



ASSOCIATION  
INTERNATIONALE DES TUNNELS  
ET DE L'ESPACE SOUTERRAIN  
**ITA**  
INTERNATIONAL TUNNELLING  
AND UNDERGROUND SPACE  
ASSOCIATION

**ferrovial**  
agroman

5<sup>th</sup> International Seminar on Underground Space  
Health & Safety in Underground Space  
October 18<sup>th</sup>, 2019, Lisboa, Portugal

## Barbara – Virtual Reality Tunnel Boring Machine

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**Società Italiana Gallerie**  
Italian Tunnelling Society

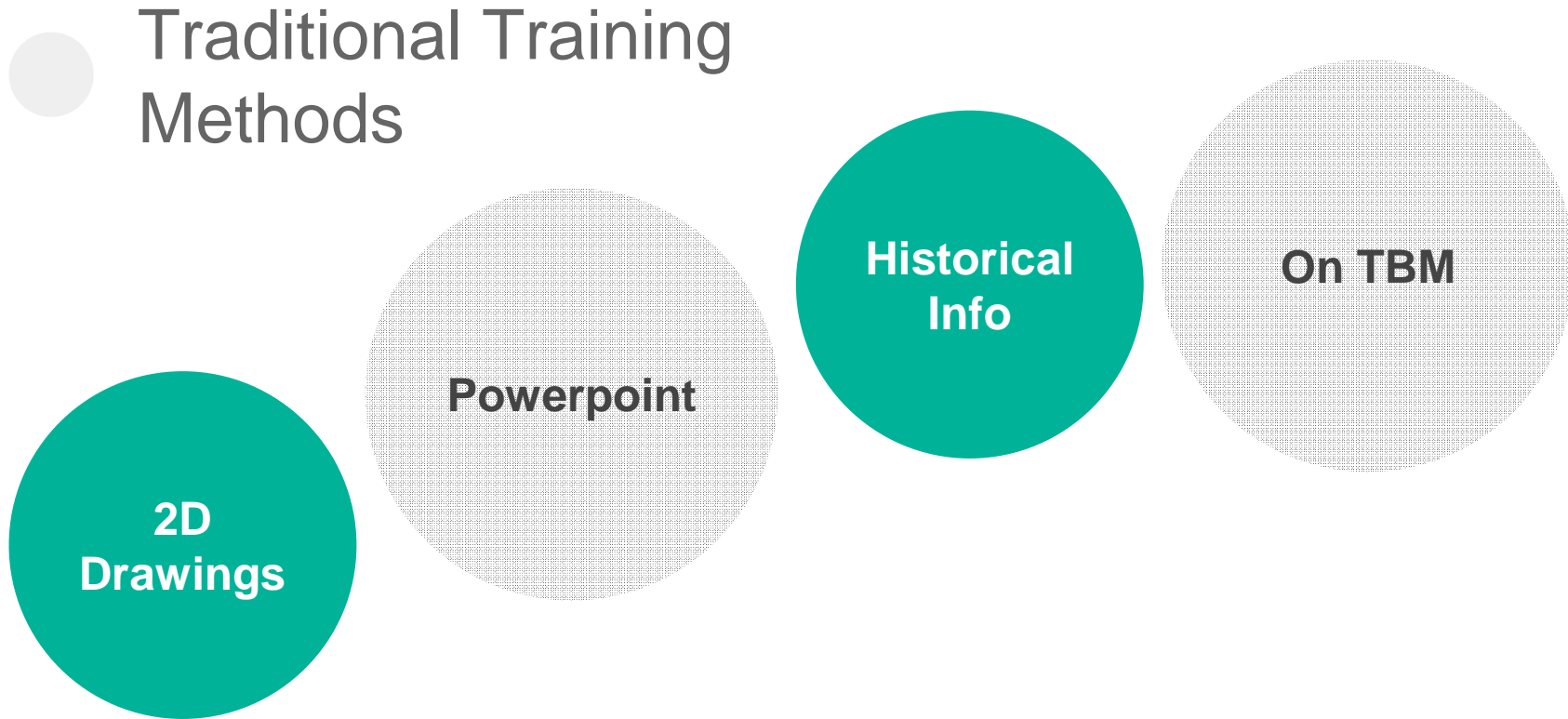


FGU Fachgruppe für Untertagbau  
GTS Groupe spécialisé pour les travaux souterrains  
GLS Gruppo specializzato per lavori in sotterraneo  
STS Swiss Tunnelling Society

# TBM Hazards



Risks arise from multiple hazards





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Existing Challenges to VR  
Training





## The Great Think Food for Thought Session

Ferrovial Agroman + Laing O'Rourke (FLO) contribute **£5,500** to produce a prototype VR Tunnel Boring Machine.

Thames Tideway save **£80,000** in safety and operational refinements discovered on the day. Engineers modified layout & position of screw conveyor.

Submitted grant application with AFRC + AMRC

Improving Access to Current VR Technology in  
Construction

# VR TBM Partners



# Dragon's Den

Have you  
got an idea that  
needs funding?

June 2017

Tideway Innovation were looking for new ideas to improve safety, productivity, diversity, the environment and more.



IMAGINE | INNOVATE | INSPIRE





Summer 2017



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- LABORATÓRIO NACIONAL  
DE ENGENHARIA CIVIL

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## Summer 2017

£20,000

Awarded full funding by Thames Tideway

September 2017

Time to deliver a prototype 1.1

**Scenario**  
TBM Orientation

**Interactivity**  
Touch Screen  
User Controls

**Software**  
Unreal Engine

**Medium**  
Stereo  
Projection



September 2017

Delivery:  
Digital Construction Week 2017



200+ industry professionals visited the TBM experience and gave invaluable feedback



£67,500

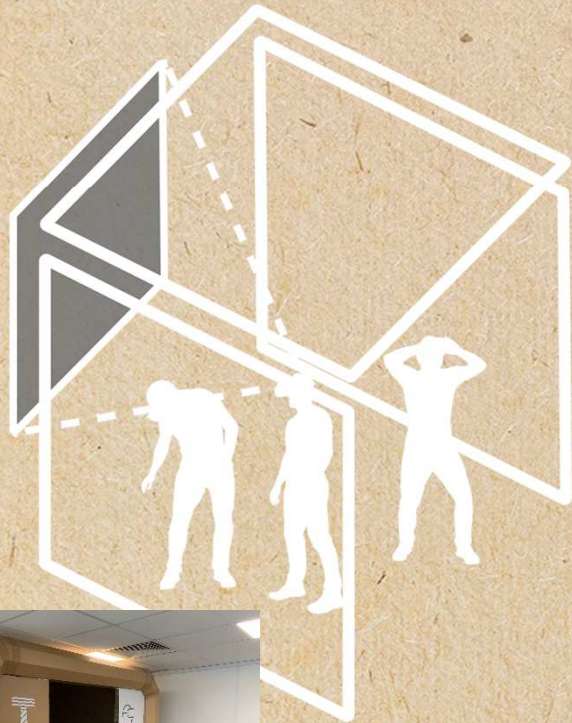
Additional funding awarded by **Innovate UK**

January 2018

Start Date

September 2017

## Virtual Reality Cubed Cardboard Prototype



### Sustainable

Recyclable material, sustainably sourced



### Accessible

In terms of Cost and Portability



### Flexible

Functional & Adaptable play environment for 3D projection & VR in AEC



### Open

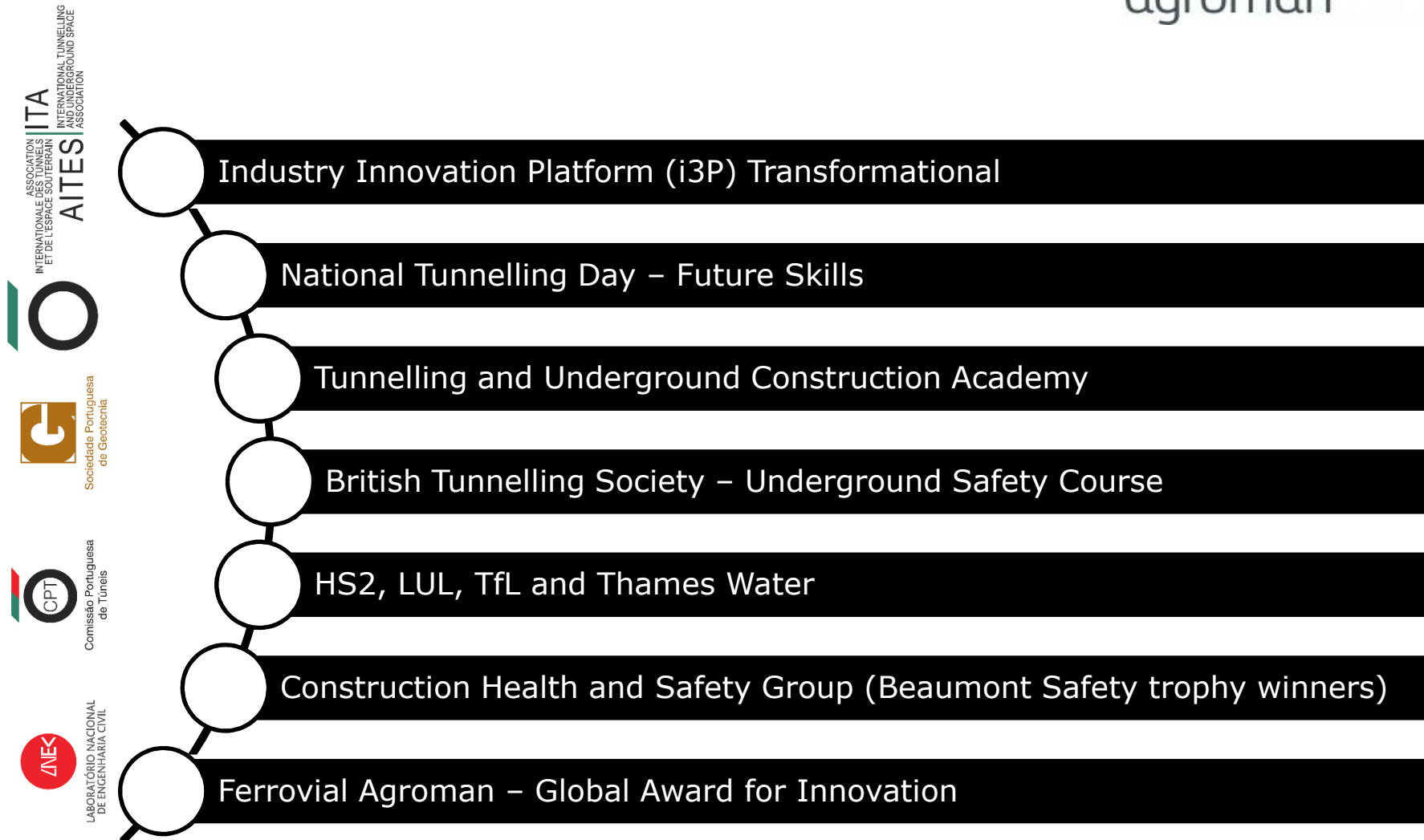
Industry Leading Hardware/software compatibility







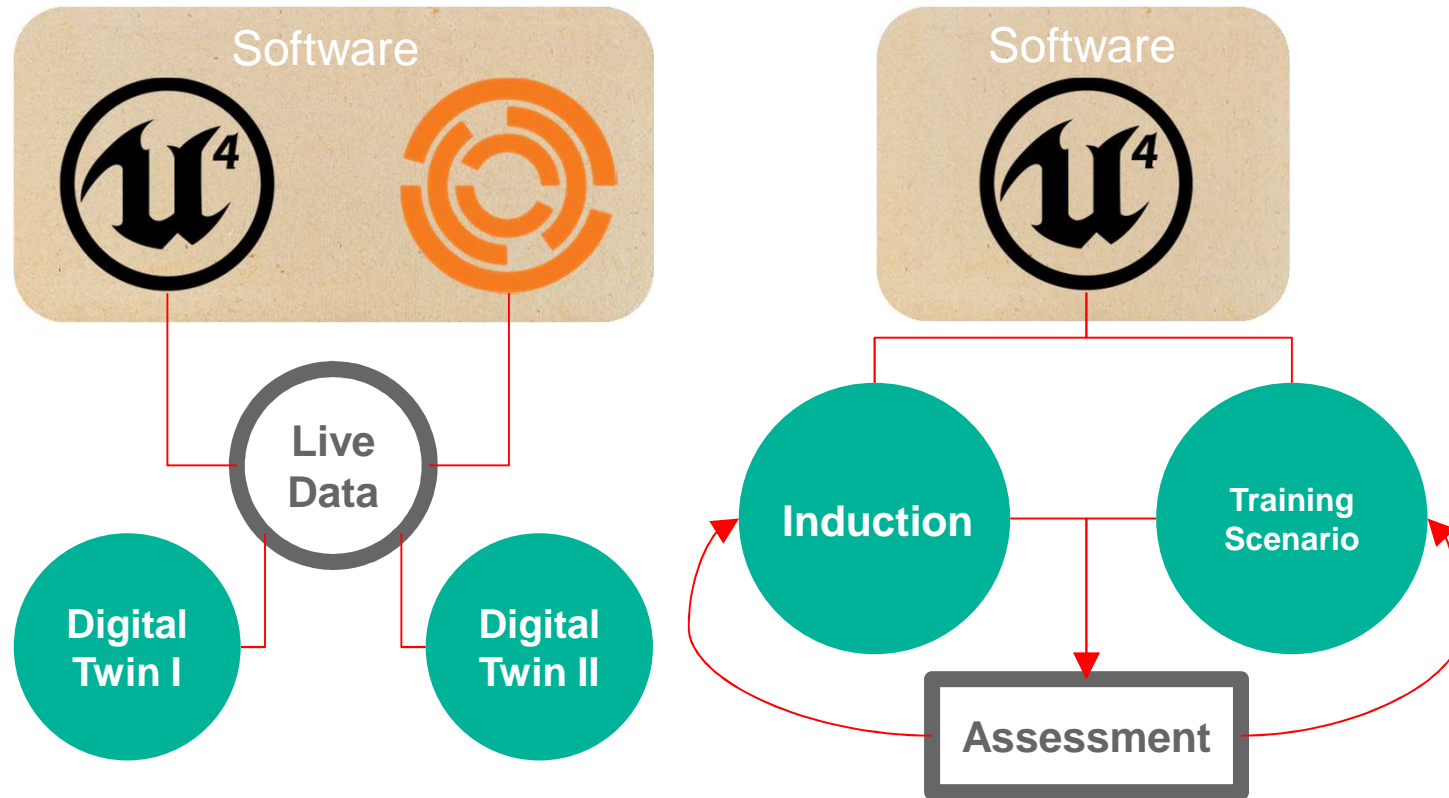
Progress





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## Next Steps



## Benefits & Uses

DESIGN OF TBM  
STEMNET ACTIVITIES  
COMPRESSED AIR WORKINGS  
**TBM FAMILIARISATION**  
SEGMENT MAGAZINE AREA  
EMERGENCY ESCAPE

**BUILD AREA**  
LOCOMOTIVE TRAINING  
**DIGITAL TWIN**  
HAZARD PERCEPTION

**REFUGE CHAMBER**  
HYPERBARIC INTERVENTIONS

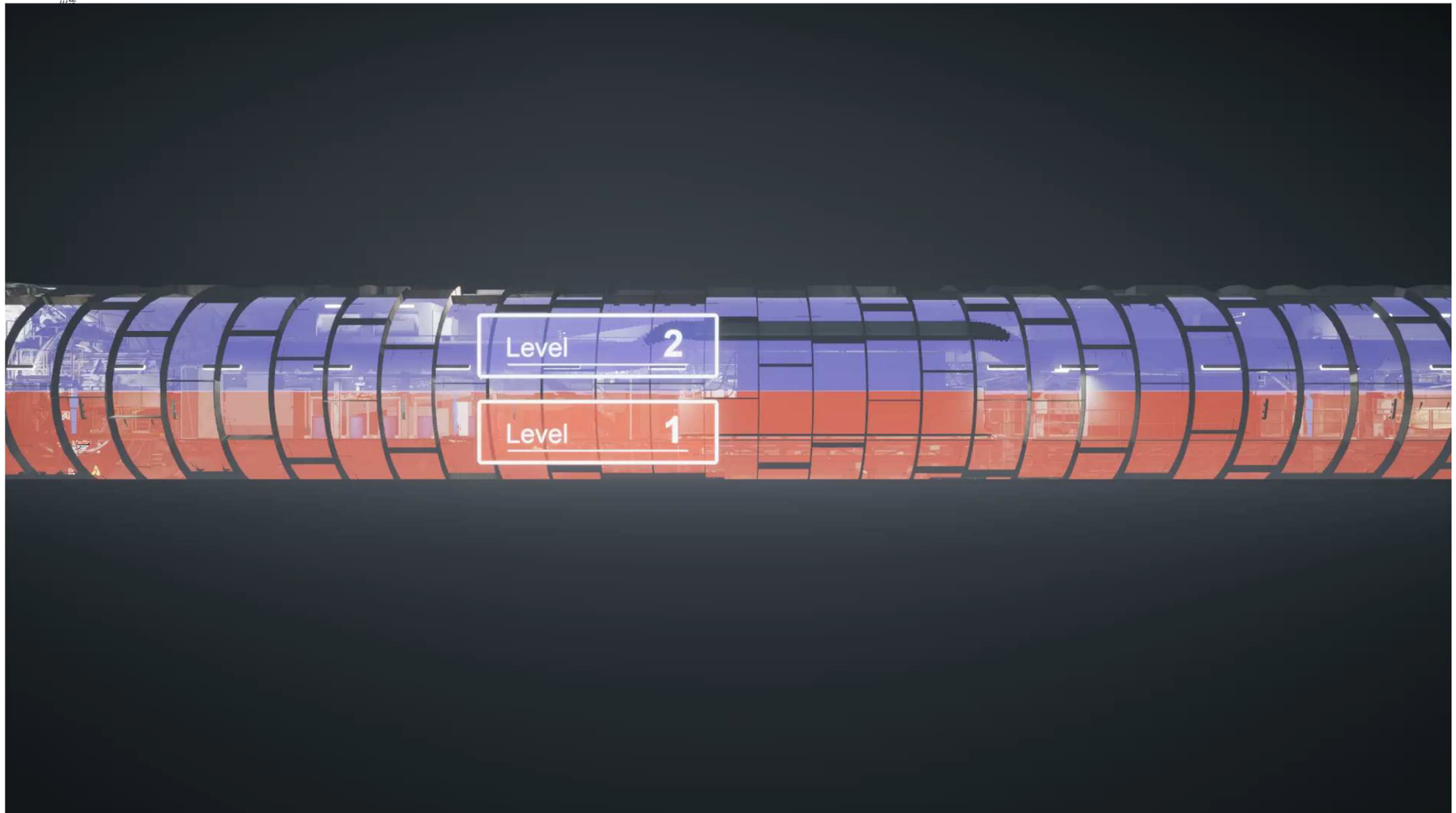
## End Users

Miners - Civil Engineers - Mechanical Engineers - TBM Operators

Designers - Health & Safety Professionals - Fitters - Electricians - Students Visitors

- Trainers - Teachers - HSE - Clients - Contractors - Visualizers





# Obrigado!

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ASSOCIATION



Sociedade Portuguesa  
de Geotecnia



Comissão Portuguesa  
de Túneis



LABORATÓRIO NACIONAL  
DE ENGENHARIA CIVIL



Tideway

ferrovial  
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