



# Tunnelling Asia' 2023

International Conference on  
Climate Change Resilience and Sustainability  
in Tunnelling and Underground Space



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INTERNATIONALE DES TUNNELS  
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## **Mechanized tunnelling** **Improving the environmental impact of chemical products** **without impacting technical performance**

by

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- Soil conditioning
- Backfill grout
- Sealant and lubricants
- Bentonite slurry

## Sustainable innovation



Technical performances

+

Reduction of environmental impact



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## Sustainable innovation in mechanized tunnelling

Reduction of  
environmental impact  
of soil conditioning

Reduction of the use of  
water

Reduction of the CO<sub>2</sub>  
emissions



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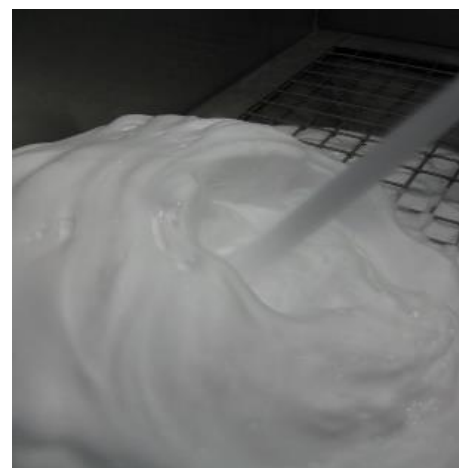
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## What is soil conditioning?

*Addition of chemical products (foams and  
polymers) to the soils, with the target to  
improve its consistency and facilitate a faster  
and safer TBM excavation*





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TBM diameter: 10 meters

1 km of excavation:



around 80,000 m<sup>3</sup> of tunnel  
muck



## What is sustainable soil conditioning?

Technical performances  
+  
Reduction of environmental impact



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**Reduction of  
environmental impact of  
soil conditioning**

## Development of the lines of foams

### POLYFOAMER ECO

- ✓ Innovative foams with reduced environmental impact against waters and soils:
  - Fast biodegradation
  - Very low ecotoxicity
  - Certification of WGK = 1



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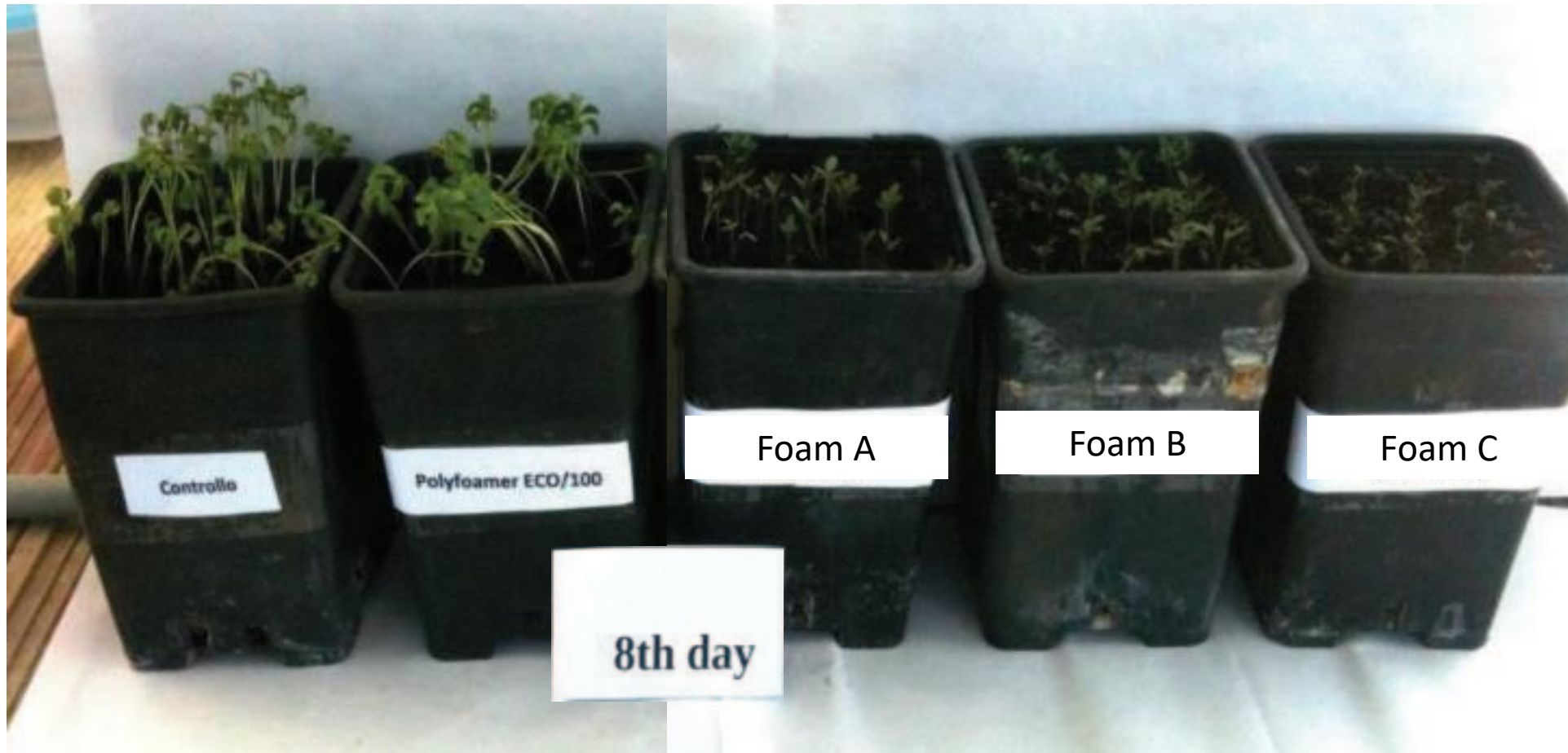


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Laboratory of the  
National Research  
Centre of Italy.

Toxicity test against  
vegetation.





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Riachuelo Project in Buenos Aires.  
Natural growth of vegetation from the tunnel muck conditioned with **POLYFOAMER ECO**





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## POLYFOAMER ECO

> 80 km of tunnelling  
Italy  
Canada  
Argentina



November 22-23, 2023, Mumbai, India



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Reduction of the use of  
water for soil  
conditioning

## Development of the lines of foams POLYFOAMER ECO WSP



- ✓ Innovative foams that allow to reduce the amount of water for soil conditioning by 15 to 30%



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| Traditional foam   | <br>POLITECNICO<br>DI TORINO | POLYFOAMER ECO WSP   |
|--|---|--|
| WIR 40%  |   | WIR 30%  |
| 31,400 litres of water injected for 1 linear meter of excavation |   | 23,550 litres of water injected for 1 linear meter of excavation |

78,500,000 litres of water saved to excavate 10 km



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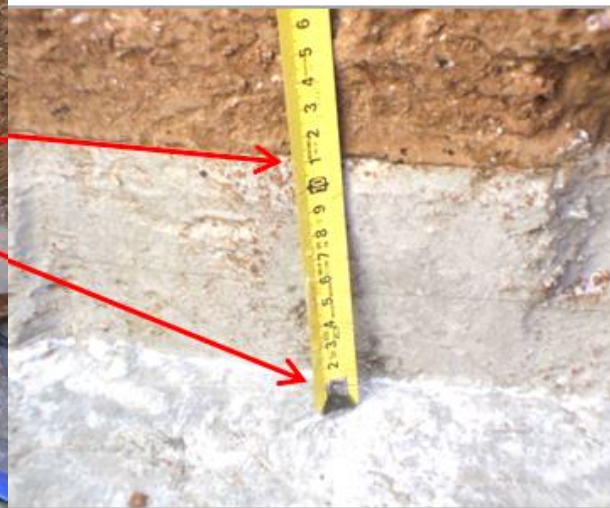
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## What is backfill grout?



*Injection of a grout to fill the annular void between the precast segments and the surrounding soil / rock mass*



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**Reduction of the  
CO<sub>2</sub> emissions**

**Development of the system**

**MAPEQUICK CBS ACTIVE**

- ✓ Innovative system to reduce the CO<sub>2</sub> emissions in two-component backfill grout for TBM



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| Cement-based two-component backfill grout            | TWO-COMPONENT CEMENT-FREE BACKFILL GROUT             |
|--|--|
| > 300 kg of CO <sub>2</sub> per cubic meter of grout | < 100 kg of CO <sub>2</sub> per cubic meter of grout |
|  |  |
| Around 20,000 tons of CO <sub>2</sub> for 10 km      | < 6,000 tons of CO <sub>2</sub> for 10 km            |

**REDUCTION OF AROUND 14,000 TONS of CO<sub>2</sub>**



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**Thank you for the attention**

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