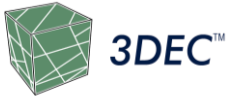


**CIVIL • ENVIRONMENTAL • MANUFACTURING • MINING • OIL & GAS • POWER GENERATION**

## PROJECT DESCRIPTION

Sweco Civil AB &  
The Extended Metro  
Administration

Stockholm, Sweden



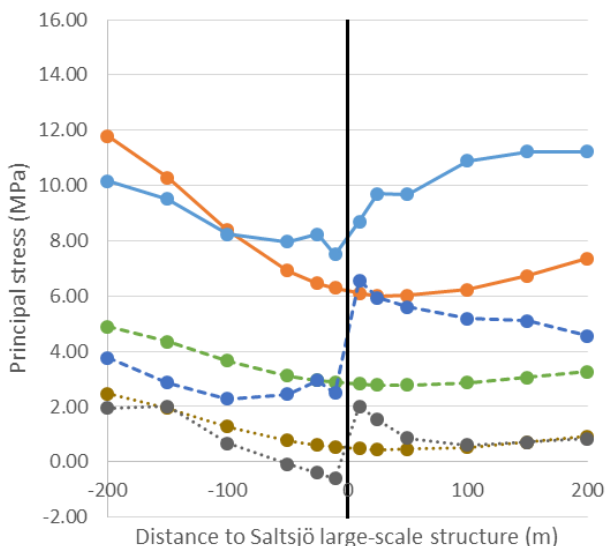
New metro lines are planned in Stockholm, comprising a total length of approximately 20 km with 10 new stations, mostly located underground. One of the new lines will pass under Saltsjön (a bay of the Baltic Sea) and through a major regional large-scale geological structure. The stress magnitudes and orientations around the structure are highly uncertain, and stress measurements are not practically possible near the structure. To quantify possible stress conditions near the structure, discontinuum three-dimensional numerical modeling was conducted.

## ITASCA'S ROLE

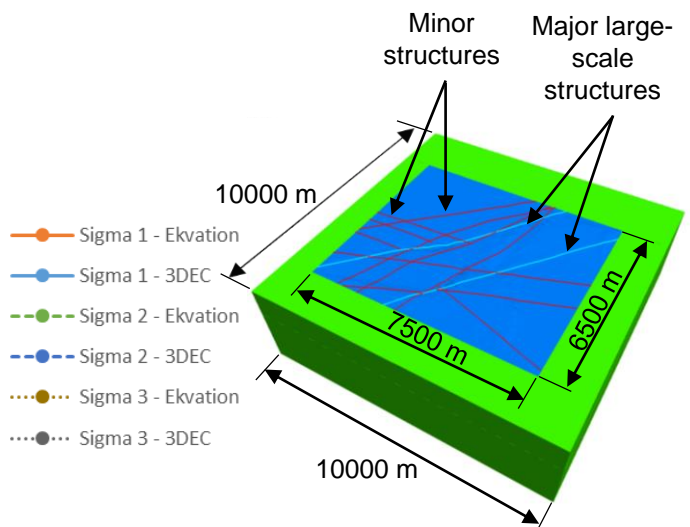
Itasca conducted regional-scale stress analysis of the Stockholm area using 3DEC. The model included a total of 14 large-scale structures, and the rock mass was represented as one unit. Calculated stresses at the location of rock stress measurements were evaluated and compared to the measurements. The stresses around two new metro stations were also evaluated.

## PROJECT RESULTS

The *in situ* rock stress levels at the depth of the new metro lines do not exhibit extremely high or low magnitudes, but stress jumps occur in the vicinity of the structures (up to a distance of about 50 m). The dip angle and dip direction of the structures influence the results, whilst strength and stiffness parameters have less influence. The importance of extended geotechnical investigations was proven.



Calculated principal stress magnitudes (in MPa) for one of the analyzed sections, where the large-scale structure is represented as a black vertical line



Overview of the 3DEC model