in figure
3. Check on “Analysis Control” and Click “Analysis Control”
4. Check on “Allow Undrained Material Behavior”
5. Click [OK]
6. Click [Save]
7. Click [New]



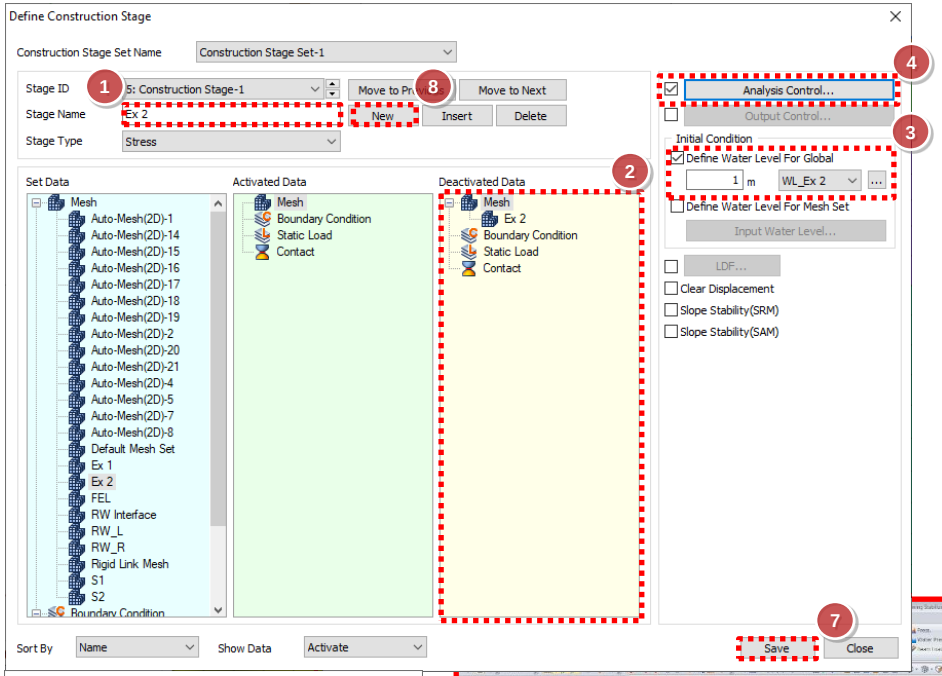


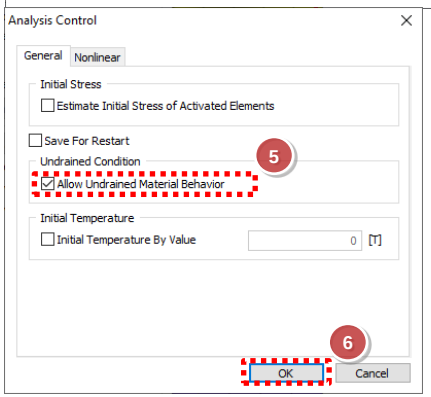


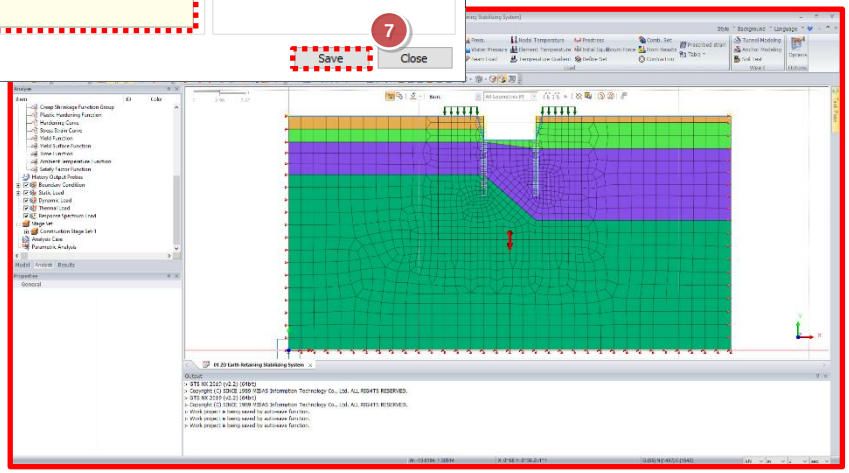
GTS NX

Procedure

1. Stage Name:
   Ex 2
2. Move(Drag & Drop) the Data from “Set Data” to “Deactivated Data” as shown in figure
3. Check on “Define Water Level For Global”
   Key in “1m”
   Select “WL_Ex 2”
4. Check on “Analysis Control” and Click “Analysis Control”
5. Check on “Allow Undrained Material Behavior”
6. Click [OK]
7. Click [Save]
8. Click [New]

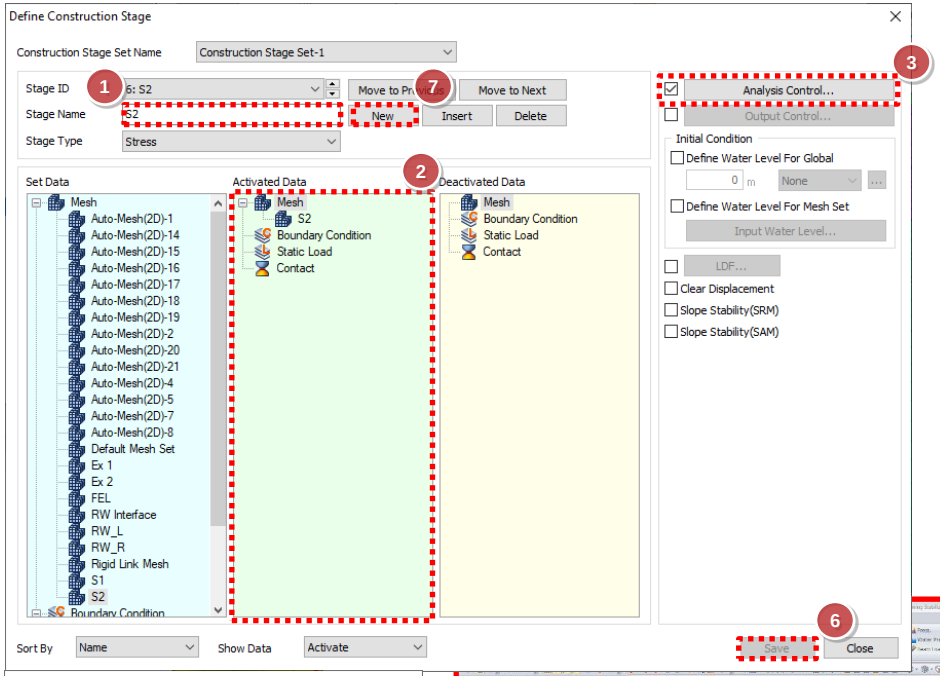


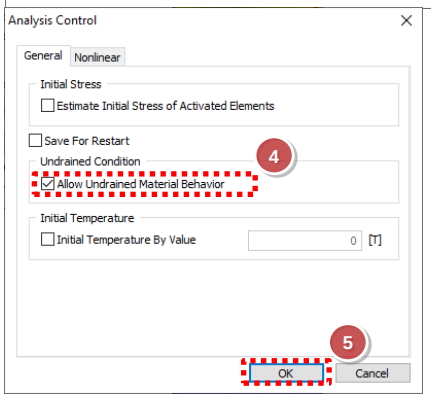


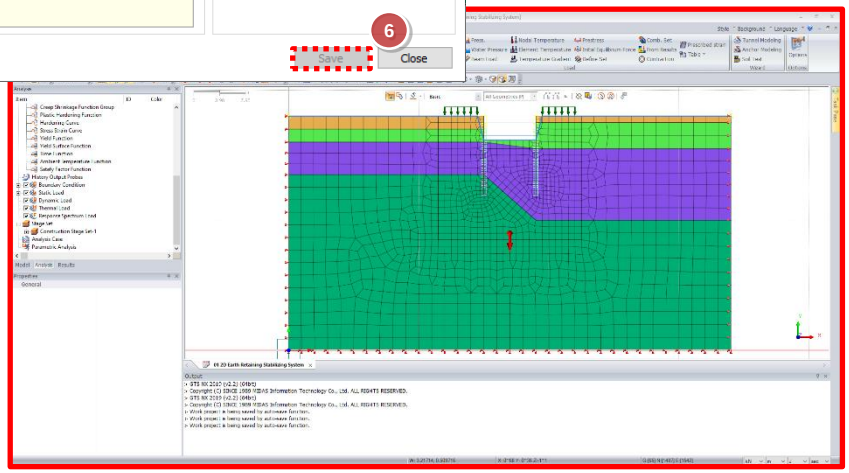


Procedure

1. Stage Name:
   S2
2. Move(Drag & Drop) the Data from “Set Data” to “Activated Data” as shown in figure
3. Check on “Analysis Control” and Click “Analysis Control”
4. Check on “Allow Undrained Material Behavior”
5. Click [OK]
6. Click [Save]
7. Click [New]



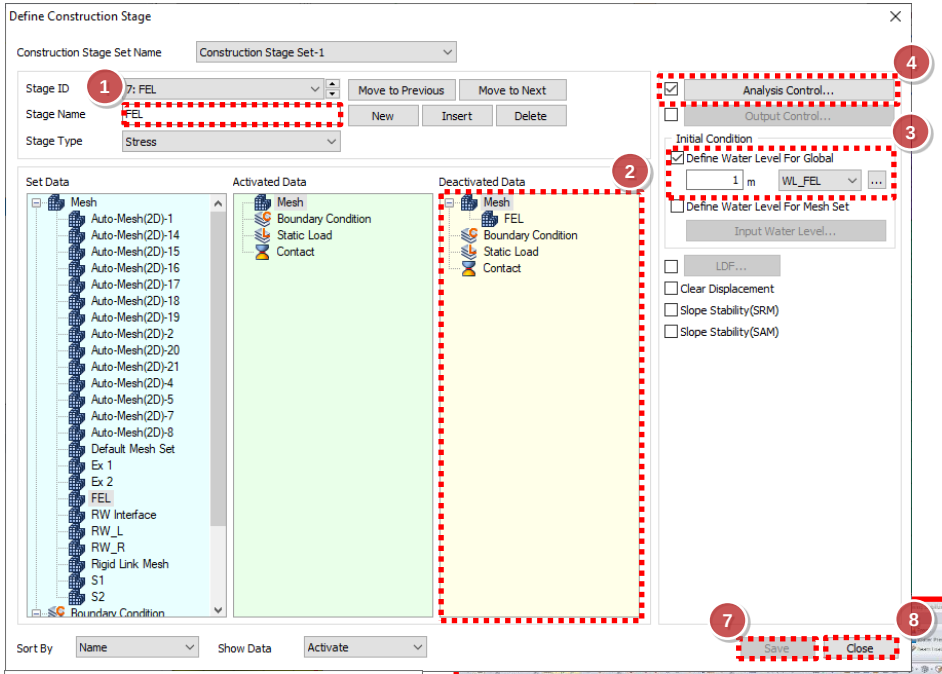


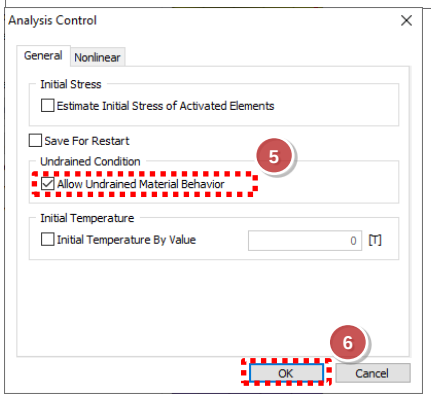


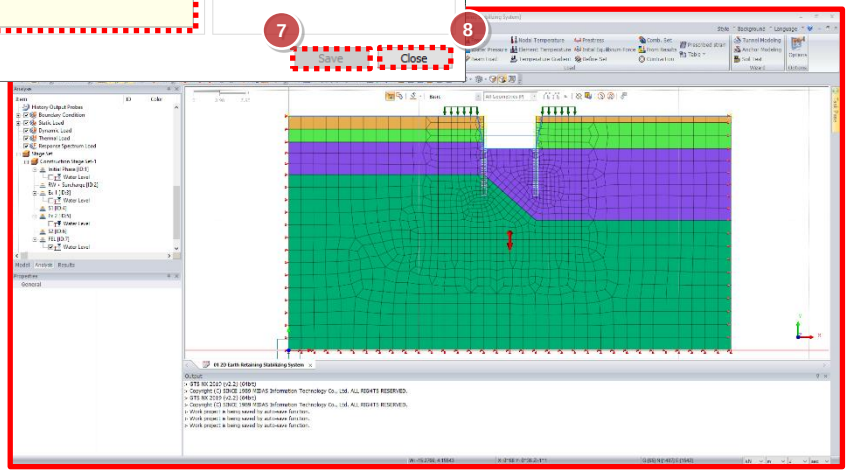
GTS NX

Procedure

1. Stage Name:
   FEL
2. Move(Drag & Drop) the Data from “Set Data” to “Deactivated Data” as shown in figure
3. Check on “Define Water Level For Global”
   Key in “1m”
   Select “WL_FEL”
4. Check on “Analysis Control” and Click “Analysis Control”
5. Check on “Allow Undrained Material Behavior”
6. Click [OK]
7. Click [Save]
8. Click [Close]





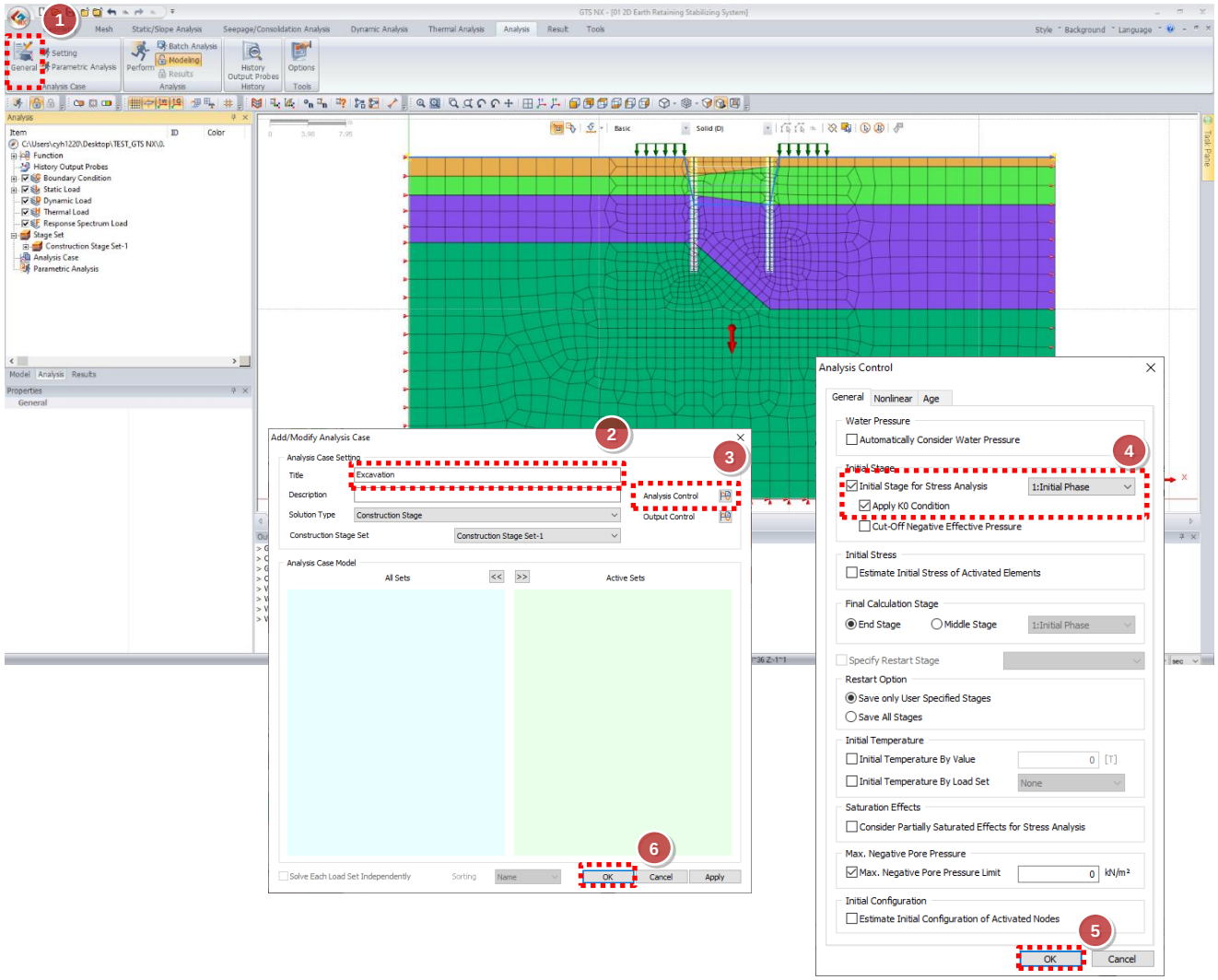


06 Analysis Setting

GTS NX

Procedure

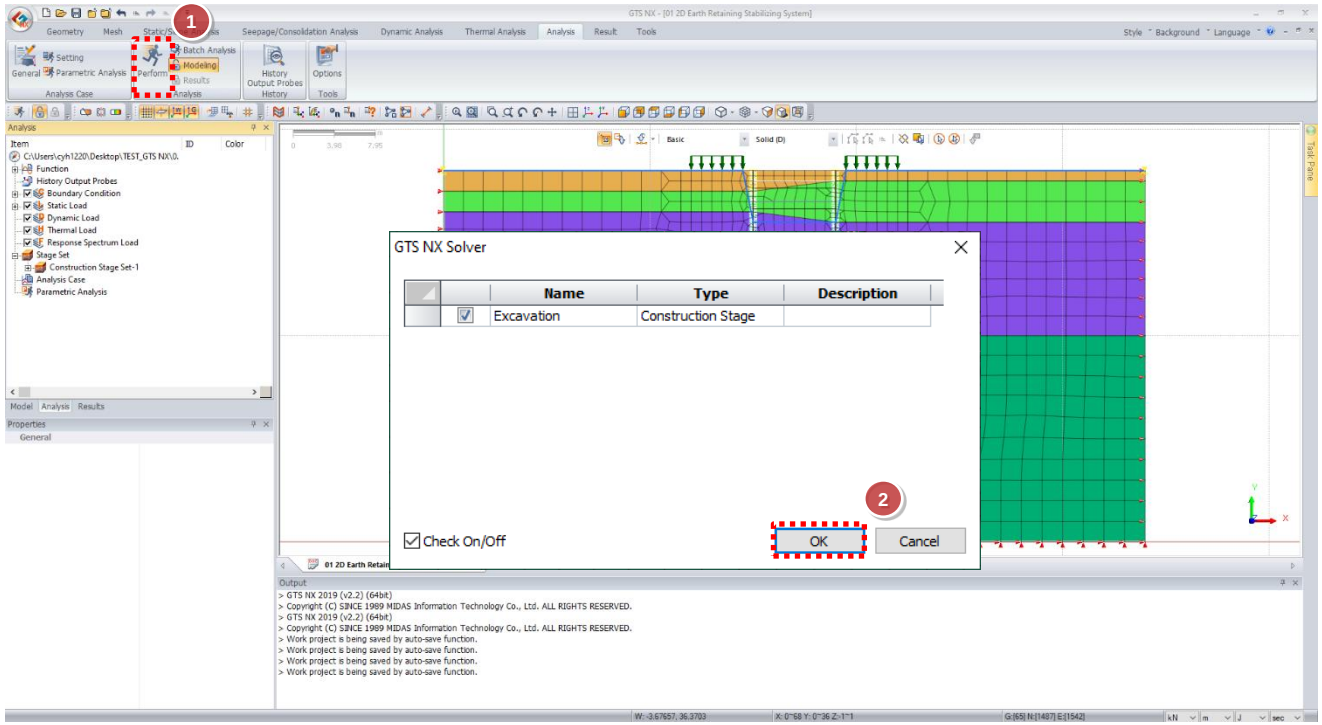
1. Click [General]
   (Analysis > Analysis Case > General)
2. Title: Excavation
3. Click [Analysis Control]
4. Check on “Initial Stage for Stress Analysis”
   Check on “Apply K0 Condition”
5. Click [OK]
6. Click [OK]



GTS NX

Procedure

1. Click [Perform]
2. Click [OK]

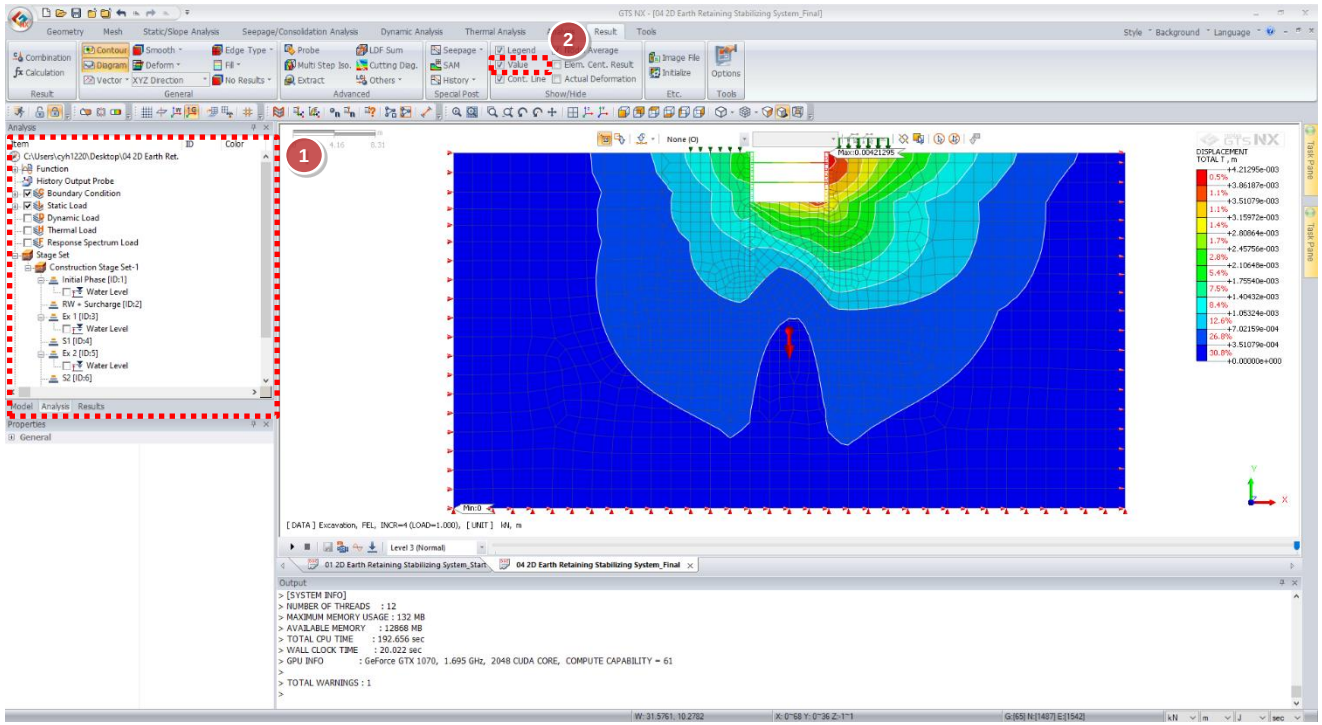


GTS NX

Procedure

1. The results from each stages can be found in the “Results” tab

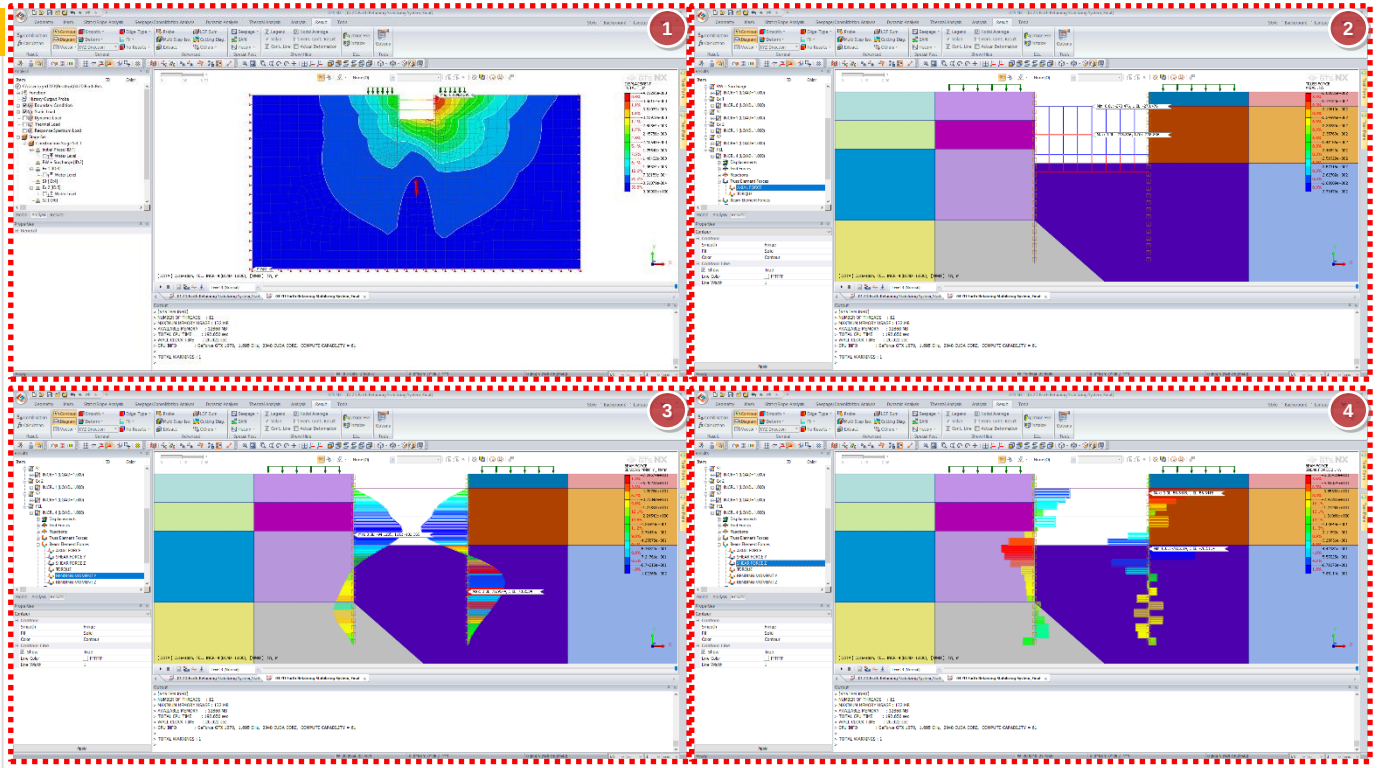
2. Check on “Value” can be found maximum and minimum value directly on the mesh



GTS NX

Procedure

1. Displacement of ground
2. Axial Force from struts
3. Bending moment of RWs
4. Shear Force of RWs



GTS NX

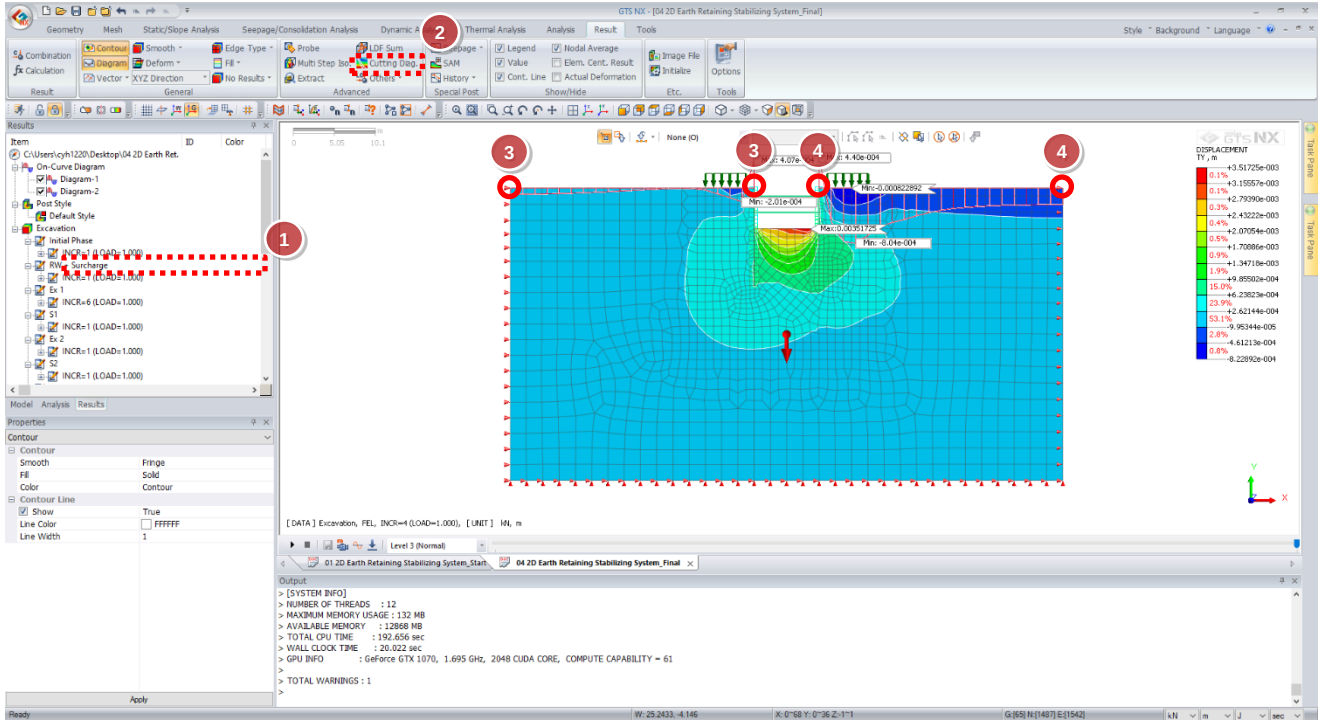
Procedure

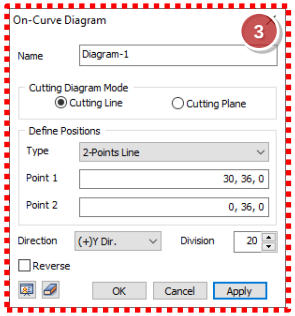
1. Select
   “TY TRANSLATION (V)”

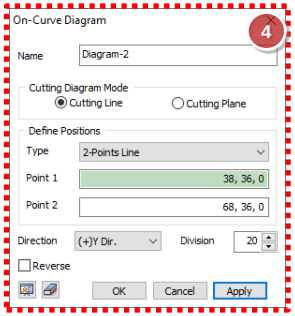
2. Click [Cutting Diag.]
   (Result > Advanced > Cutting Diag.)

3. Select start & end nodes
   Direction: (+)Y Dir.
   Click [Apply]

4. Select start & end nodes
   Direction: (+)Y Dir.
   Click [OK]





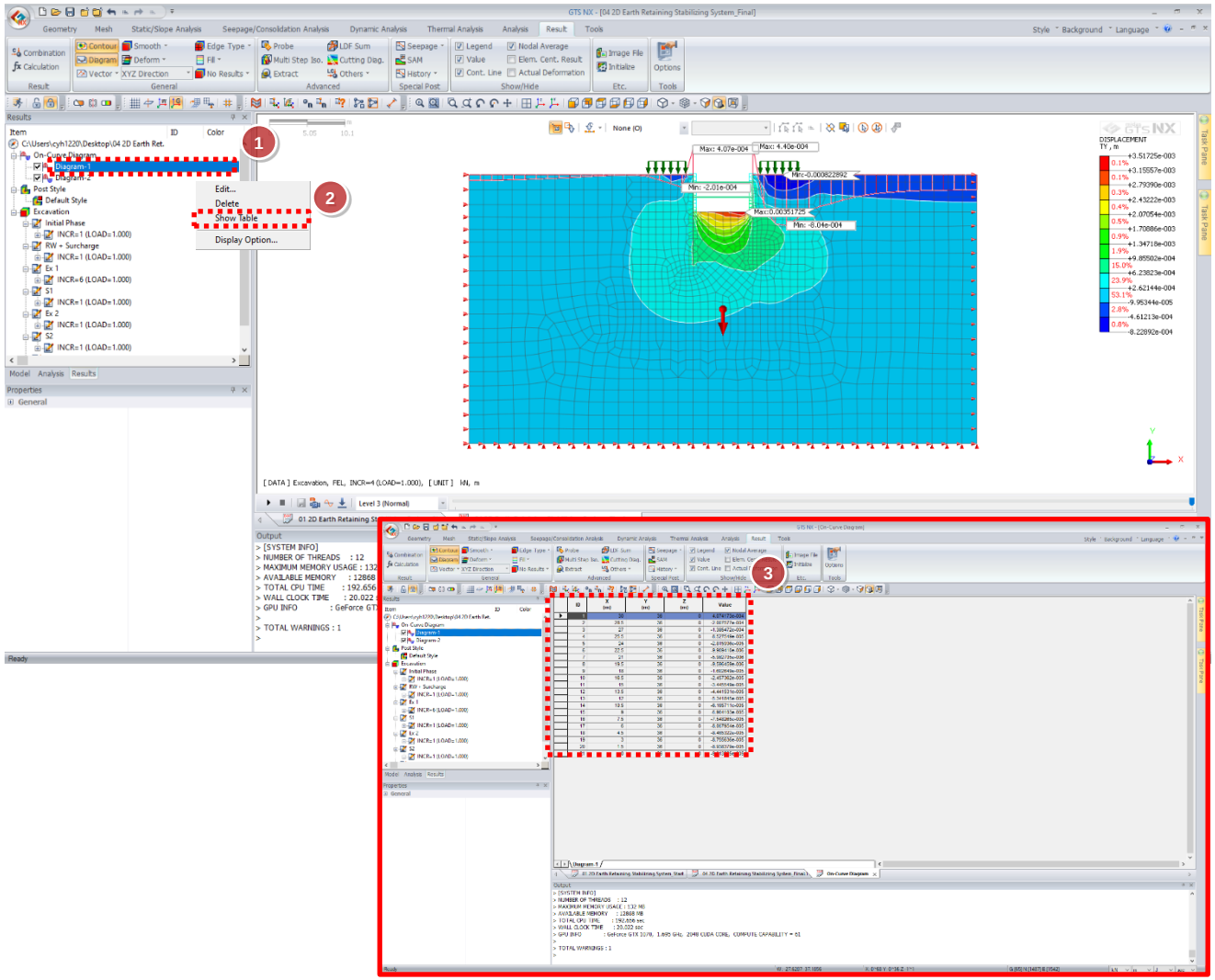


Procedure

1. Right Click on Diagram-1
2. Click [Show Table]
3. Verify the values from Diagram-1

• Table can be copied to spread sheet directly with “ctrl + c & ctrl + v”

• Increase the division from “On-Curve Diagram” function can be increase data of table.



GTS NX

New eXperience of Geo-Technical analysis System

Thank you!

MIDAS