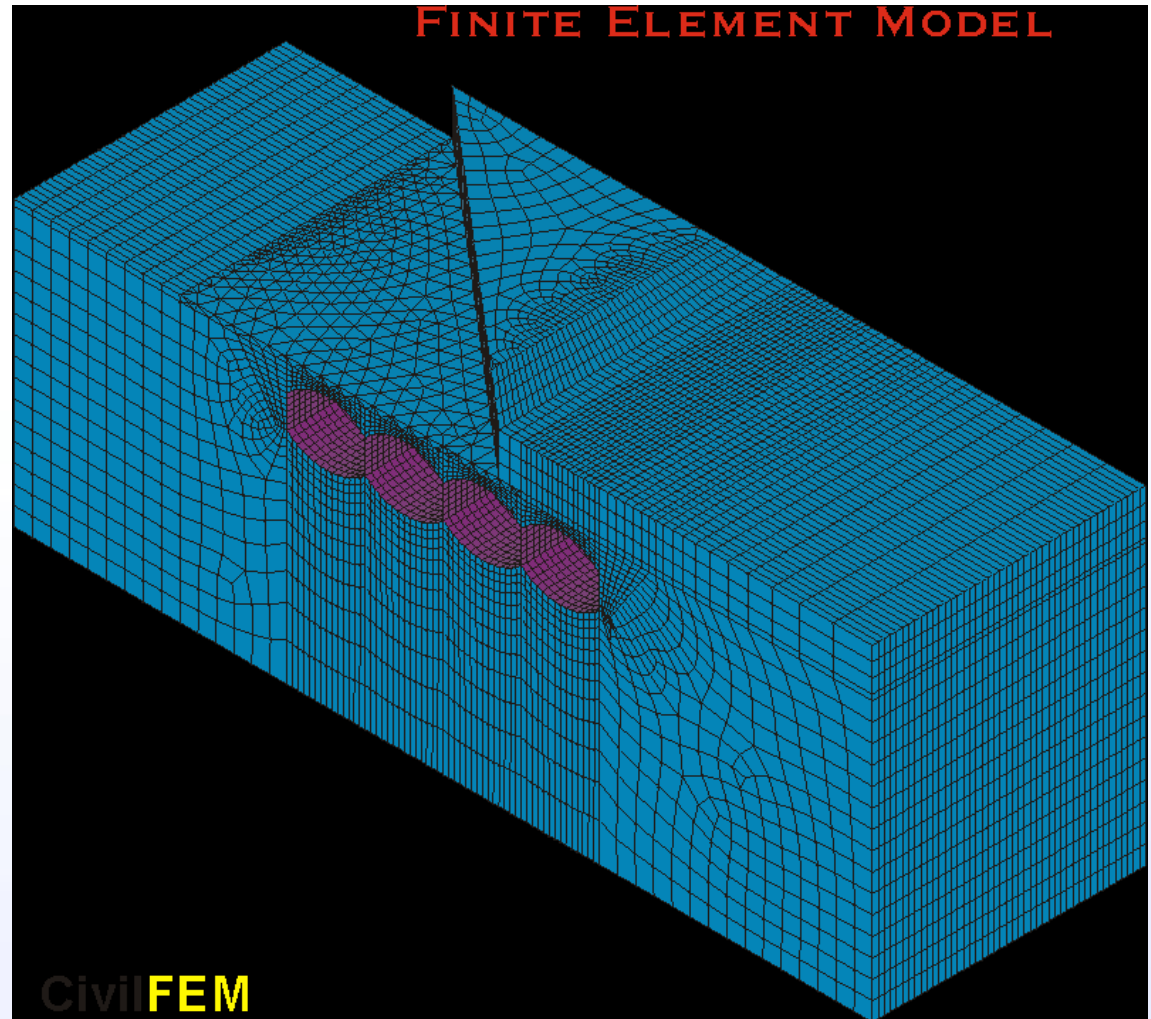


Construction Process & Cracking Analysis of a Reinforced Concrete Tunnel (Road M-111)

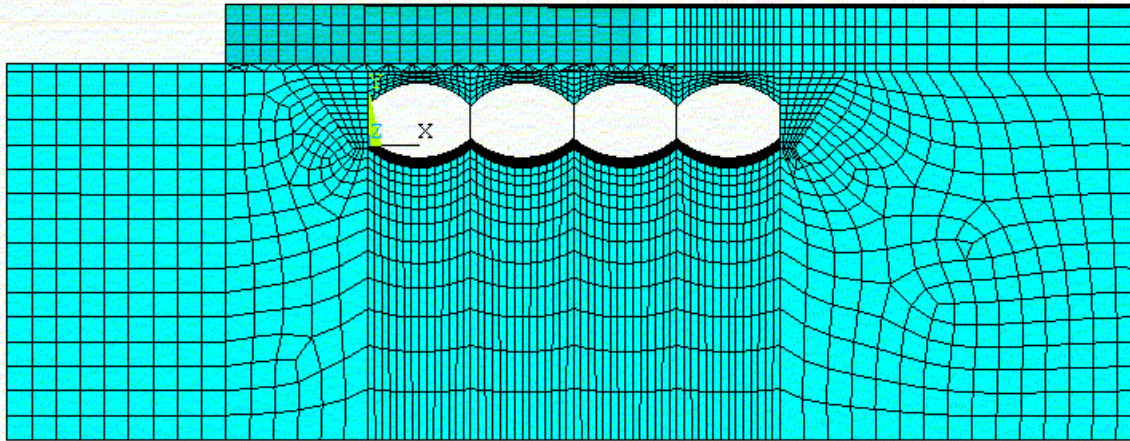


Reinforced Concrete Tunnel

Reinforced concrete tunnel of road M-111 running underneath Madrid Barajas airport. Several 2D/3D models of the soil-structure interaction was conducted, as well as the dimensioning of the reinforcement needed in the tunnel for the different zones and loads from tunnel backfilled.



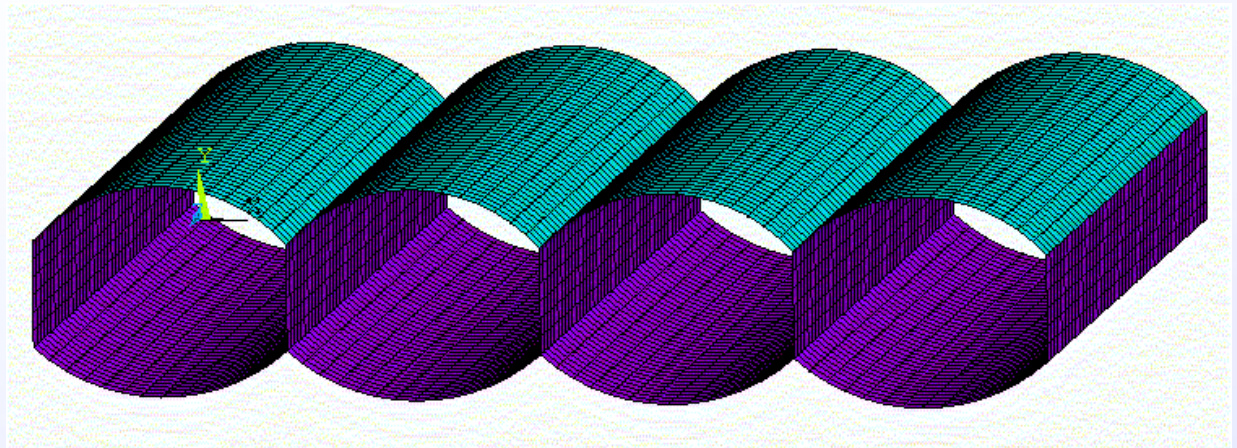
Reinforced Concrete Tunnel



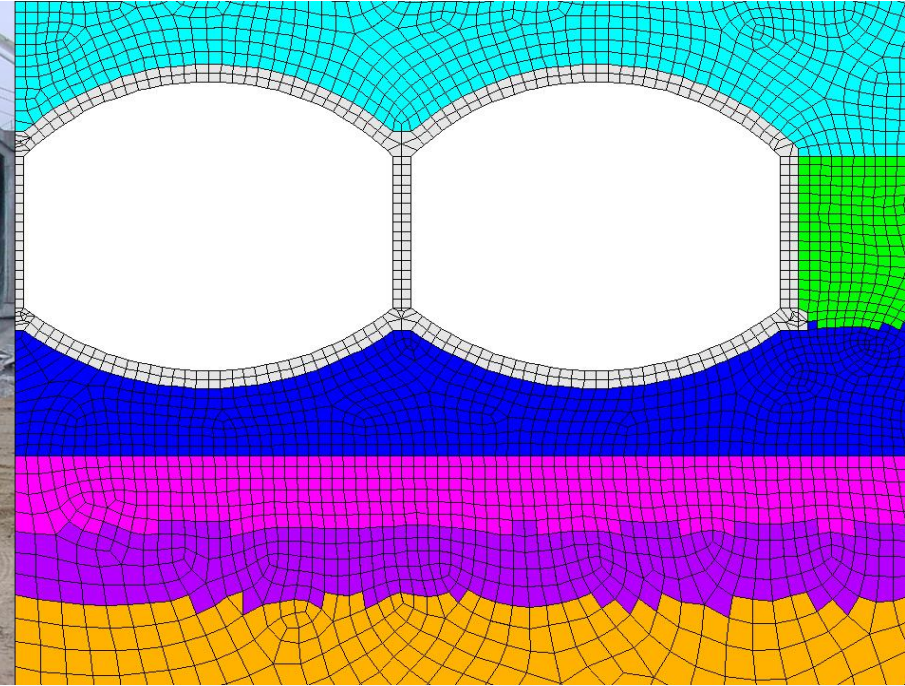
Frontal view of soil
and tunnel mesh

3D view of the 4
tunnels

Shell model



Competitive Advantages

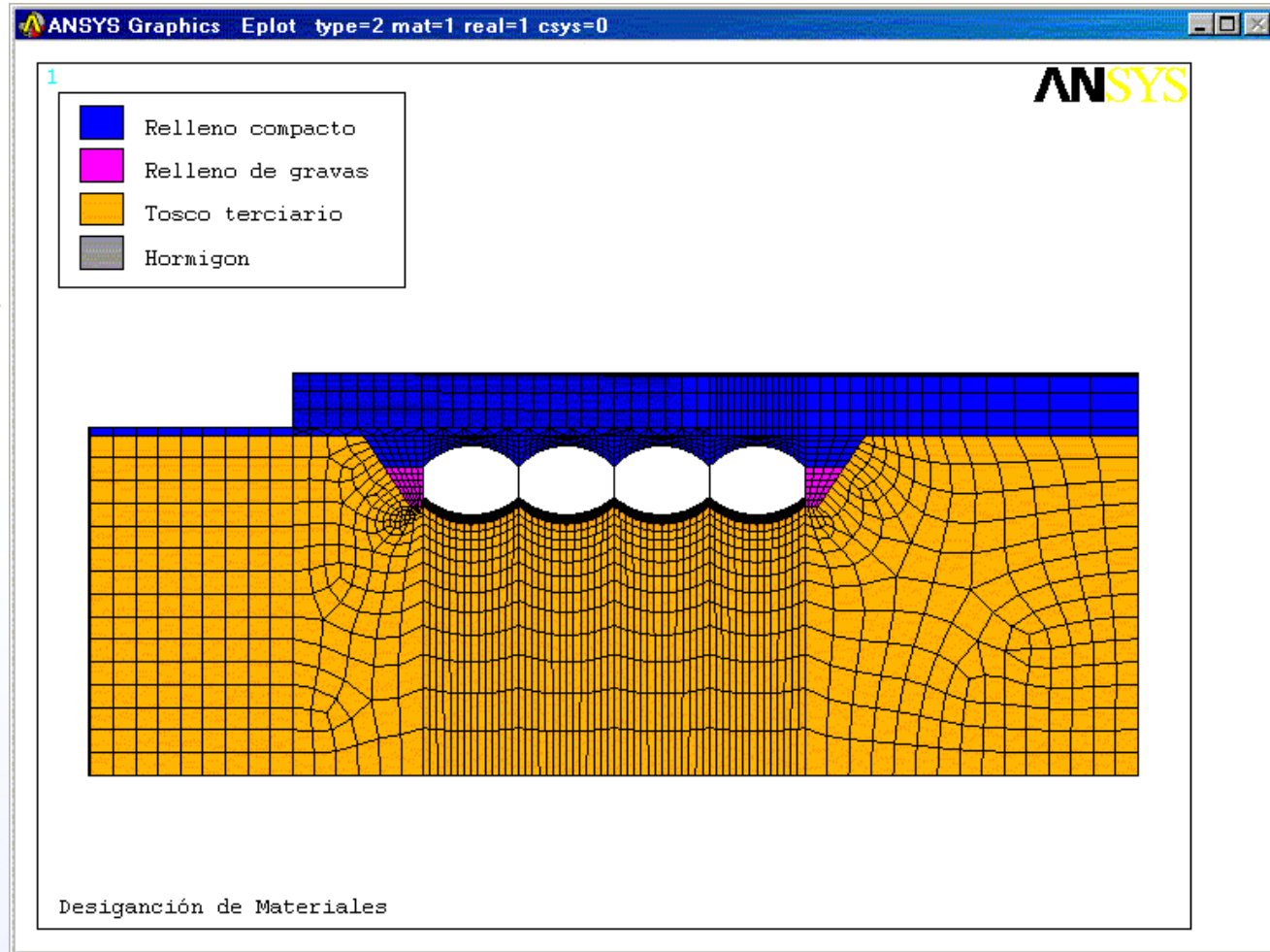


CivilFEM with ANSYS allows to simulate the behavior of real life structures, dramatically saving costs, time and optimizing results.



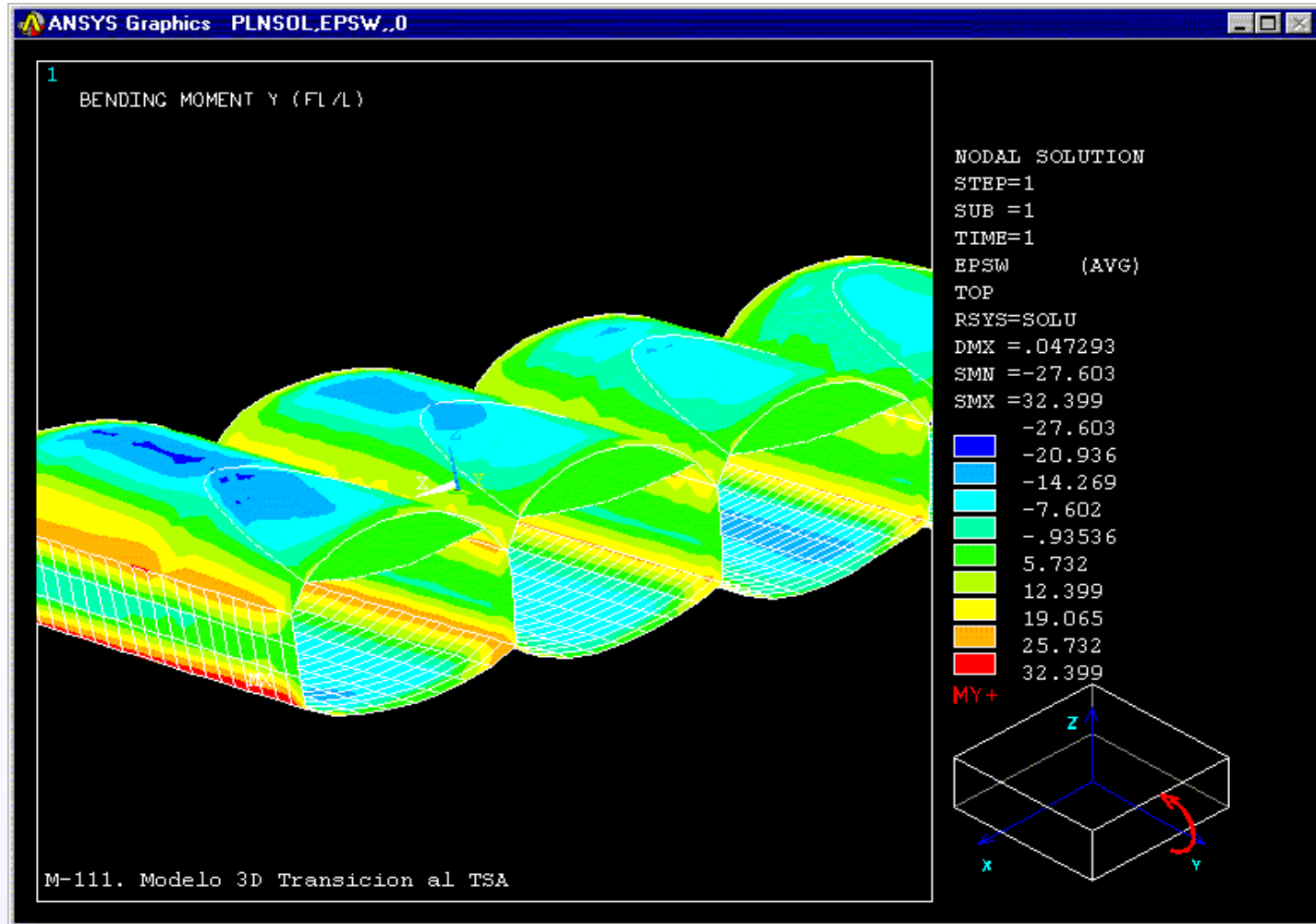
Reinforced Concrete Tunnel

Materials
layout



Reinforced Concrete Tunnel

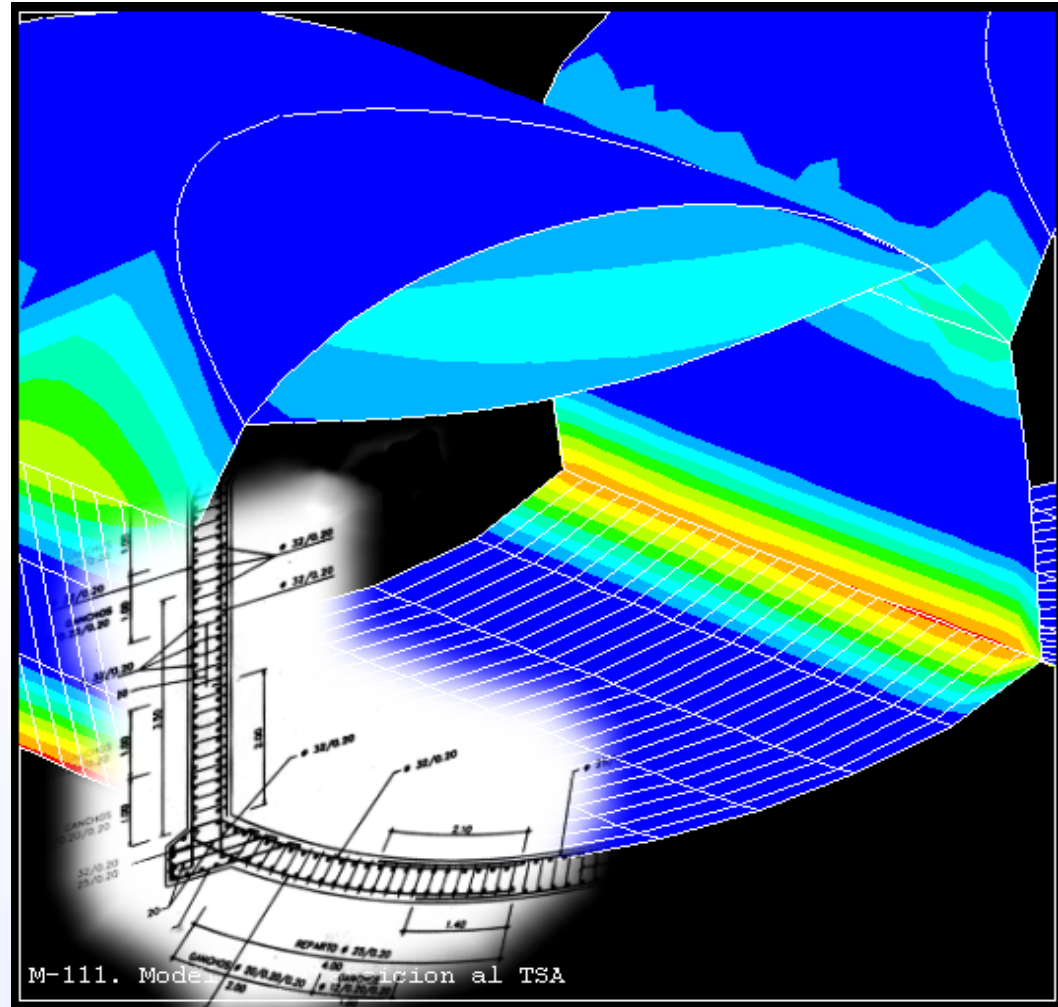
CivilFEM automatically provides the user with Beam&Shell postprocessing results, for better ease of use



Reinforced Concrete Tunnel

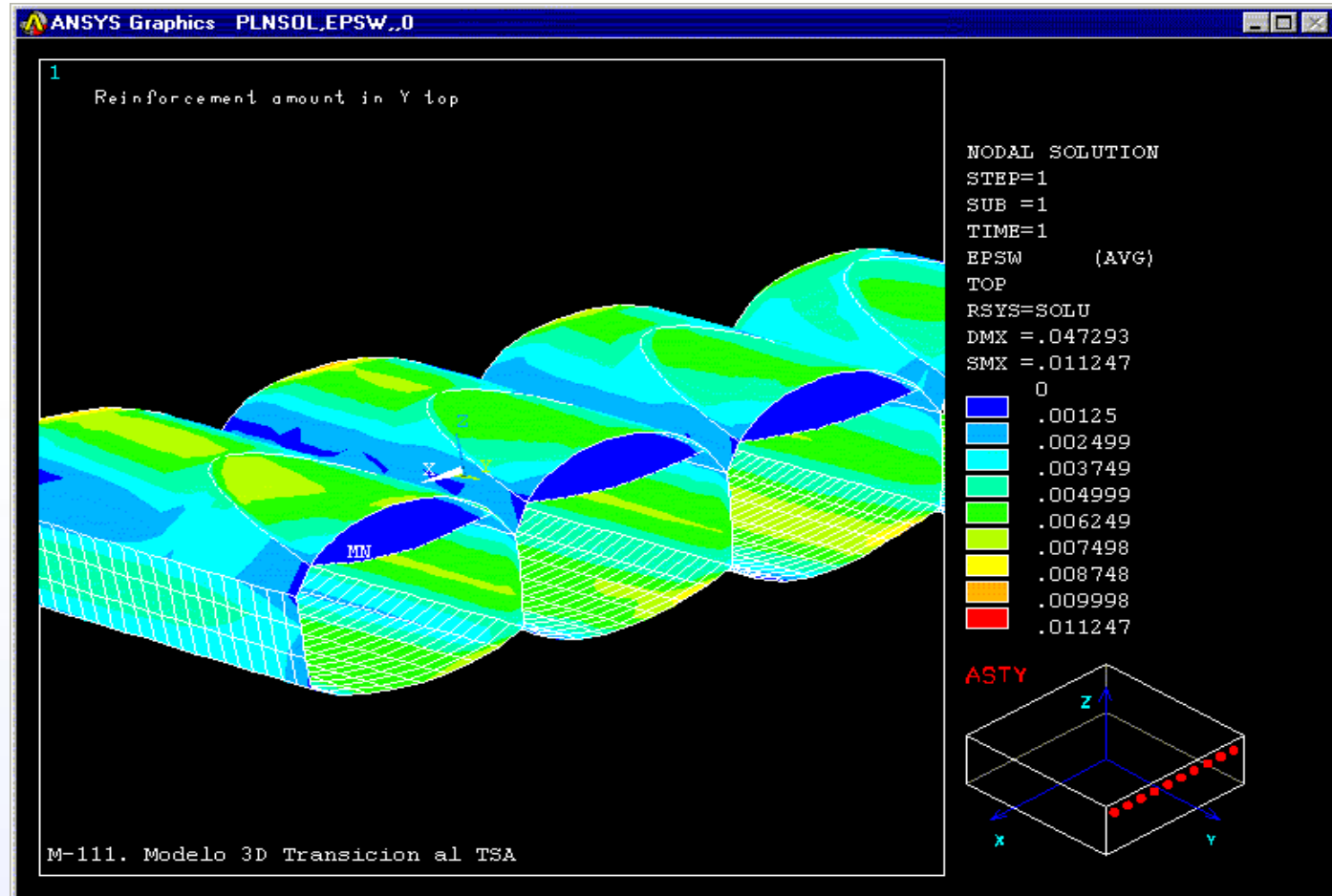


Civil**FEM** automatically calculates the reinforcement amount with the simple click of a button.



Reinforced Concrete Tunnel

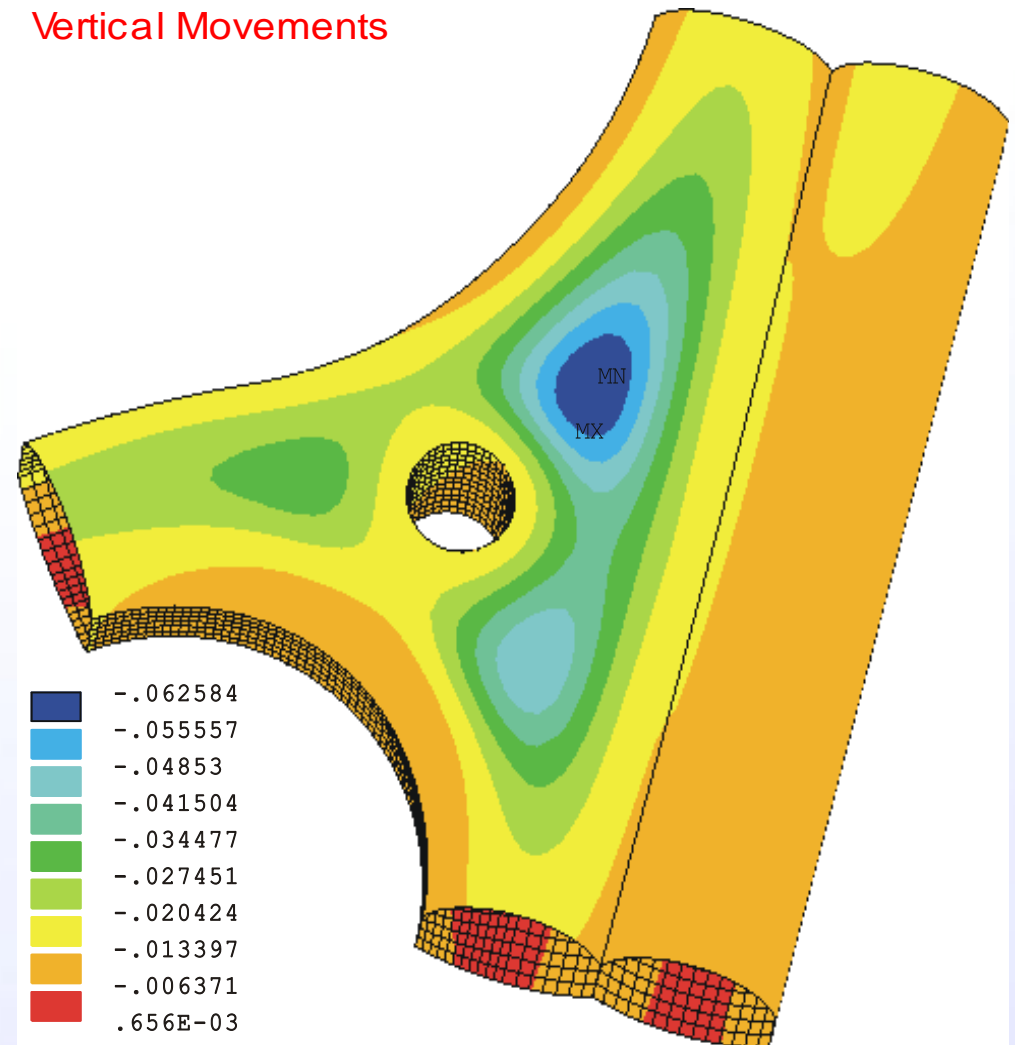
CivilFEM postprocessing includes legends and icons to better understand the results.



Reinforced Concrete Tunnel

Vertical
Movements
on a critical
zone of the
tunnel
junction.

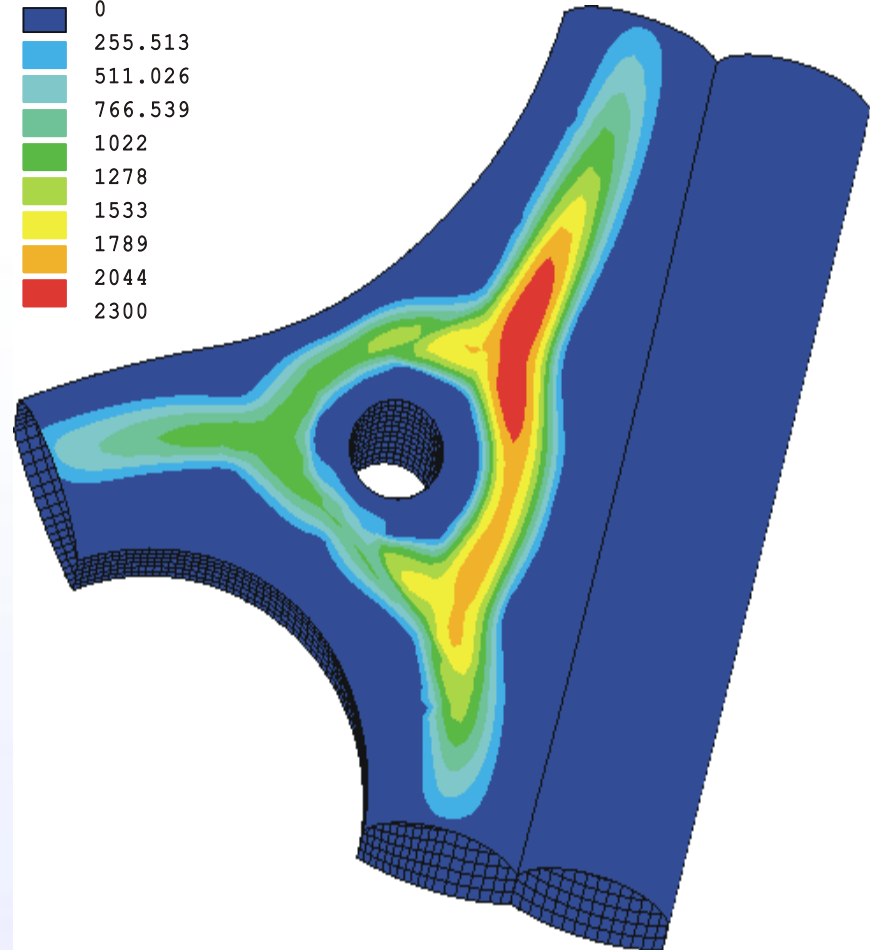
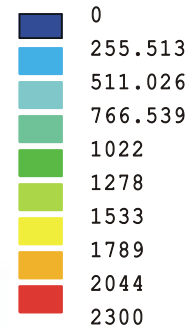
Vertical Movements



Reinforced Concrete Tunnel

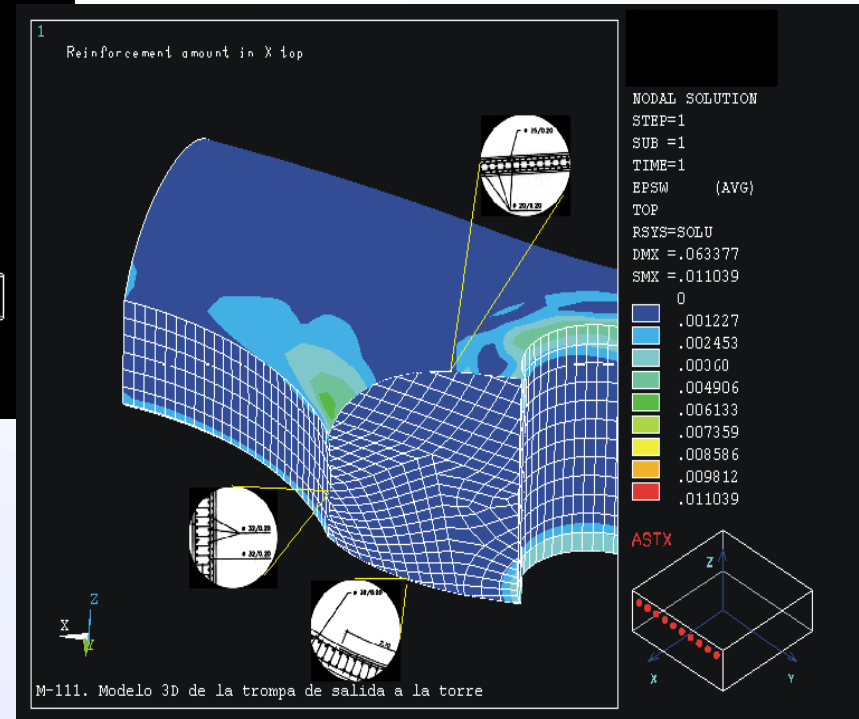
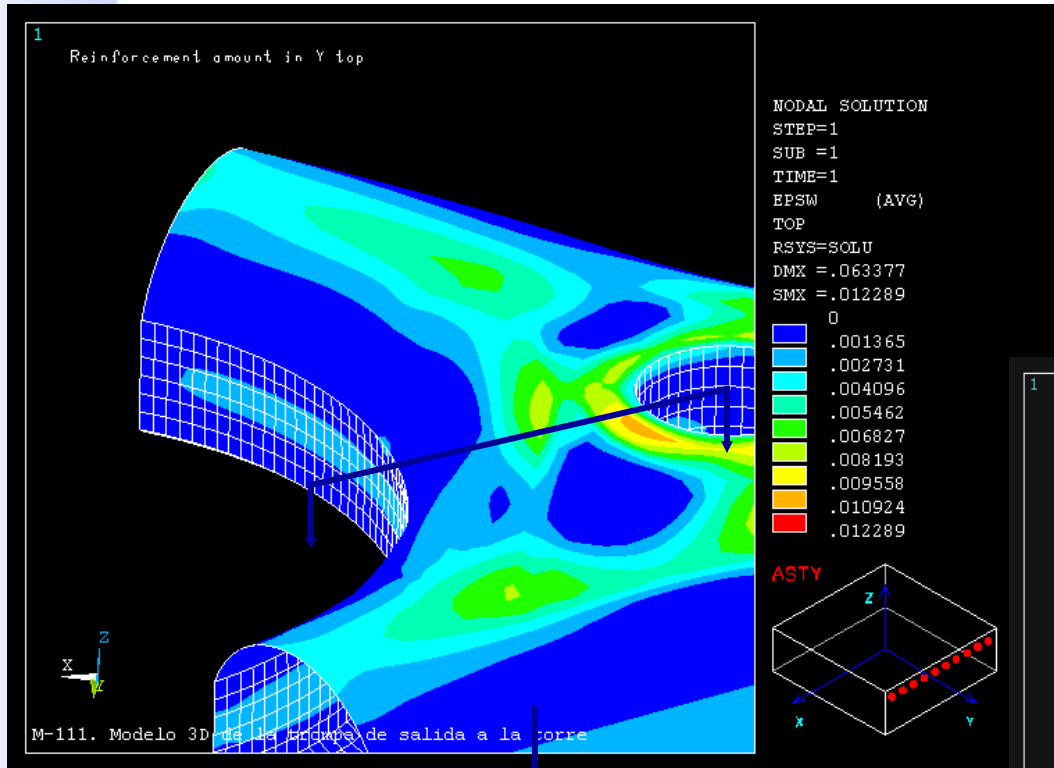
Principal stress on a critical zone of the tunnel.

Principal Stress



Reinforced Concrete Tunnel

Reinforcement designed using CivilFEM

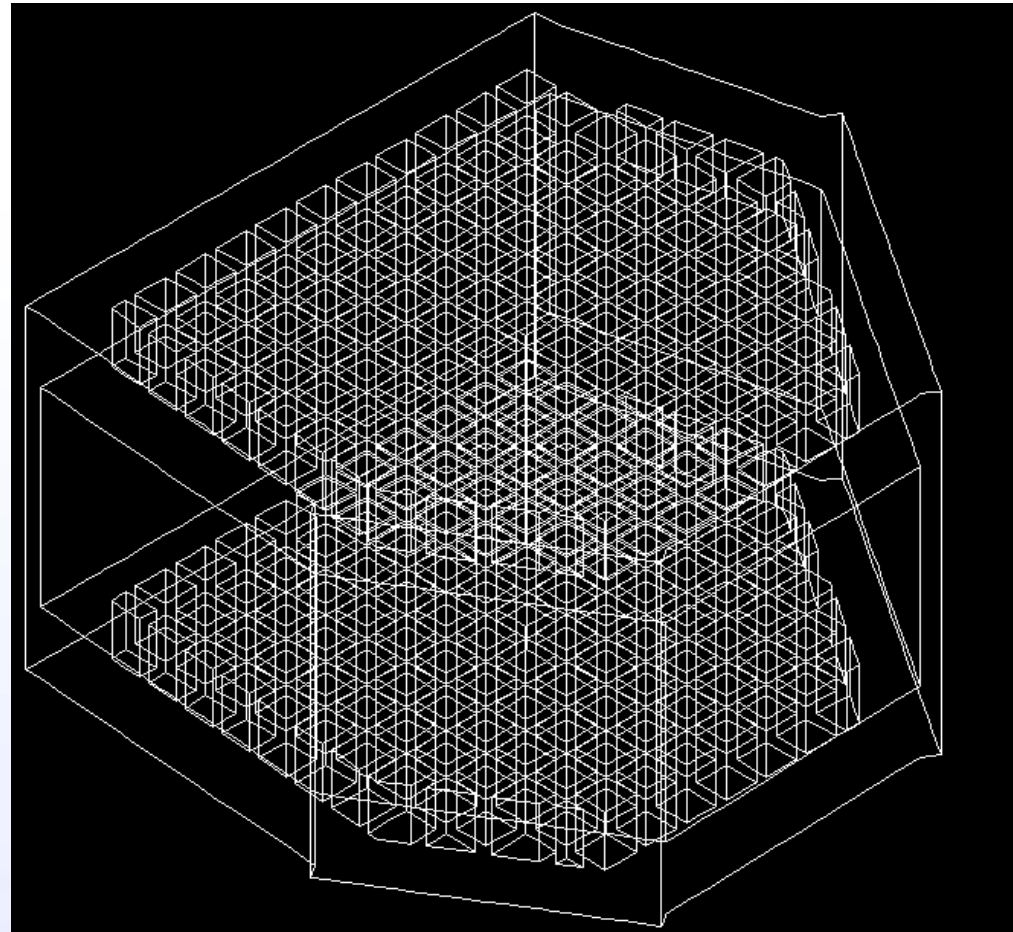
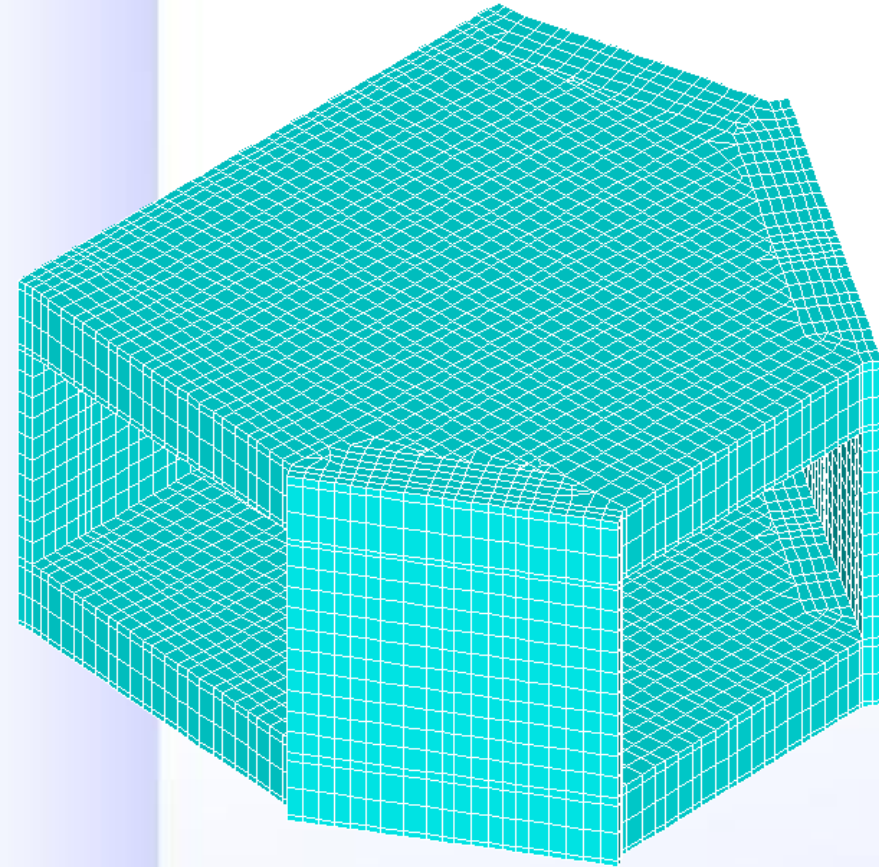


Section detail



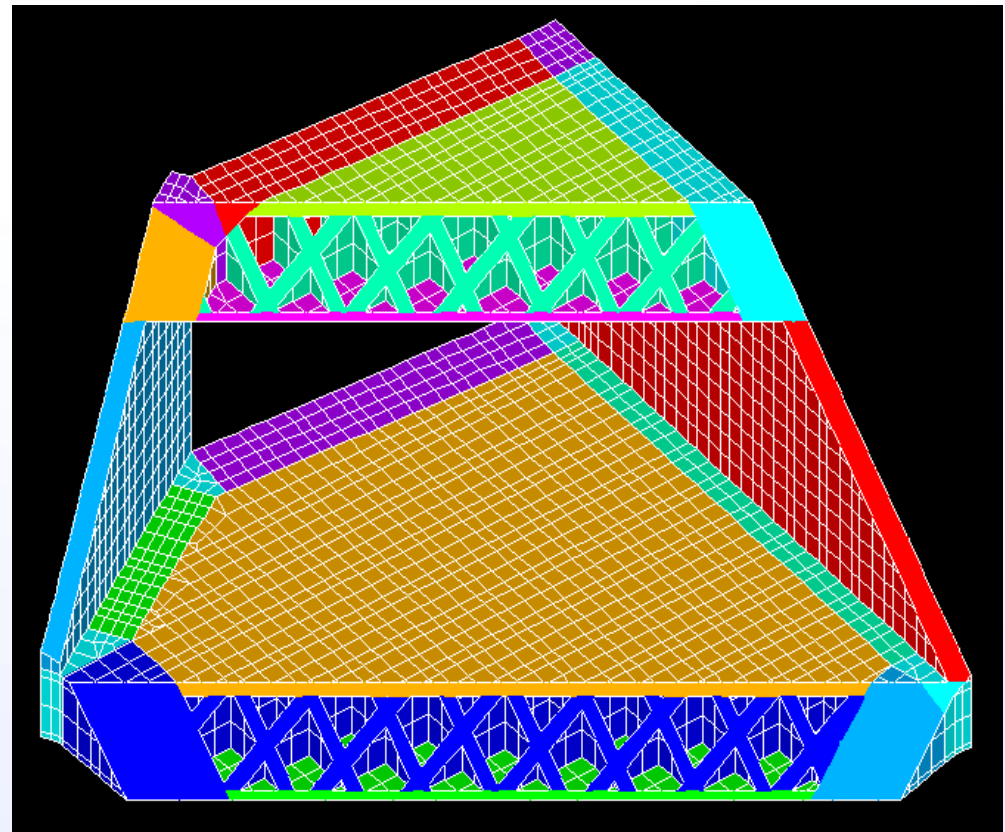
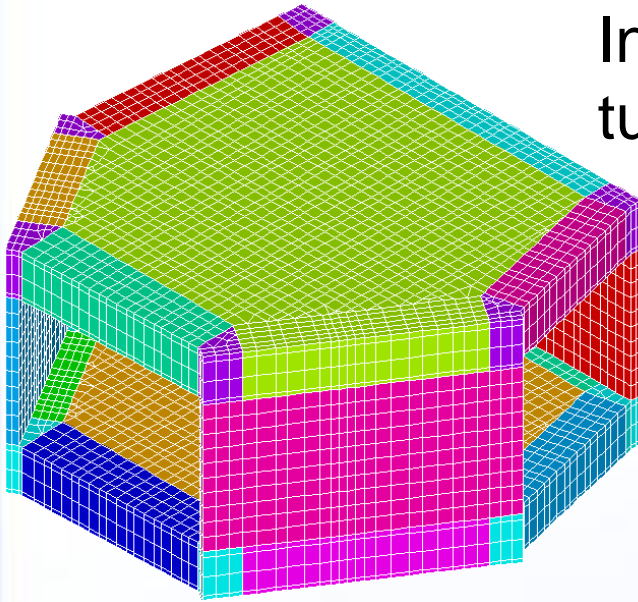
Reinforced Concrete Tunnel

Intersection of terminal
building with tunnel



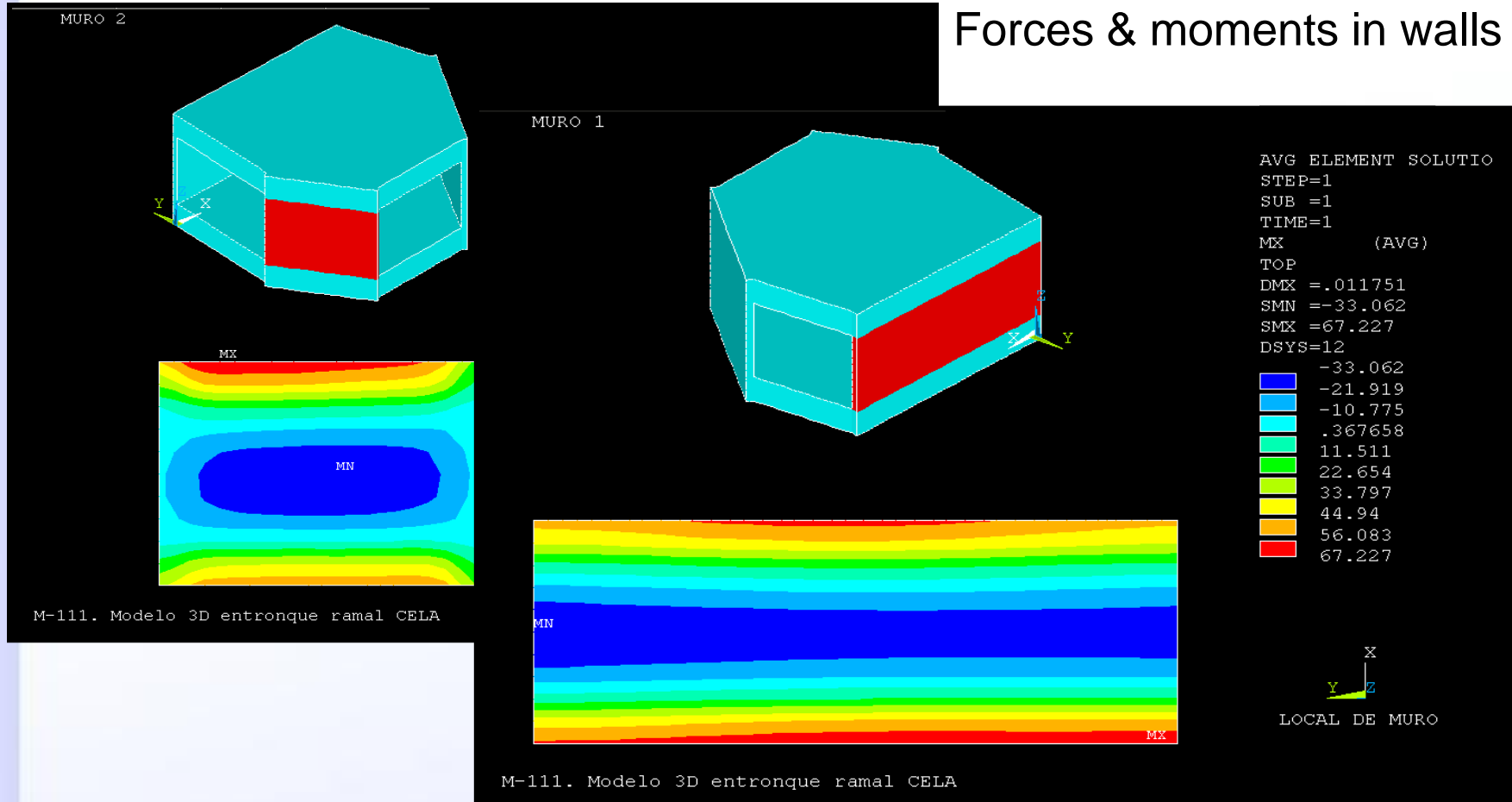
Reinforced Concrete Tunnel

Intersection of terminal building with tunnel



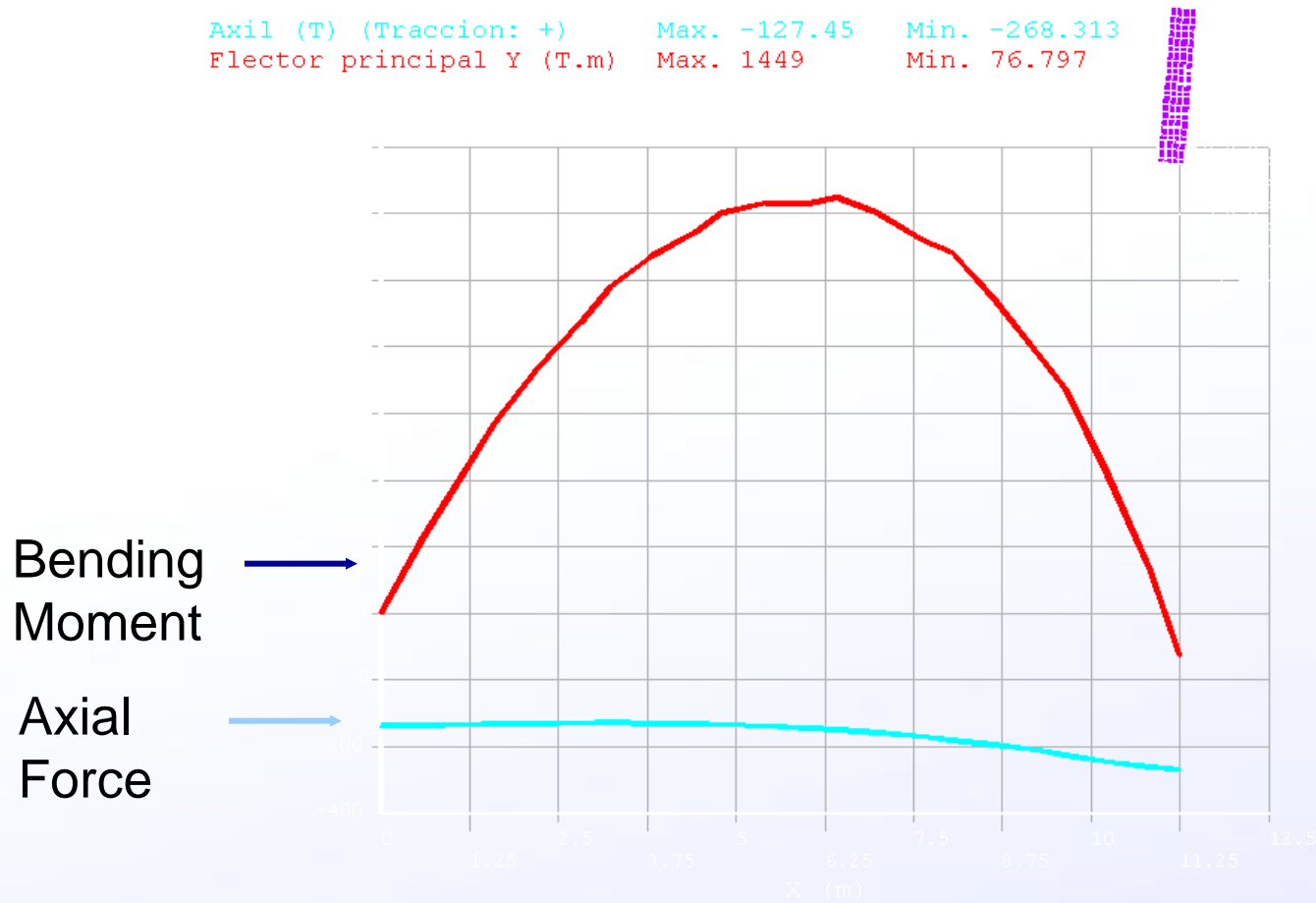
Reinforced Concrete Tunnel

Forces & moments in walls



Reinforced Concrete Tunnel

Axil (T) (Traccion: +) Max. -127.45 Min. -268.313
 Flector principal Y (T.m) Max. 1449 Min. 76.797



M-111. Modelo 3D entronque ramal CELA

Plot No. 24



Reinforced Concrete Tunnel

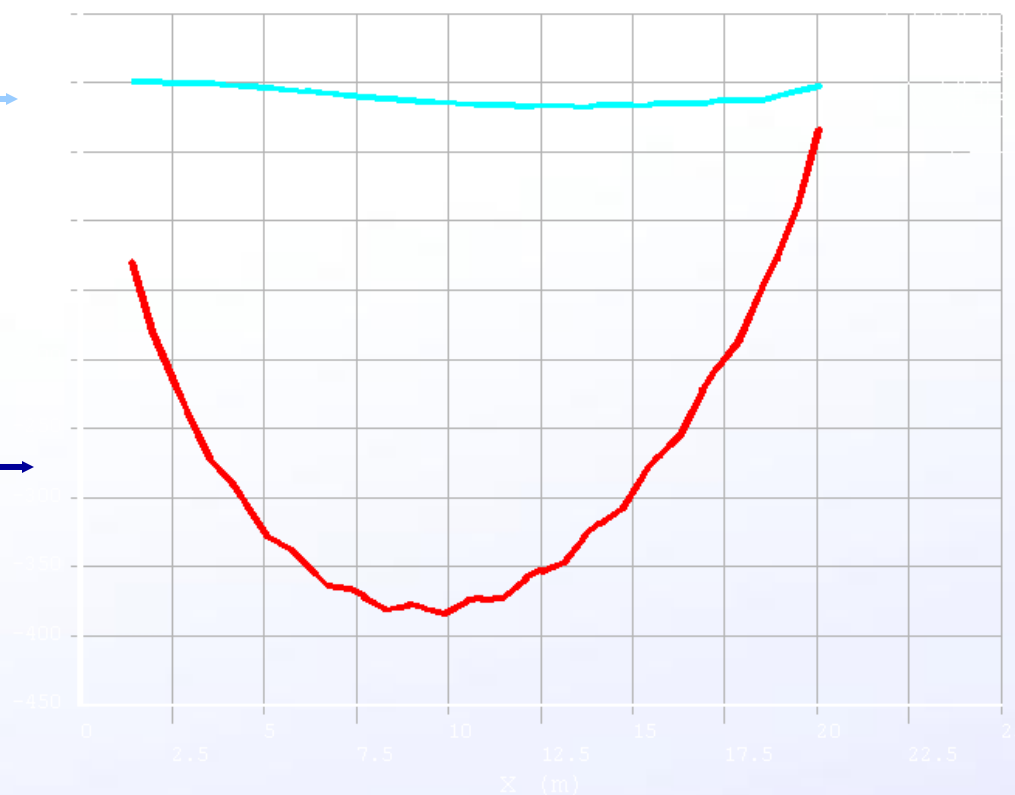
Axil (T) (Traccion: +) Max. 1.239 Min. -17.453
 Flector principal Y (T.m) Max. -33.749 Min. -383.73



Axial Force

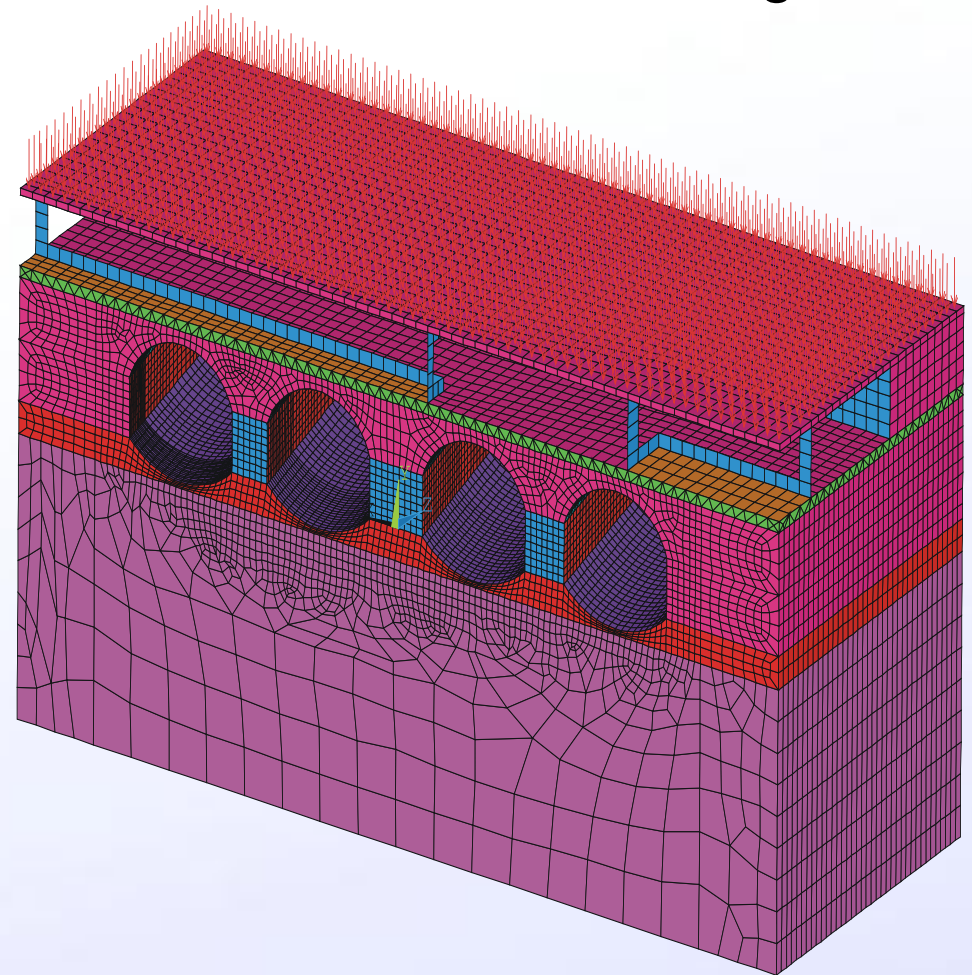
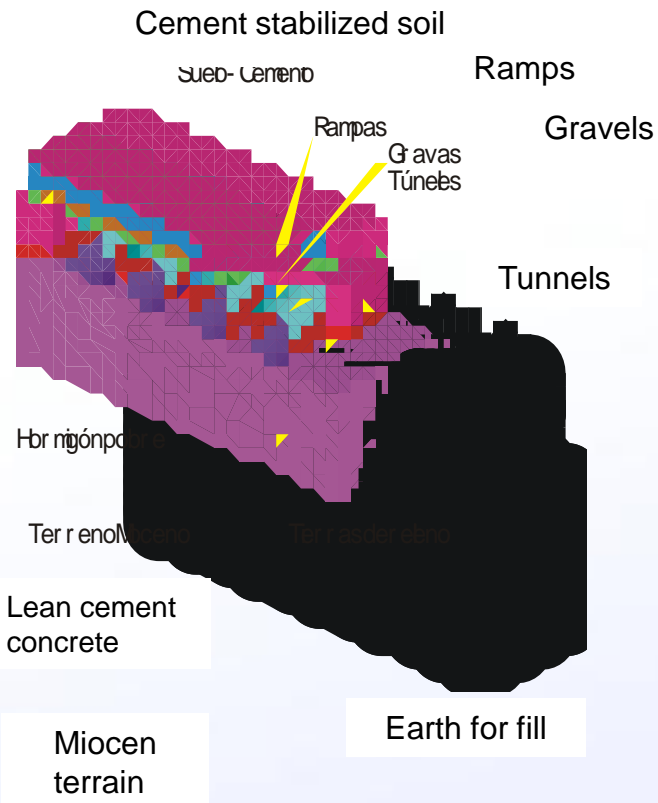


Bending Moment



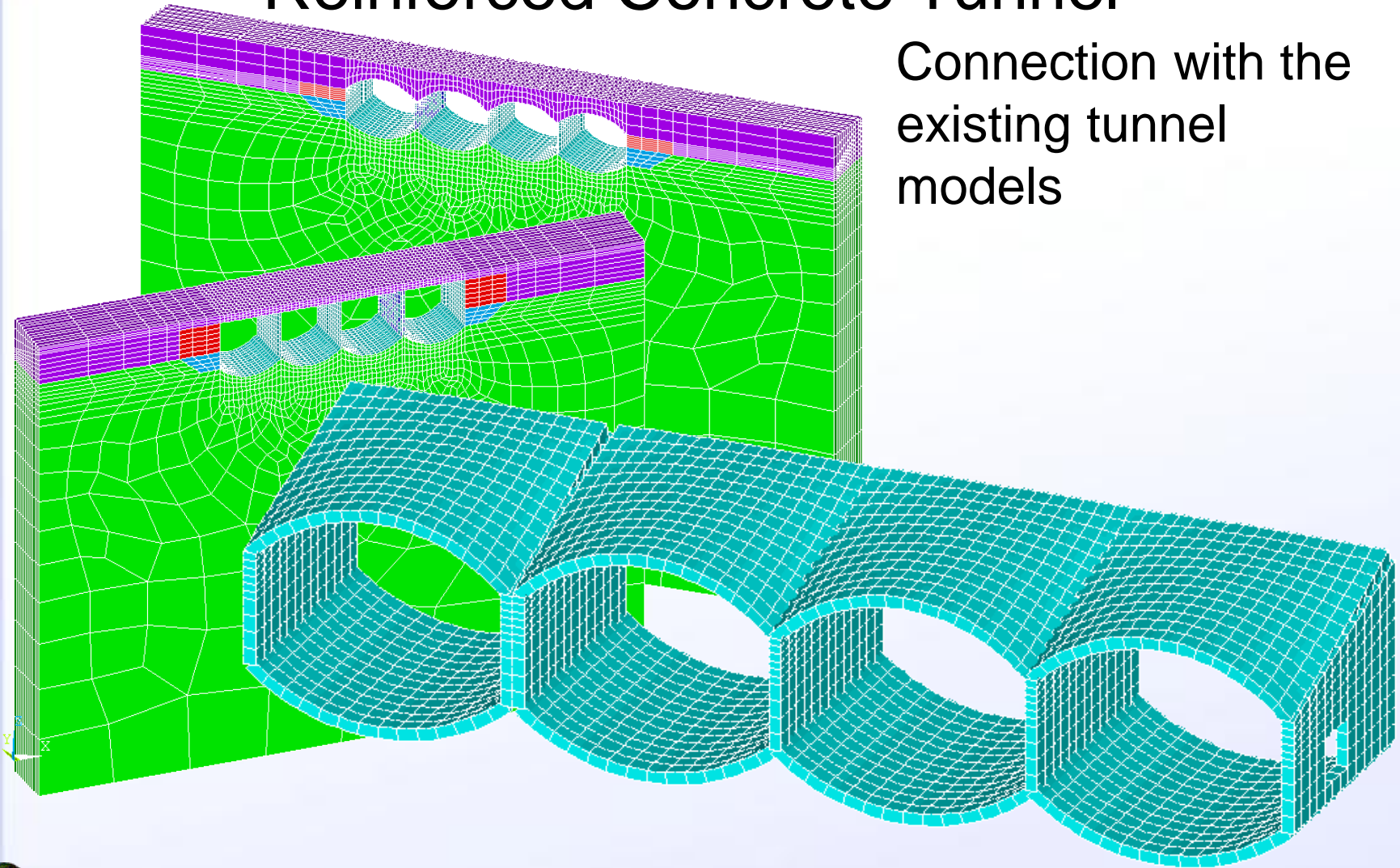
Reinforced Concrete Tunnel

FEM model of access to the satellite building



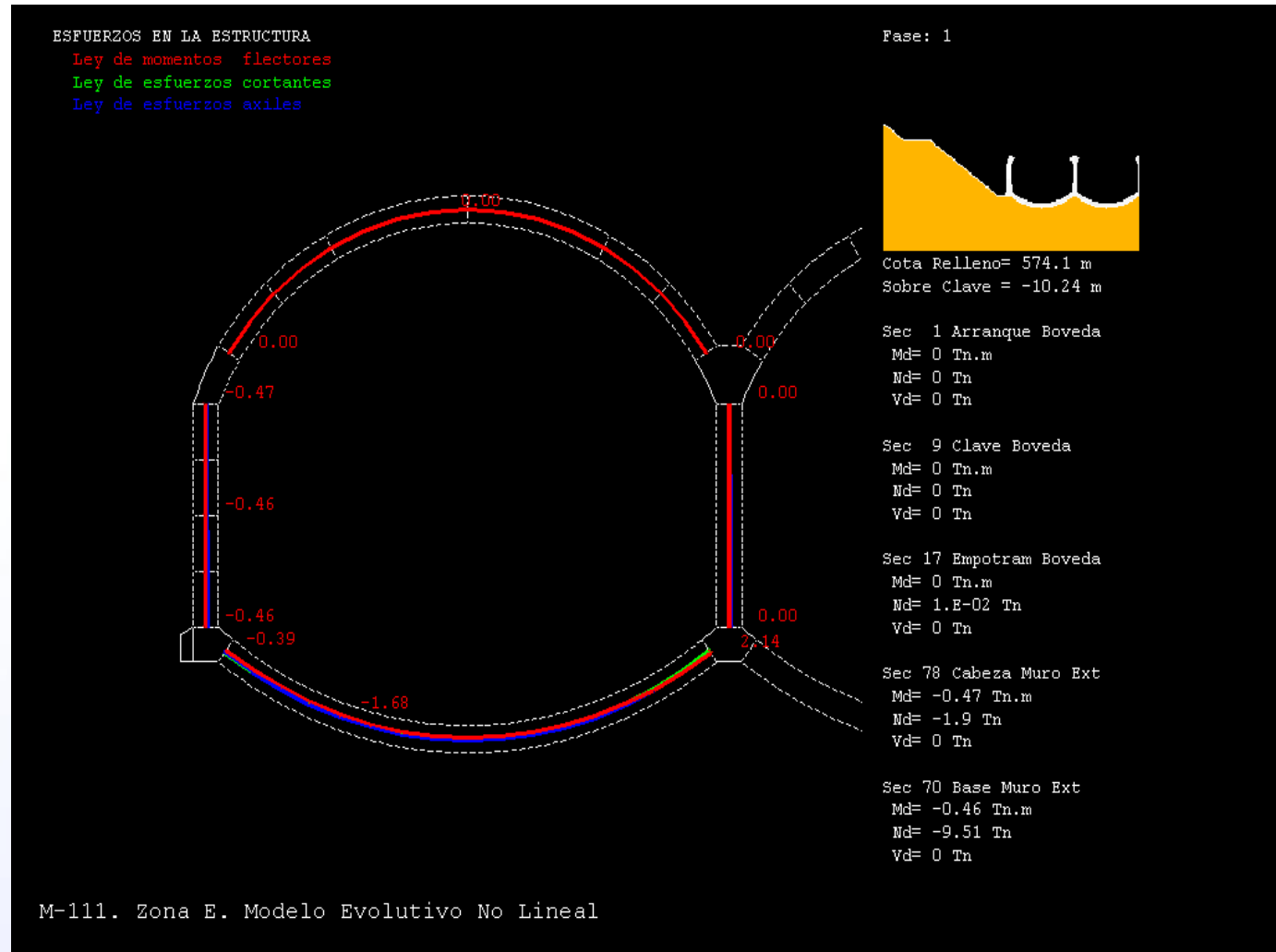
Reinforced Concrete Tunnel

Connection with the
existing tunnel
models



Reinforced Concrete Tunnel

Non linear analysis of the backfill construction process and airplane landing overload



Reinforced Concrete Tunnel

Concrete
cracking
analysis

