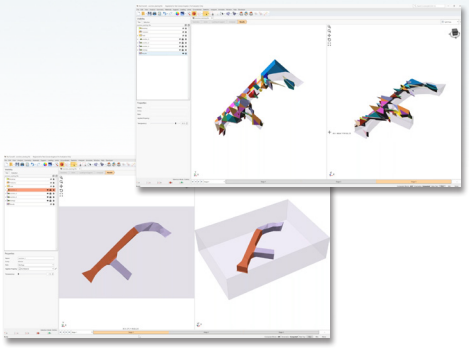
rocscience



WEBINAR

From Concept to Code - RocTunnel3

Q1: Can you do statistical analysis of FoS<1 blocks? For example: distribution of depth of failure.

A1: Yes, simply set the Design Factor of Safety to 1 in Project Settings > Analysis and turn on Statistical Analysis in Project Settings > Statistics. Once random variables are defined, along with the typical model definition, you can then Compute Blocks/Compute Kinematics. The results can be visualized just like in a Deterministic Analysis with Contour Blocks, Block Information, in addition to the plotting of Histogram, Cumulative, and Scatter charts. Note that in a Probabilistic Analysis, a block is considered "failed" if ANY of the samples are computed with FS < Design FS. The Failure Depth reported is in fact the "maximum" Failure Depth due to this assumption (it is a conservative assumption).

Q2: Does RocTunnel3 get FoS at any stretch of the tunnel?

A2: The Contour Blocks results visualization option is essentially a safety map which reports the Factor of Safety and location/extents along the tunnel where this value is computed. For Deterministic joint geometry, the location is the block's face itself. In the future when we have probabilistic realizations of joints (i.e., 1000s of synthetic or DFN realizations), this contouring will look more smooth rather than solid faces which coincides with a block.

Q3: I am imagining how arduous it is to pick coordinates for each individual joint (fracture). Would it be more practical to assign from/to coordinates of the excavation and only set spacing within this particular area to represent all of them?

A3: We offer 3 ways to define joints. If the coordinate locations of the joints is already known then Measured Joints would be your best option. However, if you would like to add joints along the length of a tunnel at some spacing, then Synthetic Joint Set would be more suitable. You would simply define the distribution of orientation, spacing, and radius, and then draw the polyline along which the joints will be sampled. The start and end points of the polyline could be your excavation extents.

Q4: By "Simple Bolt Force" support type, do you mean the bolt is pre-tensioned?

A4: No, pre-tensioned bolts are not modeled in RocTunnel3. A Simple Bolt Force is the easiest way to model a bolt where it is treated as a force vector with the specified force magnitude acting in the direction of the bolt. The bolt will apply a force to the block as long as the start intersects the block excavation face, and is long enough to pass through it and into the rock mass. There are also other types of bolts which can be modeled in RocTunnel3 (e.g., End Anchored, Friction Bolts, Expandable Bolts, Grouted Dowel, etc.) which have more complicated capacity contributions and can fail in various modes (i.e., tensile, pullout, stripping, shear). For a preliminary bolt design, it is simpler to model them as Simple Bolt Force as demonstrated in the webinar.

Q5: Can the generation of the fracture network be iterated?

A5: Measured Joints and Joint Surfaces are exactly defined in terms of orientation, location, and size and cannot be generated with another realization. However, Synthetic Joint Sets use statistical distributions to sample the joint geometry and can be MANUALLY iterated by clicking the Randomize button in the Add/Edit Synthetic Joint Set dialog. As mentioned in the webinar, in the future, we hope to expand functionality to DFNs and AUTOMATICALLY have multiple realizations of these sampled joint types in a Probabilistic Analysis.

Q6: How can I practically integrate the seismic component for dynamic-type environments?

A6: Dynamic analysis is not supported in RocTunnel3. Seismic loading is modeled by a pseudostatic seismic coefficient and a direction in which the seismic force is applied. The seismic coefficient is a dimensionless coefficient which represents the (maximum) earthquake acceleration as a fraction of the acceleration due to gravity. Typical values are in the range of 0.1 to 0.3. The seismic force is computed by Block Weight x Seismic Coefficient. The direction of application can be either user-defined or in the most conservative case, can be set to the computed direction of sliding.

Q7: In this example, are each of the stage surfaces closed shapes (i.e. the entire model has internal walls) or are they open on the ends that intersect with the other stages?

A7: Each piece of the external—geology or excavation—are defined as closed volumes. However, in the actual computation of blocks/kinematics, the shared surfaces between two excavation volumes in a given stage are ignored.