SoilWorks

2019(v1.1) Release Notes

Release Note

Pre/Post-Processing

- [Slope] Display the horizontal seismic force in free body diagram from Limit Equilibrium Method (LEM)
- [Slope] Display the reinforced forces from Limit Equilibrium Method (LEM)
- [Seepage] Multi flux result function
- [Seepage] Saturation result function
- [Common] Size control function for Result Tag (Tunnel/Slope/Seepage/Softground/Dynamic)
- [Seepage] Display Seepage flow on the Total Head result

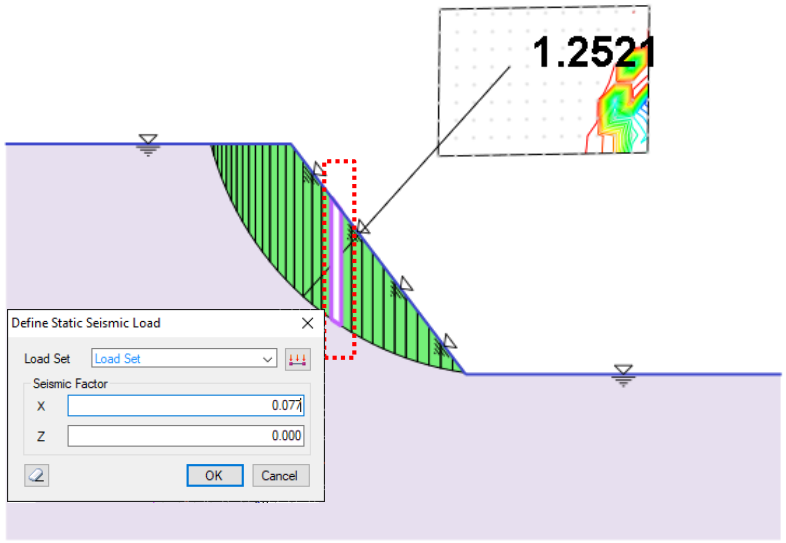
Analysis

- [Foundation] Including an Acceleration of Convergence
- [Slope] Updated slice segmentation
- [Dynamic] Generation of artificial earthquake

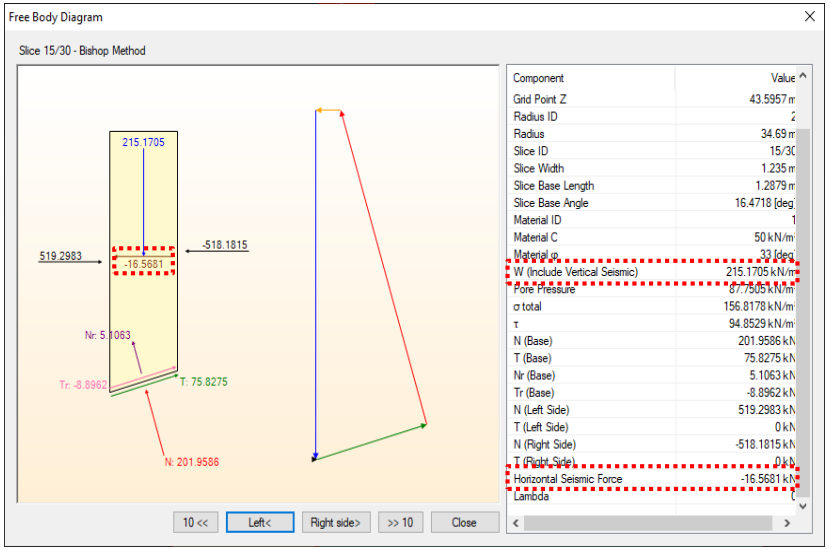
1. [Slope] Display the horizontal seismic force in free body diagram from Limit Equilibrium Method (LEM)

- Display the horizontal seismic force (direction, value) in the free body diagram from Limit Equilibrium Method (LEM)
  - Vertical Capacity : **W ➔ W(Include Vertical Seismic)**
  - Horizontal Capacity : **Horizontal Seismic Force**

- *Result Tree > **Result** > Arc Failure Surface*



[Display on Design Report]

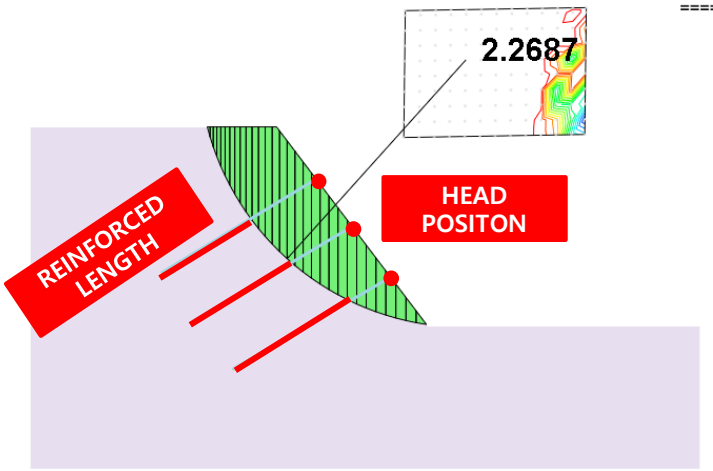


[Display on safety result]

2. [Slope] Display the reinforced forces from Limit Equilibrium Method (LEM)

- Display the reinforced force of the reinforcement from Limit Equilibrium Method (LEM)
- The axial resist mechanism will be covered by pull out and tensile strength, will be used smaller value.

• *Results* > ***Print*** > *Result File*



[Reinforcement]

REINFORCE TYPE	HEAD POSITION X-COORD	HEAD POSITION Z-COORD	REINFORCED LENGTH	REINFORCED FORCE NORMAL	REINFORCED FORCE SHEAR
NAIL	0,7826	21,7667	6,8844	1,500000E+02	0,000000E+00
NAIL	3,1404	18,6629	7,5119	1,500000E+02	0,000000E+00
NAIL	5,6683	15,3355	8,9186	1,500000E+02	0,000000E+00

[Display Reinforced Force]

REINFORCED TYPE (Nail/Anchor/Strp/Strut)

HEAD POSITON : Installation position of reinforcement (x, z) (m)

REINFORCED LENGTH (m)

REINFORCED FORCE - Normal : Axial Force (kN)

- SHEAR : Shear Force (kN)

Ex) If, Tensile force of Nail : 150kN, Equivalent radius : 0.05m, qs=200kN/m^2 and Lext=6.8844m

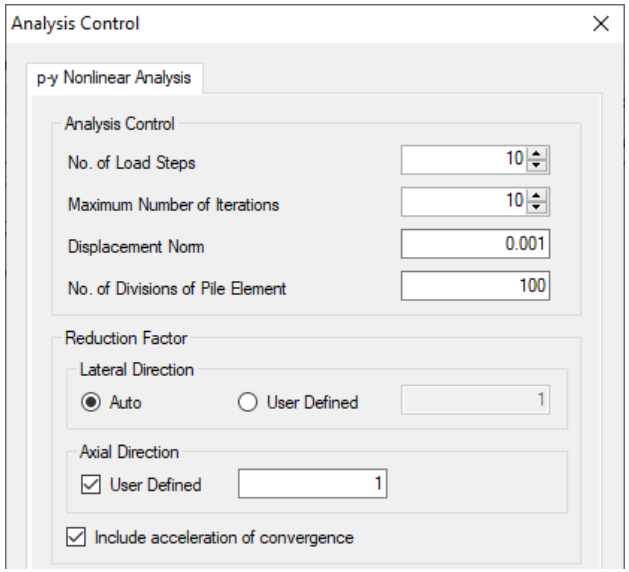
$RCS = qs \times \pi \times 2R$ $P_{Resist} = \int_0^{l_{ext}} (l_{ext} \times RCS) dl$ = 432.56 kN

$R_{Nail\_axial} = \min(P_{Resist}, T_{Yield})$ = 150kN

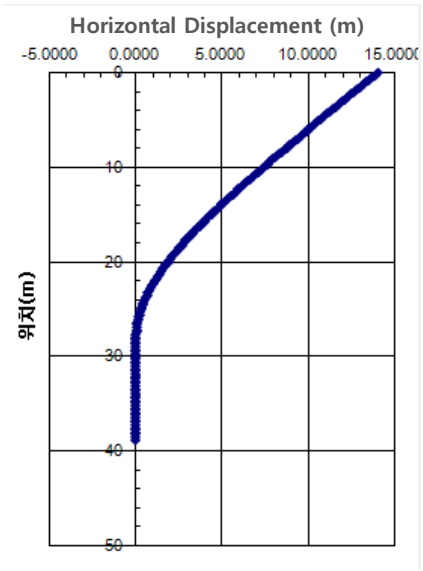
3. [Foundation] Including an Acceleration of Convergence

- To apply acceleration algorithm to P-y analysis to get the result more quickly from iterative method.
- If, there is divergence with P-y analysis. It can be got higher convergence with activation of this option.

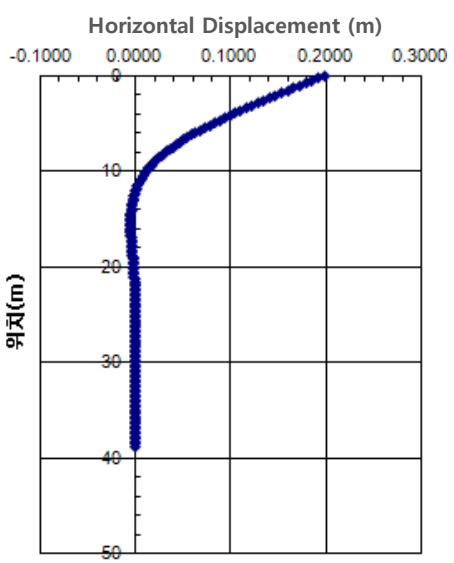
• *Foundation* > ***Analysis and Report Control*** > ***Define Analysis Case*** > *Analysis Control Data*



[Foundation – Acceleration]



Non Convergence



Convergence

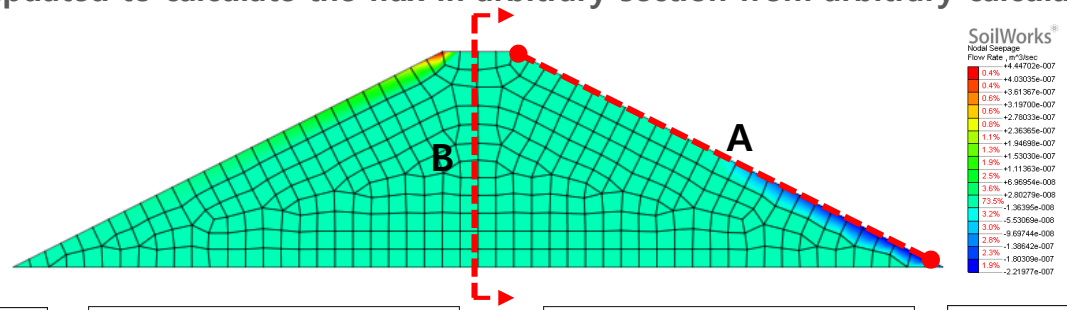
[Result of P-y Analysis]

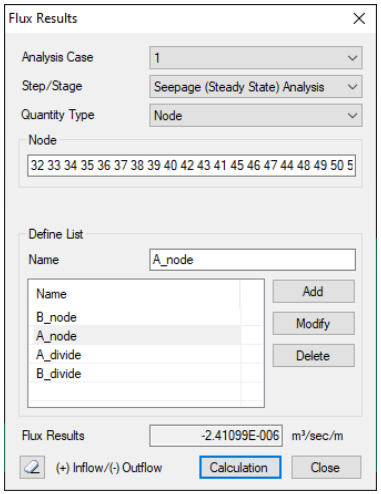
4. [Seepage] Multi flux result function

- It is possible to calculate the flux of arbitrary section which is passing the elements from a post window.

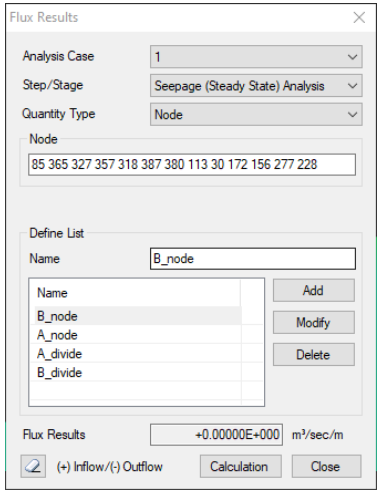
• *Result* > ***Seepage Results*** > *Flux Results*

Previously, it was calculated 0 when the flux and inflow are same.
This function has updated to calculate the flux in arbitrary section from arbitrary calculation type.

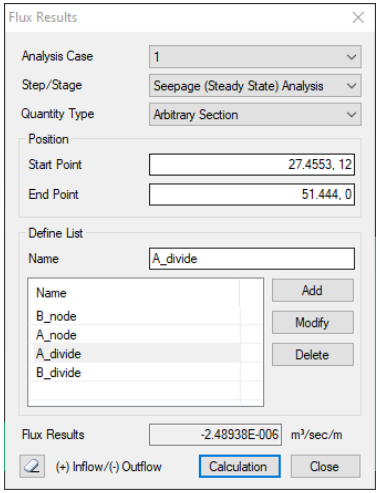




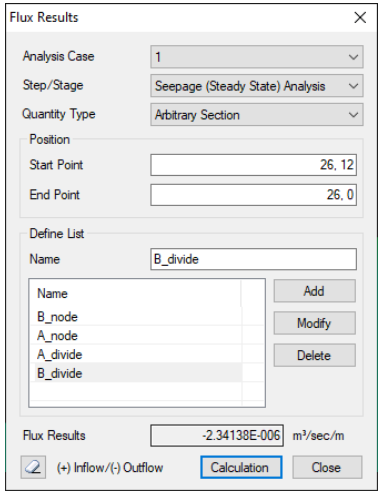
[Section A-Node]



[Section B-Node]



[Section A-Arbitrary Section]

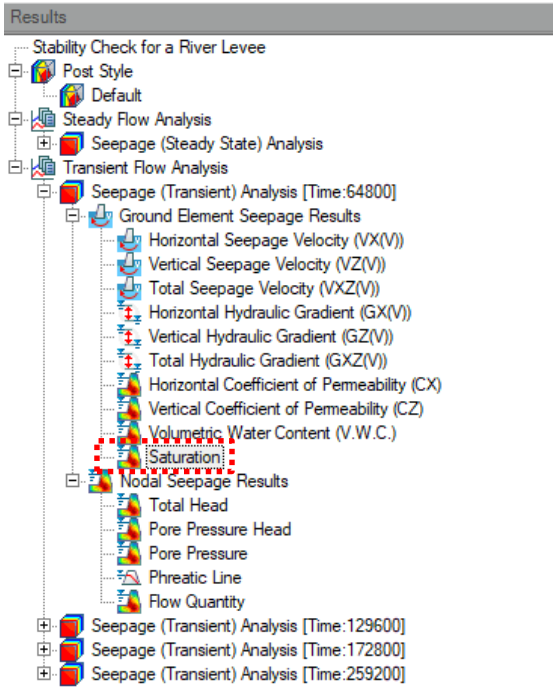


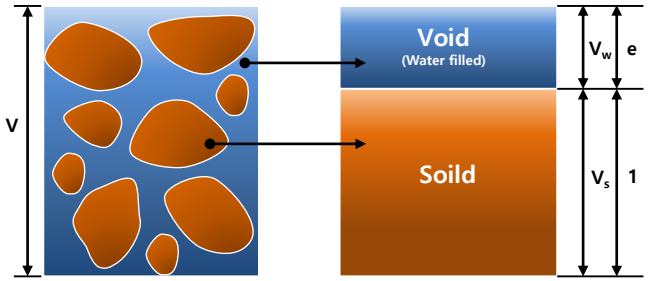
[Section B-Arbitrary Section]

5. [Seepage] Saturation result function

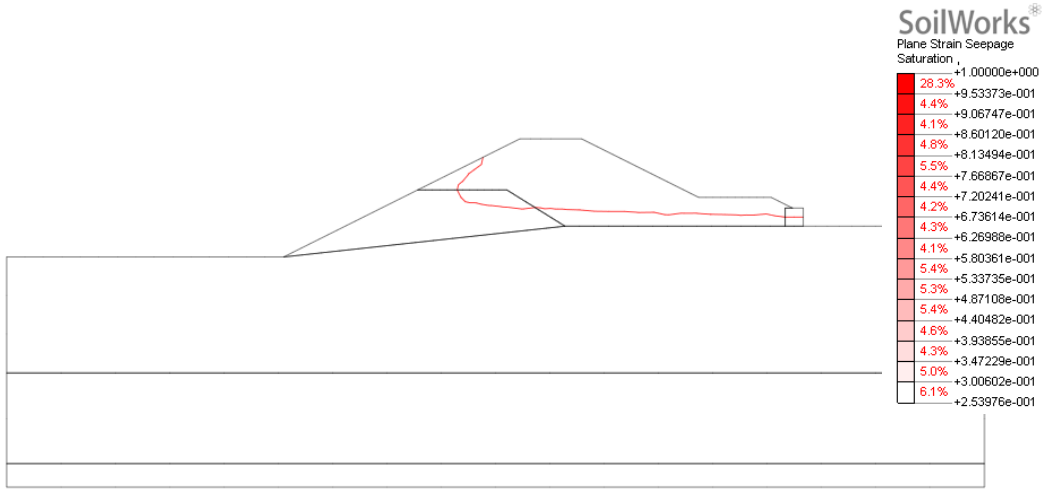
- It has updated to analyze the saturation in the ground element seepage results from the post.

• *Result* > ***Ground Element Seepage Results*** > *Saturation*





$$Saturation(S) = \frac{V_w}{V_a + V_w}$$

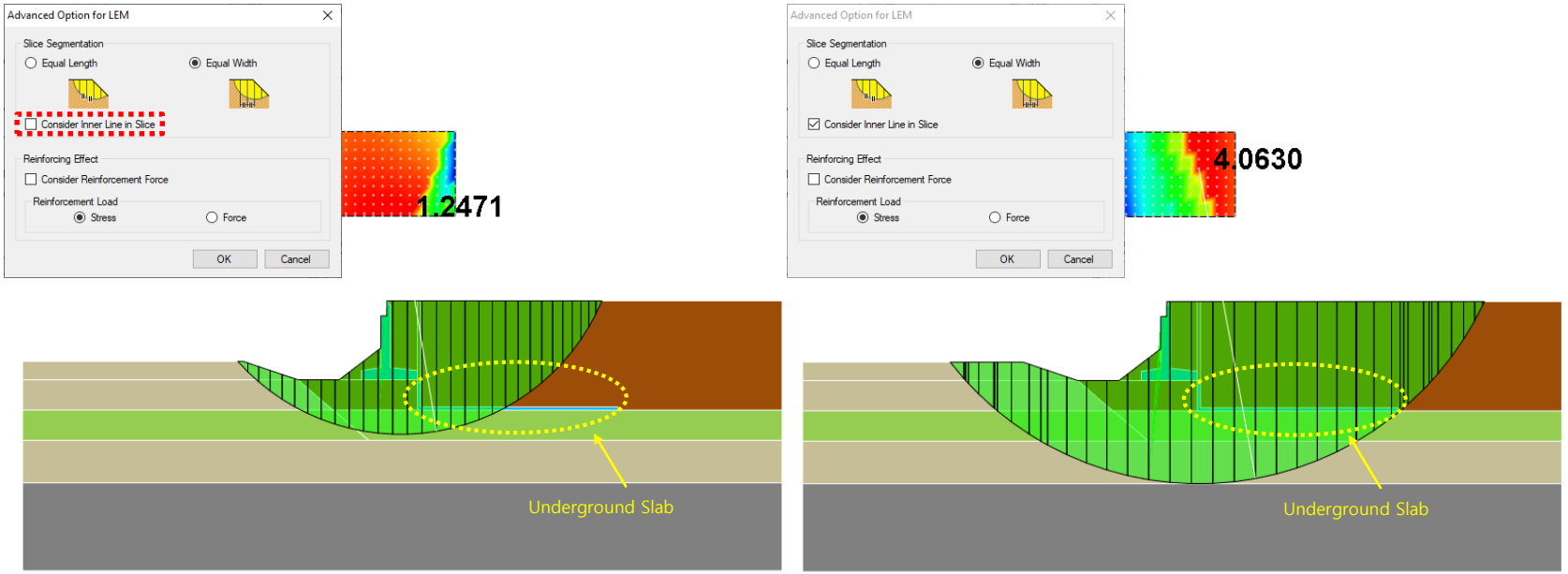


[Saturation result of seepage analysis for levee]

6. [Slope] Updated slice segmentation

- In case of underground structure, It has updated to assume the considering inner line in slice from slice segmentation in the Limit Equilibrium Method (LEM) analysis to prevent lateral flow of installation structure.

- *Slope* > ***Analysis and Report Control*** > ***Analysis Case*** > *Analysis Control*



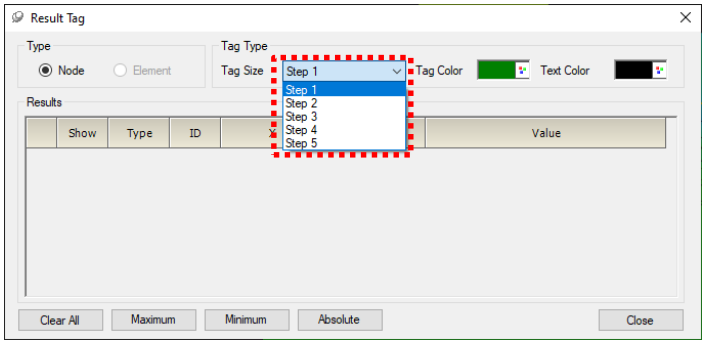
[Consider Inner Line in Slice]

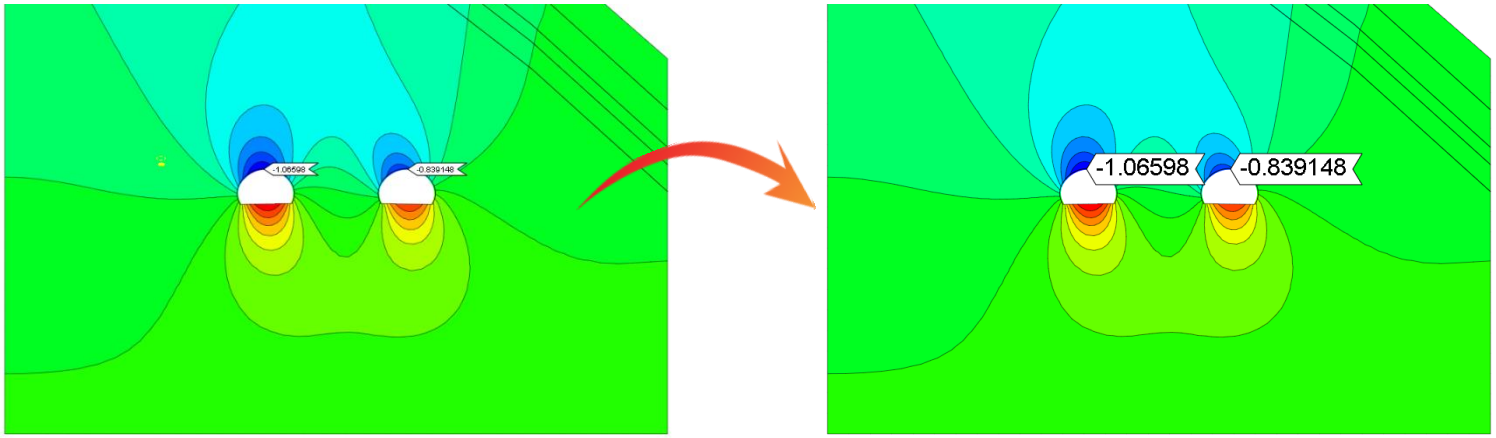
[Non-consider Inner Line in Slice]

7. [Common] Size control function for Result Tag

- It has updated to control the result tag from Tunnel/Slope/Seepage/Softground/Dynamic modules, FEM Analysis (Step 1 ~ Step 5)

- *Results > Detailed Results > Result Tag*





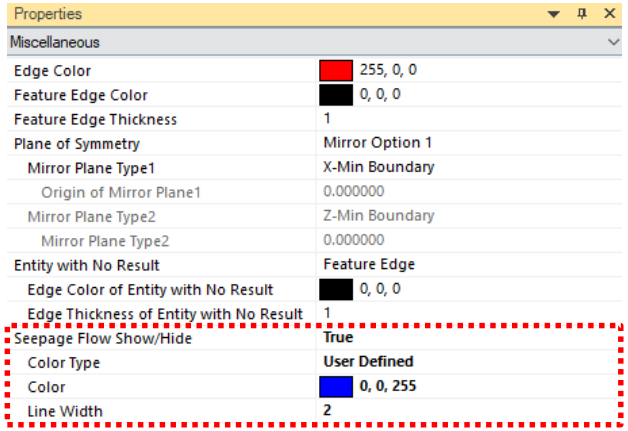
Tag Size (Step 1) Tag Size (Step 5)

[Control the Result Tag Size]

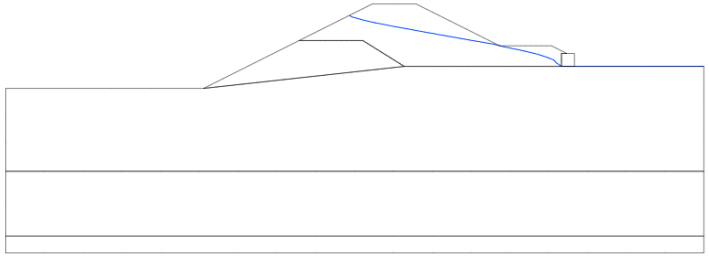
8. [Seepage] Display Seepage flow on the Total Head result

- Overlay the result of seepage flow line with other results from the seepage analysis.

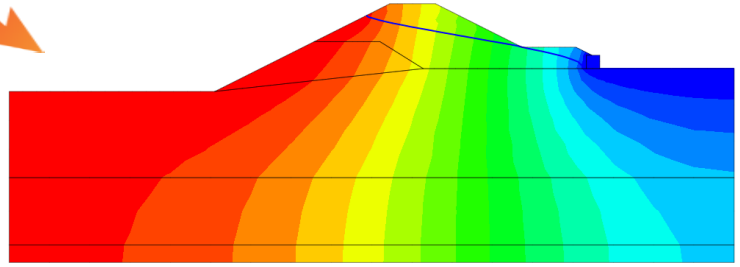
- *Properties > Miscellaneous > Seepage Flow Show/Hide*



Previous version : Seepage flow only



2019(v1.1) : Seepage flow line with total head



[Overlay the water line with others]

▪ ***Seepage Flow Show/Hide***

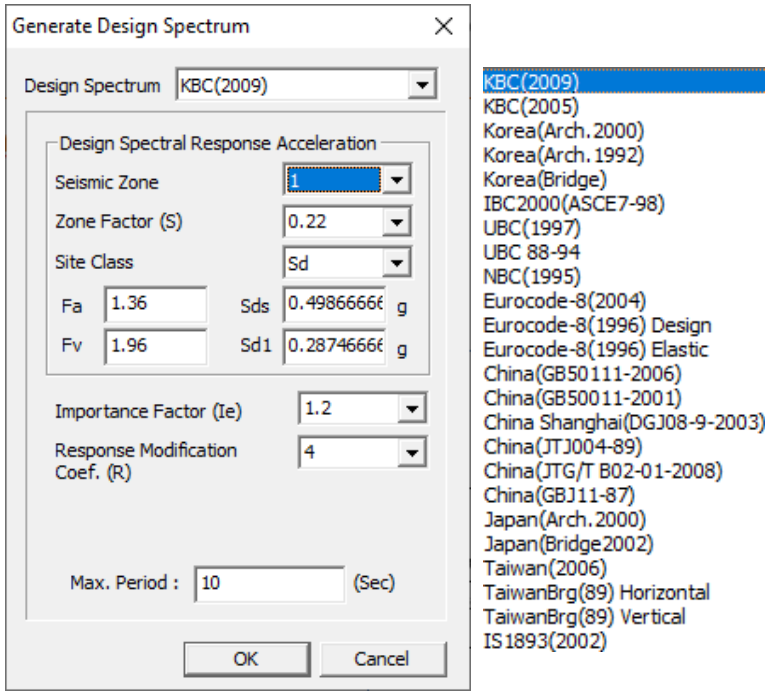
- Color Type : Select a color type from “contour” or “User Define”.
- Color : In case of ‘Color Type > User Define’, Select an line color for seepage flow.
- Line Width : Assign the width of Seepage Flow line.

9. [Dynamic] Generation of artificial earthquake

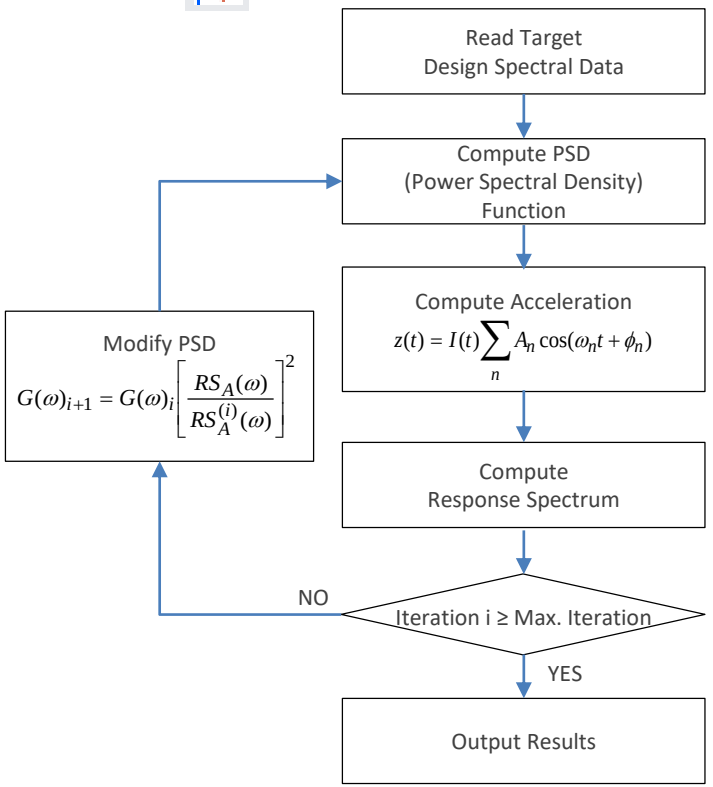
MODS

- Acceleration data is updated by the spectrum database in the SoilWorks.
- The artificial earthquake will be generated difference every time due to the artificial earthquake is using random function so that using the seismic wave which is similar as response spectrum is recommended

• *Dynamic* > ***Tools*** > ***Tools*** > ***Artificial Earthquake Generator***



[Design Spectrum in Dynamic Module]



[Flow chart of aritificial earthquake]

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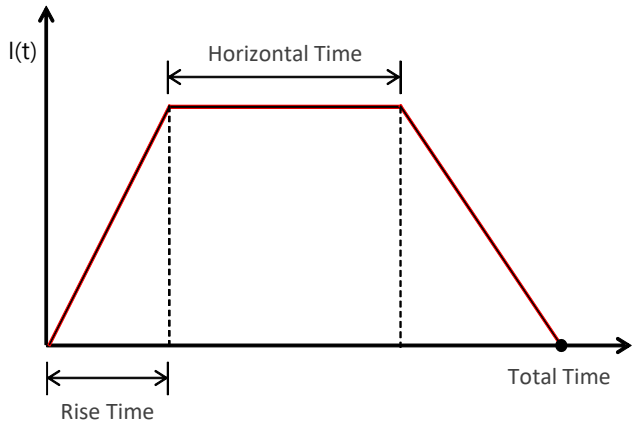
[The formulation to create acceleration time history corresponding the response spectrum]

$$z(t) = I(t)\sum_{n=1}^{N} A_n \cos(\omega_n t + \phi_n)$$

ωn = Frequency, An = Amplitude, Φn = Phase Angle,
I(t) = Envelope Function

Envelope Function

1. **The function of multiplied to steady state motion to assume the characteristic of real earthquake transient**
2. **Acceleration time will be almost same values from start to end time, if it doesn't have envelope function**
3. **SoilWorks can support the envelope function with trapezoidal shape**



[Envelope Function]

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• *Dynamic* > ***Tools*** > ***Tools*** > ***Artificial Earthquake Generator***

Generate Acceleration Option

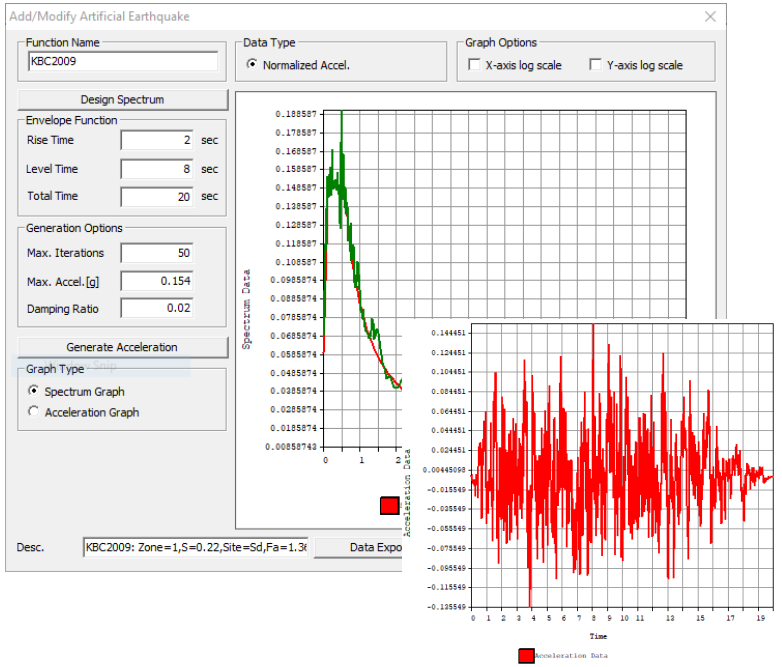
- Max. Iterations : The number of iterative calculation to match the response spectrum result of artificial earthquake with an input response spectrum
- Max. Accel.(g) : The maximum earthquake acceleration
- Damping Ratio : Damping ratio to define the response spectrum from artificial earthquake

Generate Acceleraton

- Acceleration data will be created by response spectrum

Graph Type

- Spectrum Graph: Acceleration data is verified by spectrum data
- Acceleration Graph : Graph is verified by acceleration data



[Add/Modify Artificial Earthquake]