Engineer's Studio®

1. Functions of Geo Engineer's Studio Ver.2

Geo Engineer's Studio Ver.2 has been released in August 2019. The Ver.1 only corresponded to the analysis of linear elasticity. This analysis method could cover most issues related to the civil engineering. However, as the original nature of ground, the opinion that the geotechnical analysis should consider the non-linearity and yield stress to simulate real behavior had to be respected. To correspond to this issue, FORUM8 added the elasto-plastic analysis function.

Elasto-plastic analysis

Addition of bilinear beam and bilinear bar element
The bilinear constitutive law has been added to the beam and bar element. This enables the seismic verification of level 2 earthquake by using the responded seismic coefficient method of box culvert built on highway. (The static seismic analysis is performed by multiplying the design horizontal seismic coefficient.)
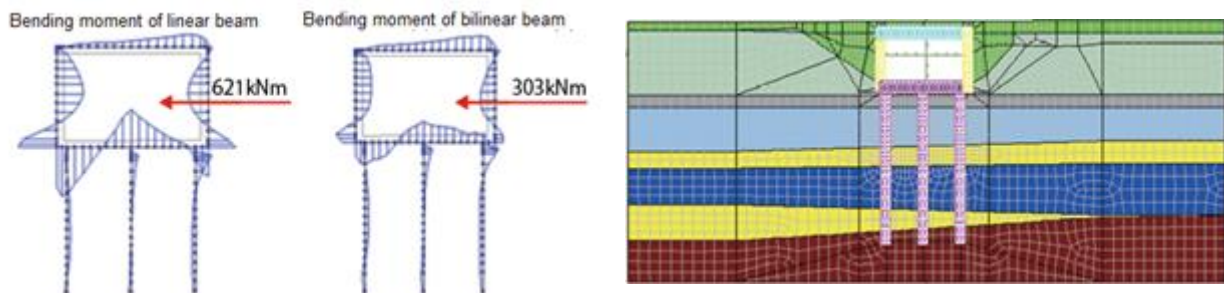

Fig.1 Consideration of box culvert by using the responded seismic coefficient method

Correspondence to the Mohr-Coulomb model
The Mohr-Coulomb model has been added to the elasto-plastic soil constitutive law for the 2D solid element. This model allows the depiction of looseness of surrounding ground by the distribution of deformation and shear strain, etc., and it can evaluate the safety more confirmly.
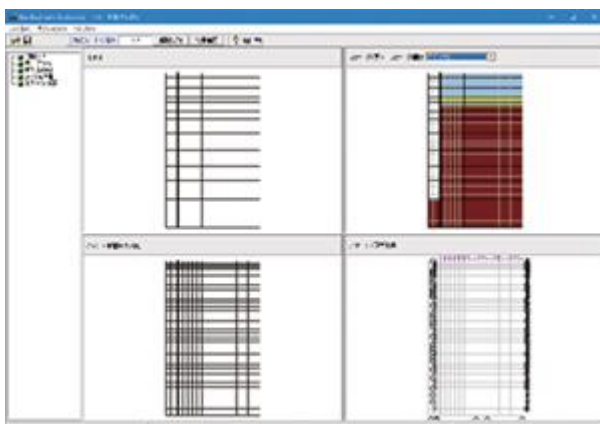

Fig.2 Consideration of effects on nearby construction according to the excavation of pipe jacking starting shift
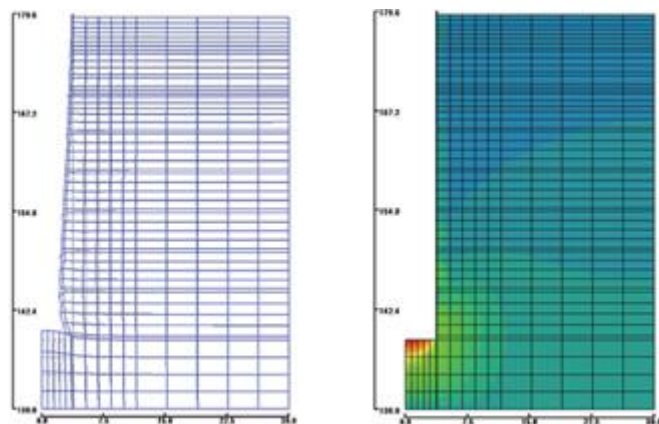
Fig.3 Drawings of the deformation at the final excavation and the displacement contour

The program has corresponded to the liquefaction verification of ground according to "Seismic performance verification standard of river structure, March 2016". It evaluates the seismic performance of levee by considering the change of soil layer property according to the liquefaction and calculating the deformation of levee statically for the level 2-1 and 2-2 earthquake.
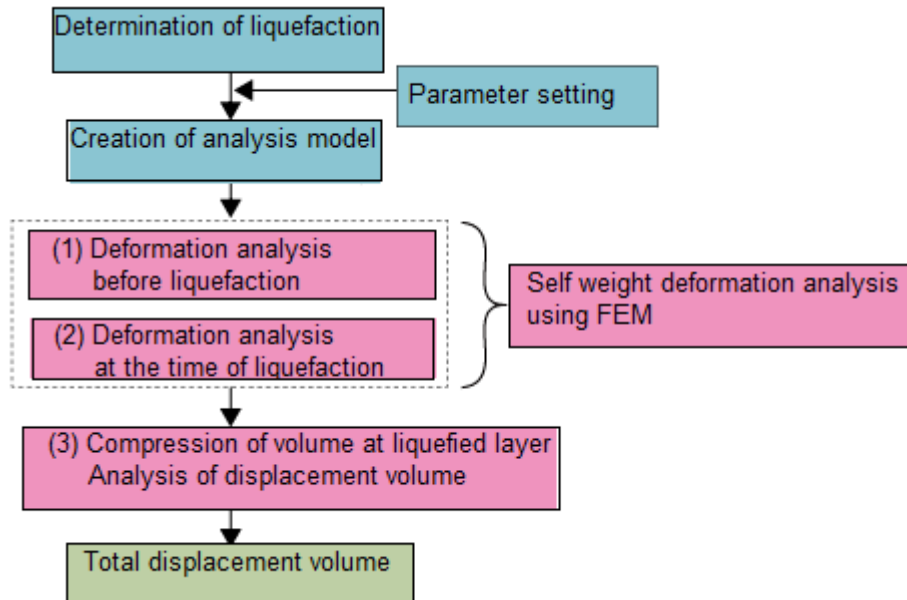

Fig.4 Analysis of deformation by self-weight according to the liquefaction

To execute the analysis of deformation from the start to the end of liquefaction, users set the following 3 stages: "Analysis of deformation before earthquake (liquefaction)", "Analysis of deformation after earthquake (liquefaction)", and "Amount of sinking according to the shrink of volume of liquefaction layer". The program calculates the safety rate according to the liquefaction (FL) and considers the change of rigidity from the FL value based on the standard. The reduction of rigidity against self-weight causes the deformation by liquefaction.
The amount of deformation by liquefaction and by the volume compression (dynamic consolidation) in the process of pore pressure disappearing after liquefaction are computed. The amount of displacement of the whole model is computed by adding both amounts.
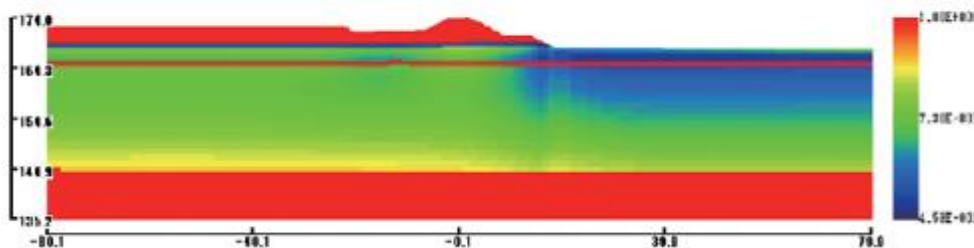

Fig.5 Distribution of liquefaction safety rate (FL)