

Winner 2026

Porto Metro 3.0: Optimizing tunnel design at scale

Project summary

Organization:
AYESA Engineering

Solution:
Bridges and tunnels

Location:
Porto, Portugal

Project phase:
Design

Expected completion date:
December 12, 2026

Key results

- **26% reduction in work hours.**
- **30% reduction in design costs.**
- **4,500 cubic meters of sprayed concrete avoided.**
- **1.5 million kilograms of carbon emissions avoided.**

Project

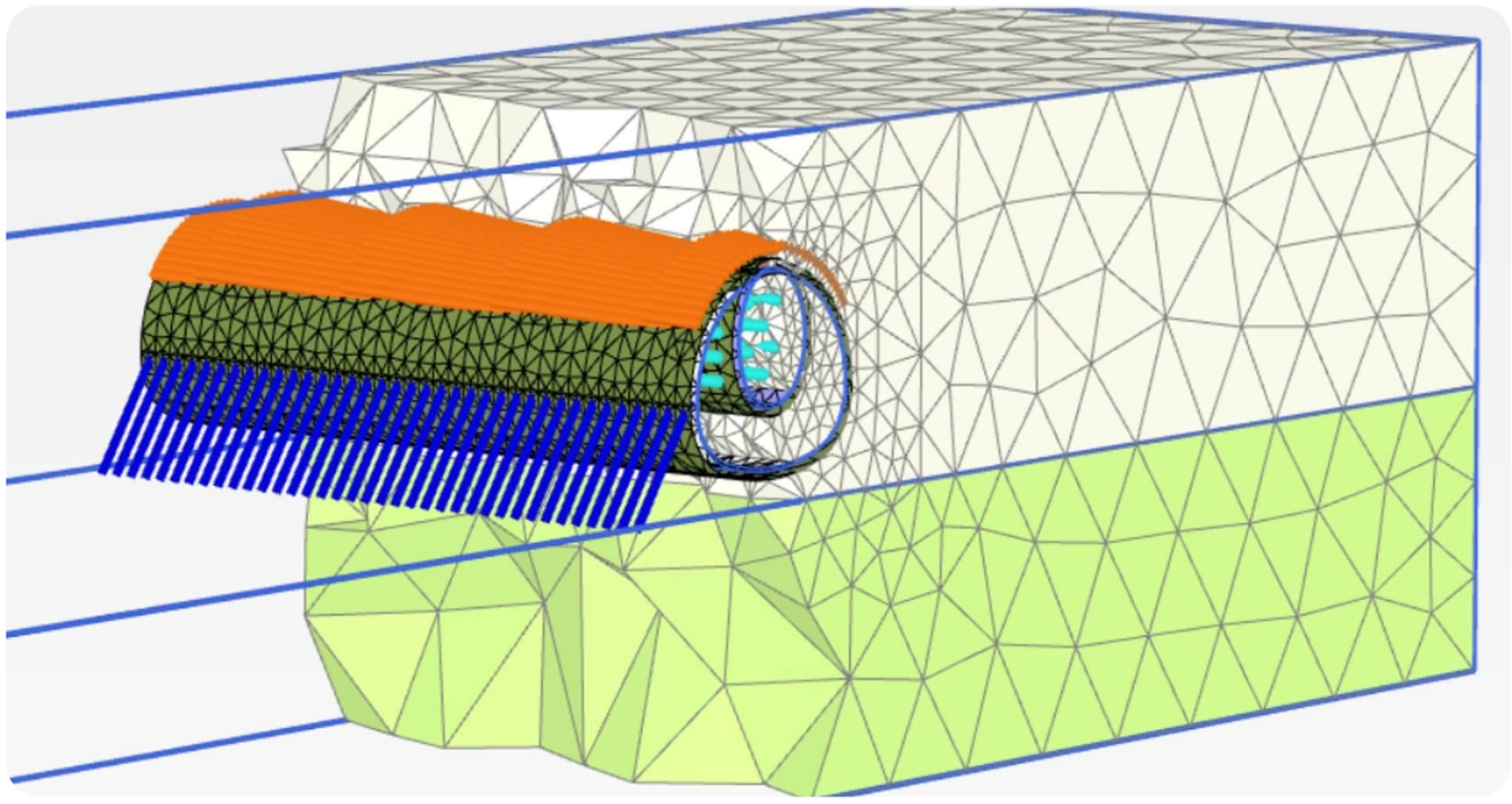
AYESA Engineering is responsible for approximately 5.3 kilometers of conventional tunnels and 12 emergency exit shafts on Porto Metro 3.0. The team had to work through highly varying ground conditions, integrate data from more than 200 boreholes, 35 DPSH tests, and approximately 1,200 meters of geophysical surveys, and reduce manual processes that slowed tunnel design and increased error risk.

Results

Using a connected workflow enabled by Bentley applications, AYESA linked BIM, geotechnical modeling and analysis, geospatial context, and AI-assisted evaluation in one digital environment. The approach reduced work hours by 26%, design costs by 30%, and sprayed concrete use by 4,500 cubic meters, avoiding 1,500,000 kilograms of carbon emissions while improving traceability and supporting sustainable tunnel delivery.

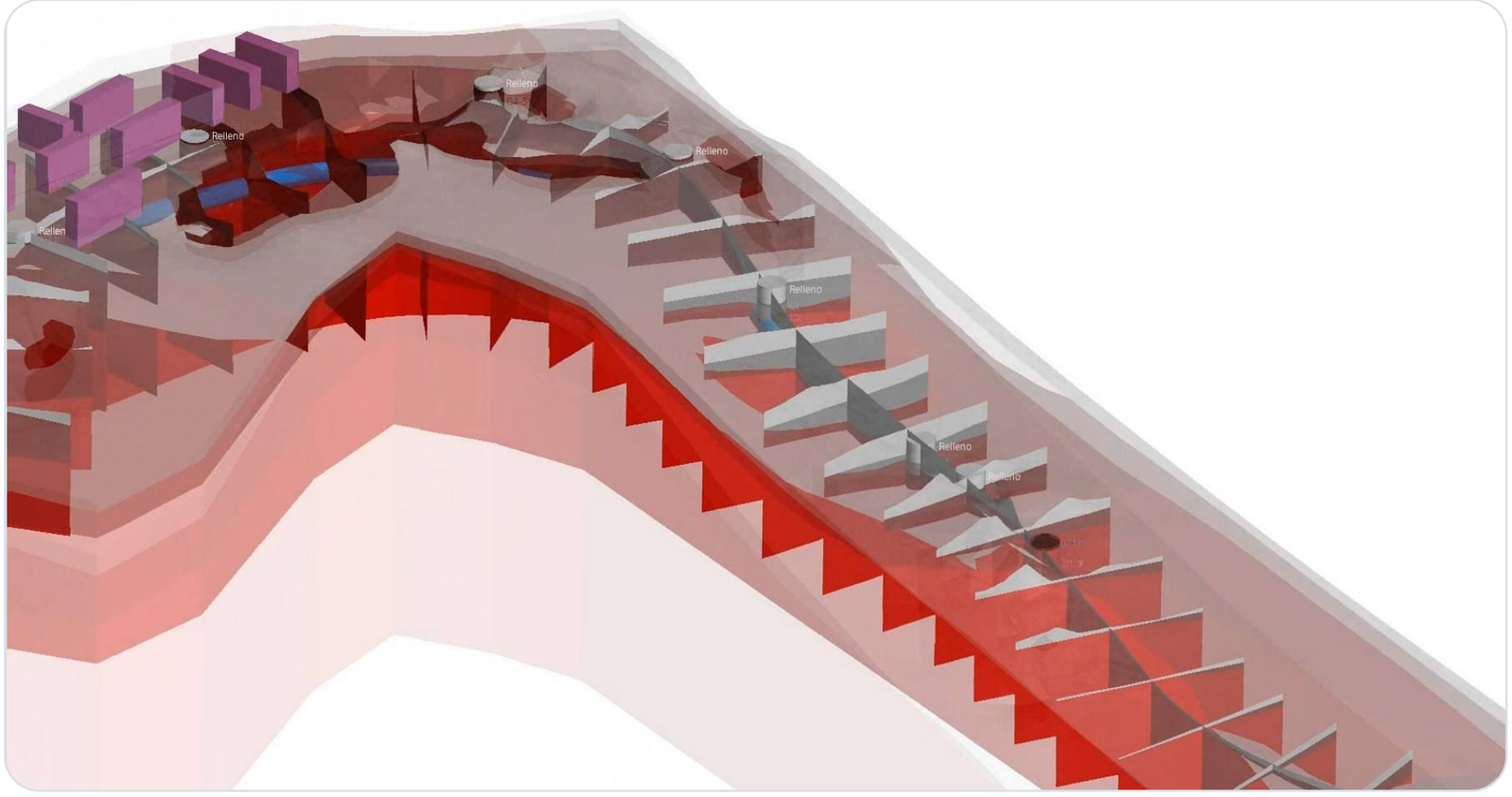
Bentley software

- Cesium®
- Leapfrog®
- OpenTunnel®
- PLAXIS®



Work hours fell by 26% through the integrated tunnel workflow.

> **The [Seequent®] ecosystem—Cesium, Leapfrog Works, OpenTunnel Designer, and PLAXIS—was the foundation that made our Porto Metro 3.0 digital tunnel design workflow possible.**
>
> *— Claudio Cabral Dias, Head of Ground Engineering and Tunnelling, AYESA Engineering*



Sprayed concrete use fell by 4,500 cubic meters.

Solution

One workflow connects geology, tunnel BIM, geotechnical analysis, geospatial context, and AI.

- Leapfrog connected ground investigation data to a dynamic geological model.
- OpenTunnel supported integrated tunnel and ground-treatment modeling.
- PLAXIS enabled geotechnical analysis, construction staging, and soil-structure assessment.
- AI agents automated model creation and evaluation of simulation outputs.

Facts

- AYESA designed approximately 5.3 kilometers of conventional tunnels and 12 emergency exit shafts.
- The workflow integrated data from more than 200 boreholes, 35 DPSH tests, and 1,200 meters of geophysical surveys.
- Work hours fell by 26% and design costs fell by 30%.
- Sprayed concrete use fell by 4,500 cubic meters, avoiding over 1.5 million kilograms of carbon dioxide equivalent avoided.

Find out more at Bentley.com
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