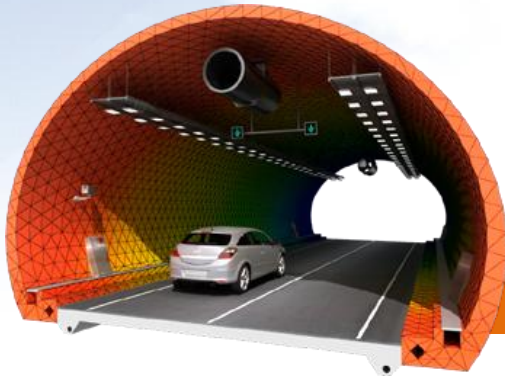


midas **GTS** 2012(v1.1) Release Note

Next Generation Solution for Geotechnical and Tunnel Engineering





Enhancements

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Pre-Processing

1. Auto Generation of Boundary Elements for Dynamic Analysis

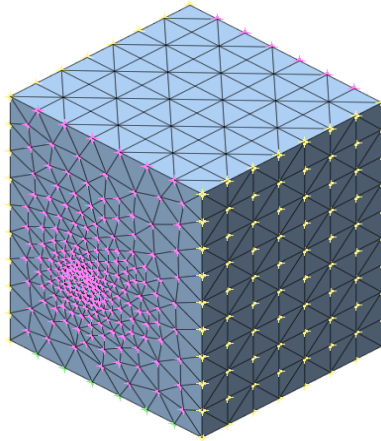
Upgrade Contents

- Auto calculation of the modulus of sub-grade reaction and generation of the elastic boundary elements for eigenvalue and response spectrum analysis
- Auto calculation of the damping constant and generation of the viscous boundary elements for time history analysis

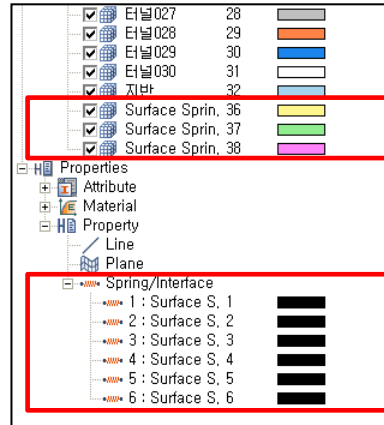
Effects & Usage

- The ground boundary elements and constraints can easily be generated without a separate calculation for dynamic analysis.

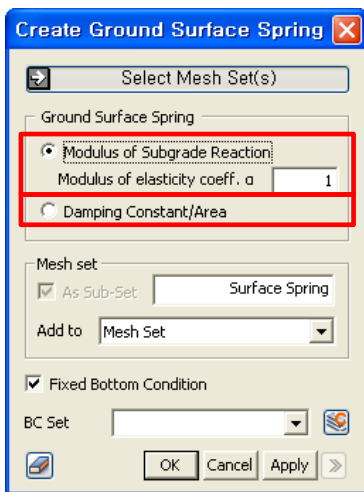
▪ *Model > Element > Create Ground Surface Spring*



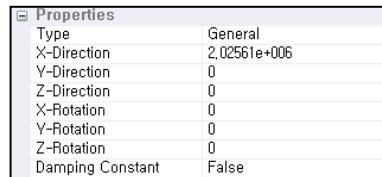
Surface Spring



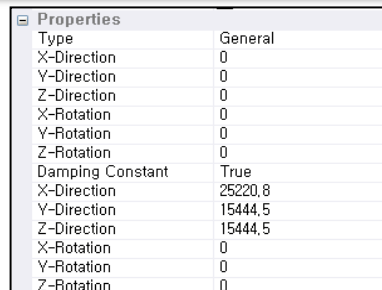
Generation of Auto Mesh-set



Create Ground Surface Spring



Auto Generation of Elastic Boundary Element



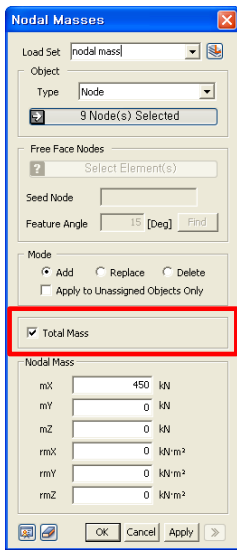
Auto Generation of Viscous Boundary Element

2. Total Mass

Upgrade Contents

- The entered mass data (Lumped Translation Mass/Rotational Mass Moment of Inertia) can be distributed evenly on the selected nodes without a separate calculation for dynamic analysis.

▪ **Model > Element > Load > Nodal Mass**



Nodal Mass

F	Load Set	Node	mX (kN)	mY (kN)	mZ (kN)	rmX (kN-m²)	rmY (kN-m²)	rmZ (kN-m²)
	nodal ma	7	450.00	0.00	0.00	0.00	0.00	0.00
	nodal ma	8	450.00	0.00	0.00	0.00	0.00	0.00
	nodal ma	9	450.00	0.00	0.00	0.00	0.00	0.00
	nodal ma	16	450.00	0.00	0.00	0.00	0.00	0.00
	nodal ma	17	450.00	0.00	0.00	0.00	0.00	0.00
	nodal ma	18	450.00	0.00	0.00	0.00	0.00	0.00
	nodal ma	25	450.00	0.00	0.00	0.00	0.00	0.00
	nodal ma	26	450.00	0.00	0.00	0.00	0.00	0.00
	nodal ma	27	450.00	0.00	0.00	0.00	0.00	0.00

Uncheck Total Mass

F	Load Set	Node	mX (kN)	mY (kN)	mZ (kN)	rmX (kN-m²)	rmY (kN-m²)	rmZ (kN-m²)
	nodal ma	7	50.00	0.00	0.00	0.00	0.00	0.00
	nodal ma	8	50.00	0.00	0.00	0.00	0.00	0.00
	nodal ma	9	50.00	0.00	0.00	0.00	0.00	0.00
	nodal ma	16	50.00	0.00	0.00	0.00	0.00	0.00
	nodal ma	17	50.00	0.00	0.00	0.00	0.00	0.00
	nodal ma	18	50.00	0.00	0.00	0.00	0.00	0.00
	nodal ma	25	50.00	0.00	0.00	0.00	0.00	0.00
	nodal ma	26	50.00	0.00	0.00	0.00	0.00	0.00
	nodal ma	27	50.00	0.00	0.00	0.00	0.00	0.00

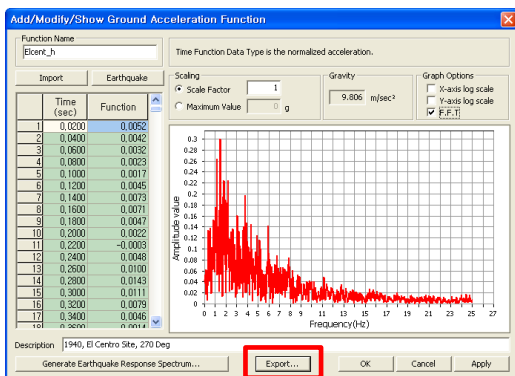
Check Total Mass

3. Text Output of Ground Acceleration in 1D Ground Response Analysis

Upgrade Contents

- The seismic waves used in 1D ground response analysis can be viewed in the text format.
(Can be output of F.F.T results)

▪ **Tools > 1D Ground Response Analysis > Model > Ground Acceleration**



Ground Acceleration

```

** Ground Acceleration Function Data
** Function Name : Elcent_h
** Data Type : FFT

X-Axis      Y-Axis
-----
2.44140625e-002  4.37072357e-002
4.88281250e-002  5.21025248e-002
7.32421875e-002  4.36864695e-002
9.76562500e-002  3.84010776e-002
1.22070313e-001  2.60763330e-002
1.46484375e-001  1.76606120e-002
1.70898438e-001  6.22266455e-003
1.95312500e-001  2.10596299e-002
2.19726563e-001  2.33264034e-002
2.44140625e-001  4.44279802e-002
2.68554688e-001  7.22478402e-003
2.92968750e-001  3.39554551e-002
    
```

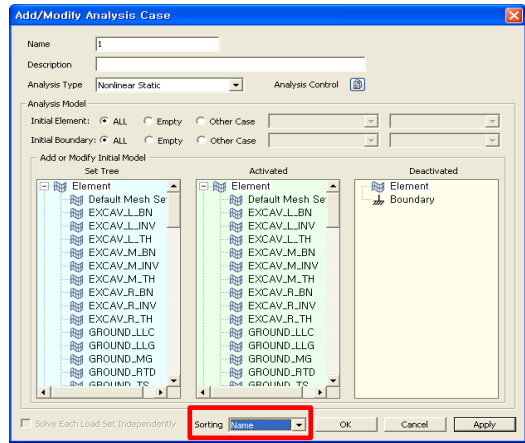
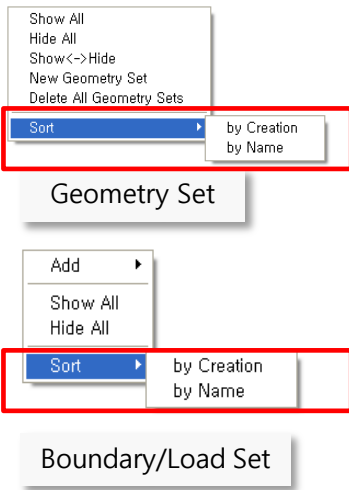
Data Export (F.F.T)

4. Improvements of Sorting Function

Upgrade Contents

- Add 'Sort by Name' in Geometry Set, Boundary Set, Load Set.
- Add 'Sort' function in Analysis case.
- A more intuitive check through 'Sort by Creation' as well as 'Sort by Name'

- *Model Works Tree > Geometry set > Sort*
- *Analysis Works Tree > Boundary/Load > Sort*
- *Analysis > Analysis case > Add/Modify Analysis Case*



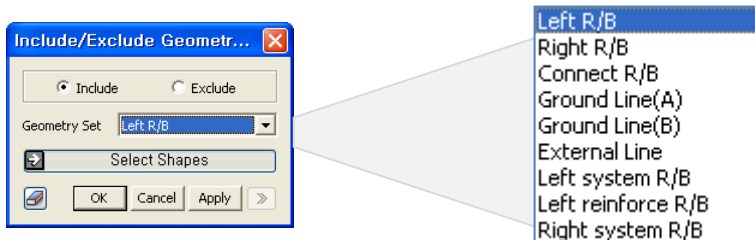
Analysis Case

5. Geometry Set Combo

Upgrade Contents

- Select the geometry set using the combo box.

- *Model Works Tree > Geometry set > Sort*



Geometry Set Combo

Analysis

1. Nonlinear Elastic Link

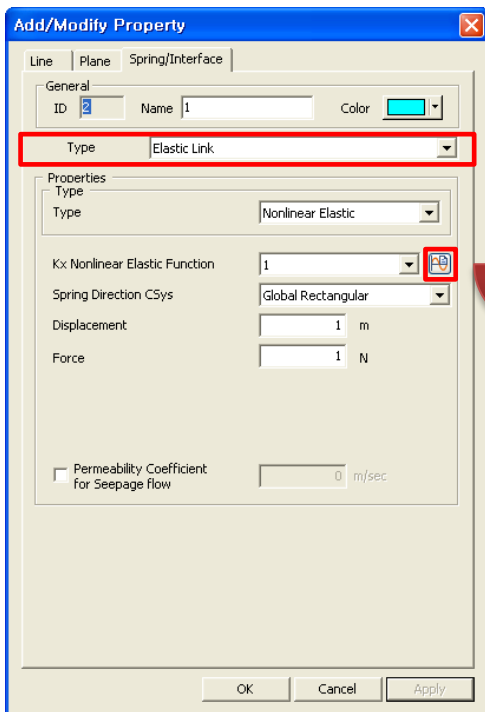
Upgrade Contents

- Nonlinear elastic property for construction stage analysis
- 'Tension only' and 'Compression only' elastic link types in nonlinear analysis
- If **the nonlinear elastic property for spring coefficient can be defined by function**, the spring constant begins to take effect.

Effects & Usage

- Construction stage analysis can be performed considering the nonlinear elastic link property.
(Only for construction stage and nonlinear static analysis)

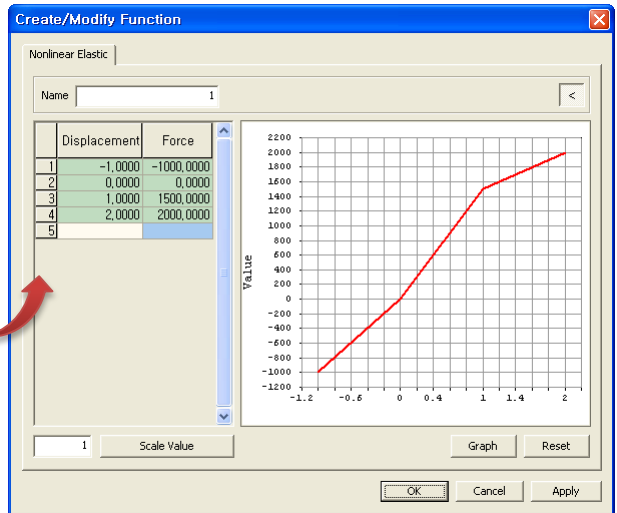
▪ **Model > Property > Property > Elastic Link**



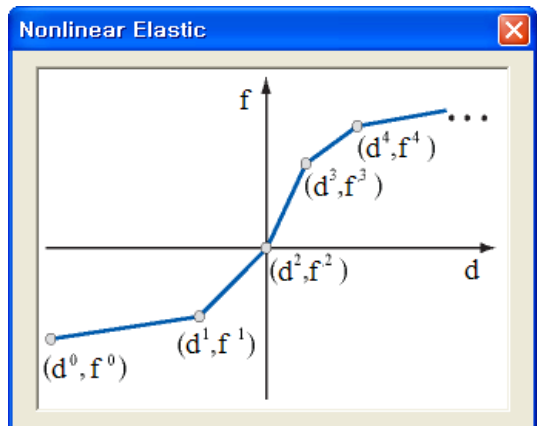
Nonlinear Elastic Link



Elastic Link Type



Nonlinear Elastic Link Function



Nonlinear Elastic

2. Various Types of Point Spring

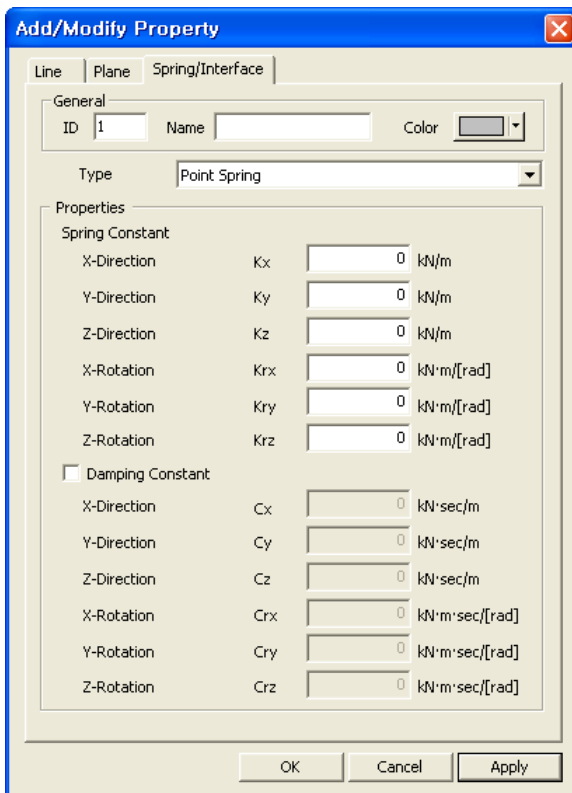
Upgrade Contents

- Selecting the various types of point spring
(General, Tension only, Compression only, Hook, Gap, Nonlinear Elastic)

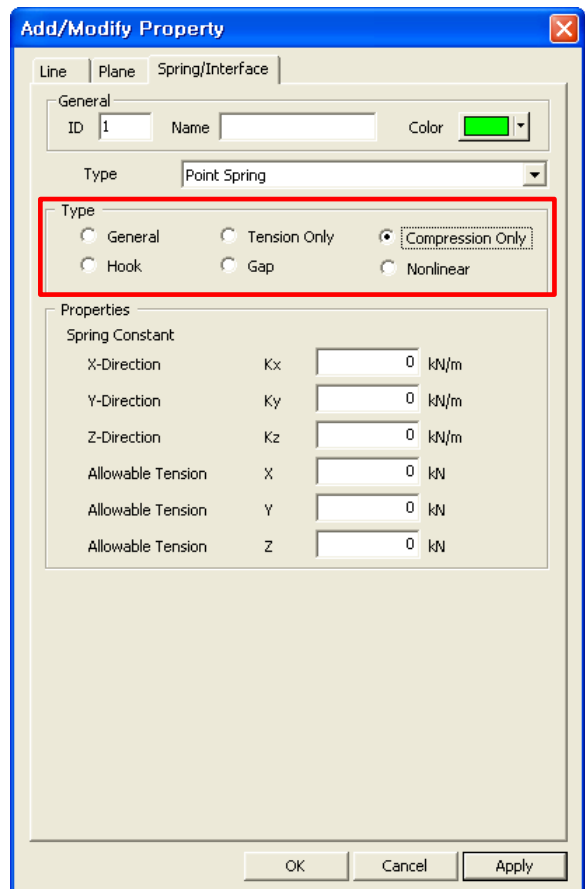
Effects & Usage

- Nonlinear behavior can also be simulated using point spring as well as link element.
(Only for construction stage and nonlinear static analysis)

▪ *Model > Property > Property > Point Spring*



Point Spring - Previous



Point Spring - New

3. Setting Nonlinear Option at Each Construction Stage

Upgrade Contents

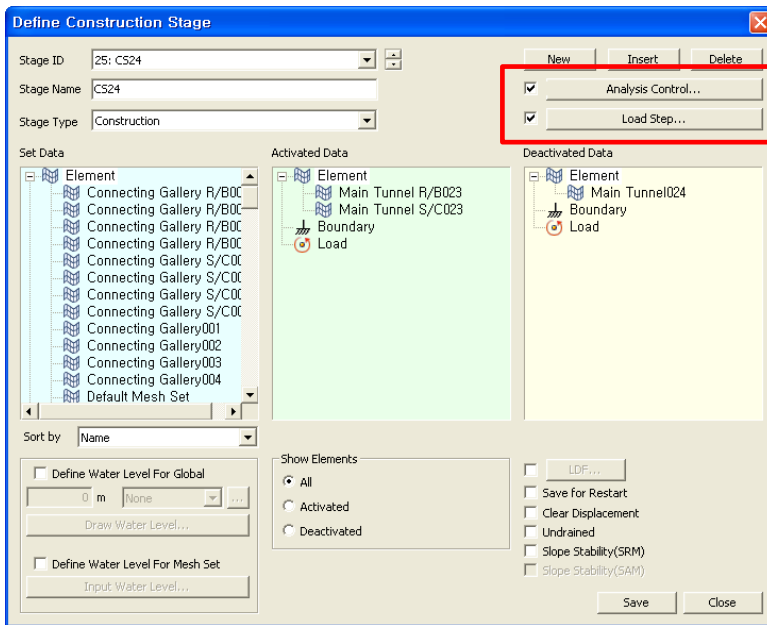
- Different convergence criteria and number of iterations can be applied to each stage of construction stage analysis.

(Construction stage, Seepage(Steady-State), Seepage(Transient), Consolidation)

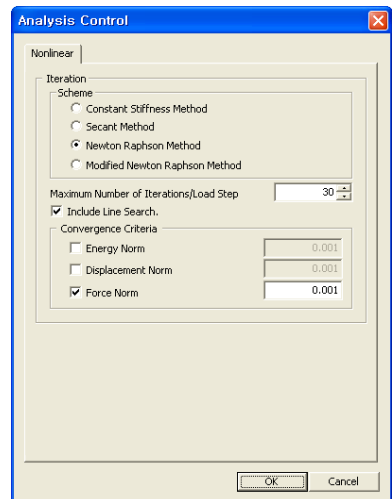
Effects & Usage

- Setting the convergence criteria of nonlinear static analysis and the details of iterations at each stage
- Controlling convergence criteria for a particular stage for the better convergence

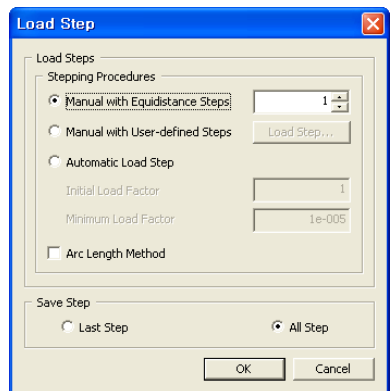
▪ Model > Construction Stage > Define Construction Stage



Define Construction Stage



Analysis Control



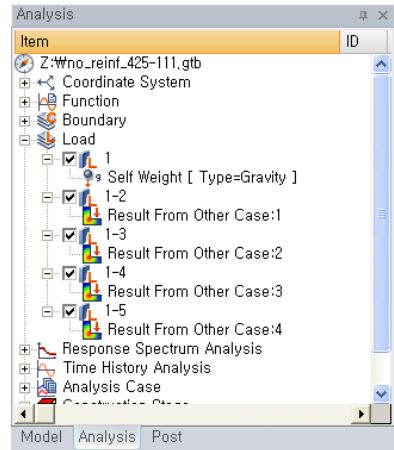
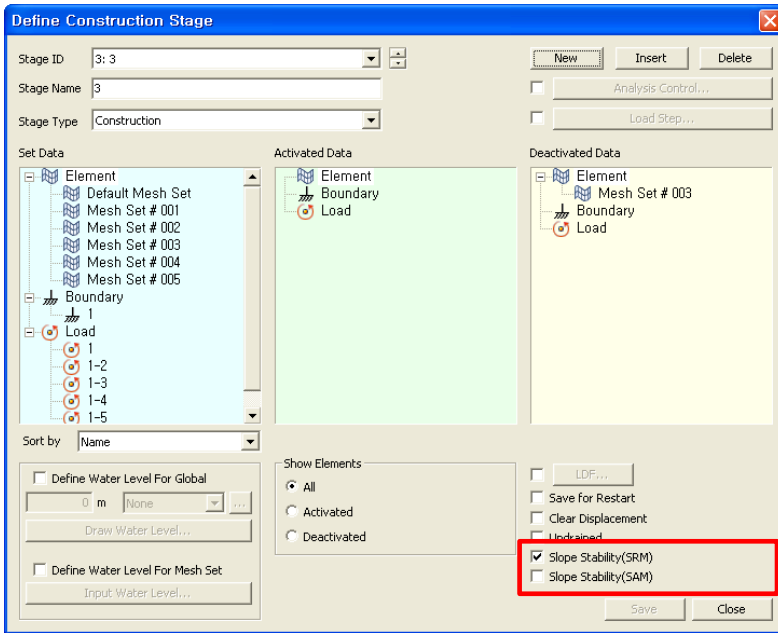
Load Step

4. Slope Stability Analysis Considering Construction Stage

Upgrade Contents

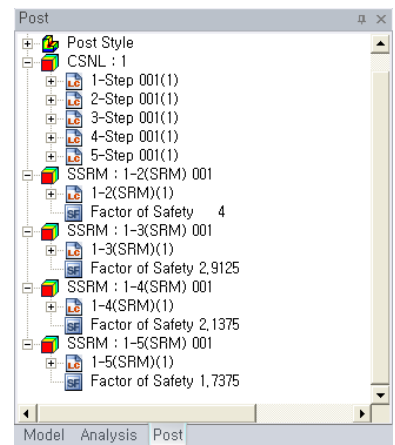
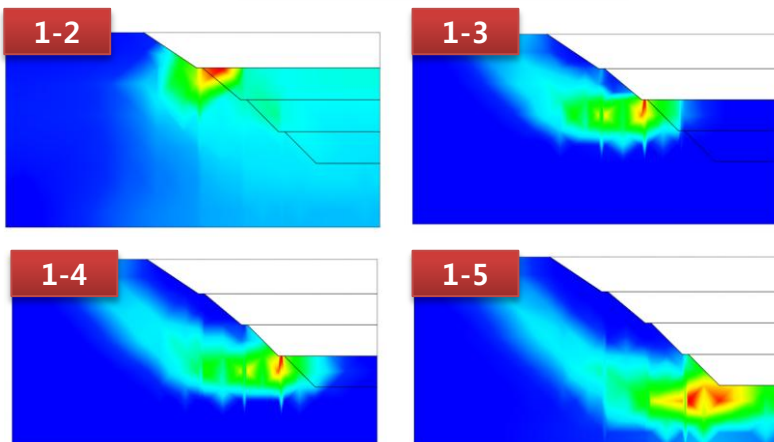
- Slope stability analysis considering the changes in stresses during construction stages (e.g. excavation or embankment)
- Option for determining whether to perform slope stability analysis in the current construction stage. (Slope stability(SAM) can be applied only in 2D analysis and the boundary conditions of virtual failure surface should be set.)
- Slope stability analysis during construction stages is performed based on the stress results of each stage from construction stage analysis and generates loads by 'Result From Other Case'. Therefore the message 'Self weight is not activated.' can appear, and then click 'Yes' if you want to proceed.

▪ *Model > Construction Stage > Define Construction Stage*



Result From Other Case

Define Construction Stage



Factor of Safety

5. Add Specific Storativity and Unsaturated Property in Seepage Analysis

Upgrade Contents

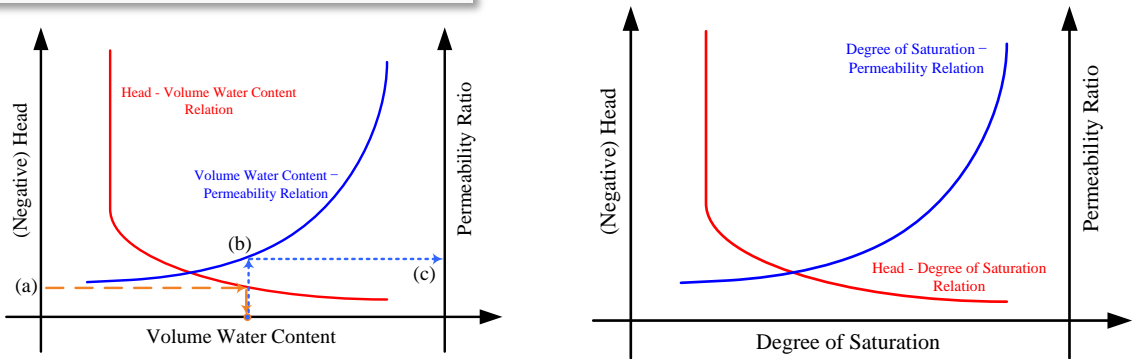
- Define the permeability function by Van Genuchten type.
- Define the nonlinear equations of permeability and volumetric water content at the same time.
- Degree of saturation and effective porosity can be input for a function besides volumetric water content.

Effects & Usage

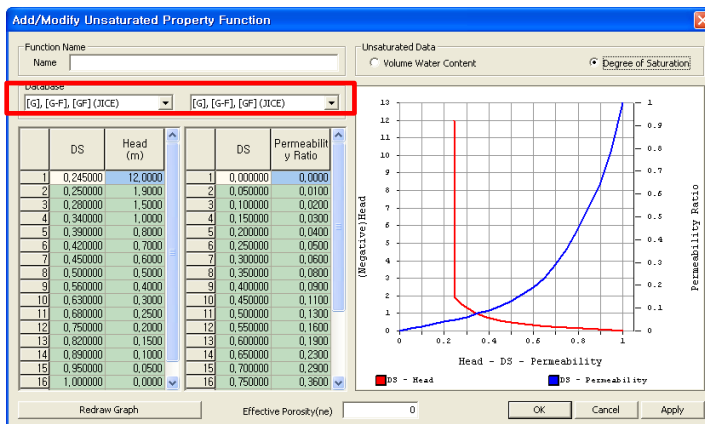
- Support two definition methods of the nonlinear equations of permeability and volumetric water content separately or at the same time.

▪ **Model > Property > Unsaturated Property Function**

Calculation of Relative Permeability(K)



- 1) Select the soil type in the unsaturated property function dialog box or user input.
- 2) Update the relative permeability after calculating the element pressure head at each step in transient seepage analysis.
- 3) Calculate the pressure head (a) → Define the volume water content or degree of saturation (b) → Update the relative permeability by the volume water content or degree of saturation (c).



- [G], [G-F], [GF] (JICE)
- [S], [S-F] (JICE)
- [SF] (JICE)
- [M], [C] (JICE)
- User Defined

Soil Type

Unsaturated Property Function

Post-Processing

1. Soil Status Index Output

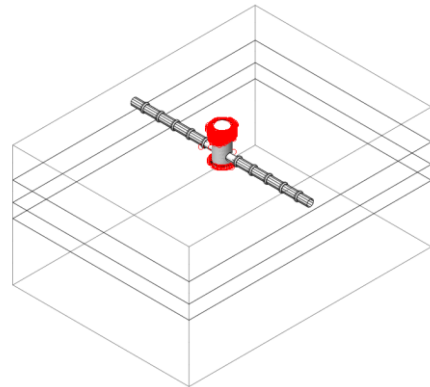
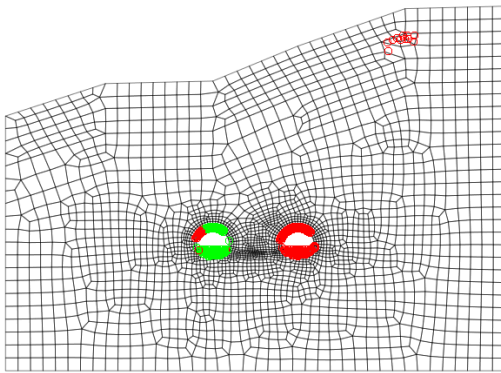
Upgrade Contents

- Display the mark in the plastic or failure area after analysis.
(Soil Status result type in construction stage, slope stability and consolidation analysis)

Effects & Usage

- Intuitive check for the plastic or failure area
- Check the failure state for the ground constitutive model.

▪ *Post Works Tree > Element Status > Soil Status*



Soil Status Index

Mohr-Coulomb	
Plastic	○
Unloading or reloading	⊖
Tension failure	⊕

Duncan-Chang	
Failure	△
Unloading or reloading	△
Tension	△

Drucker-Prager	
Plastic	□
Unloading or reloading	□
Tension failure	⊕

D-min model	
Failure	□
Tension	⊕

Modified Cam-Clay	
Plastic	□
Unloading or reloading	□

Hoek-Brown	
Plastic	▽
Unloading or reloading	▽

Modified Mohr-Coulomb	
Plastic	◇
Unloading or reloading	◇
Tension failure	⊕
Cap failure	◇

- **Failure / Plastic:** In case of shear failure
- **Unloading or Reloading:** In case of changing state when loads are added or removed
- **Tension / Tension Failure:** In case of failure in the tension area
- **Cap Failure:** In case of failure in the compressive yield area

Plastic Points Output of Material Model

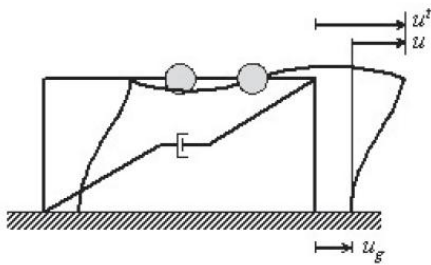
Post-Processing

2. Absolute Displacement Output in Dynamic Analysis

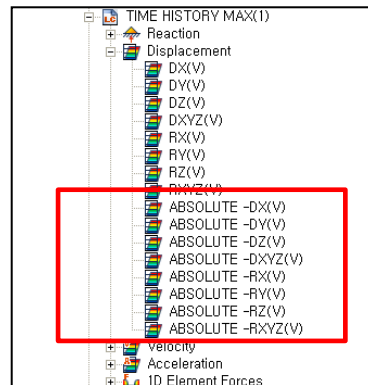
Upgrade Contents

- Add absolute displacement results.
(Output the absolute displacement of each time step by 'Result > Time History Result > Time History Graph > Add Ground motion')

▪ *Post Works Tree > Time History > Displacement*



Displacement by Earthquake



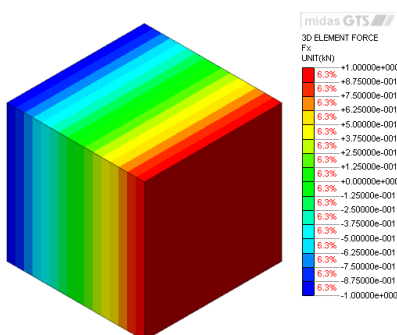
Absolute Displacement Output

3. Element Force Output in Linear Static Analysis

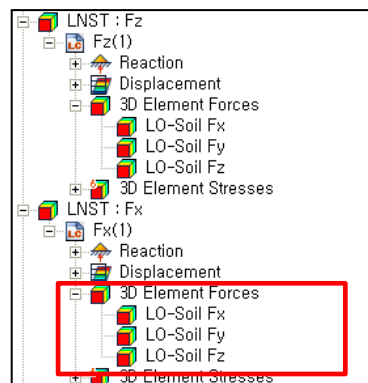
Upgrade Contents

- Directional forces output of 2D plain strain or 3D solid elements
(Only for linear static, linear time history, response spectrum analysis)

▪ *Post Works Tree > Element Forces > Soil Fx, Fy, Fz*



Element Force



Element Force Output