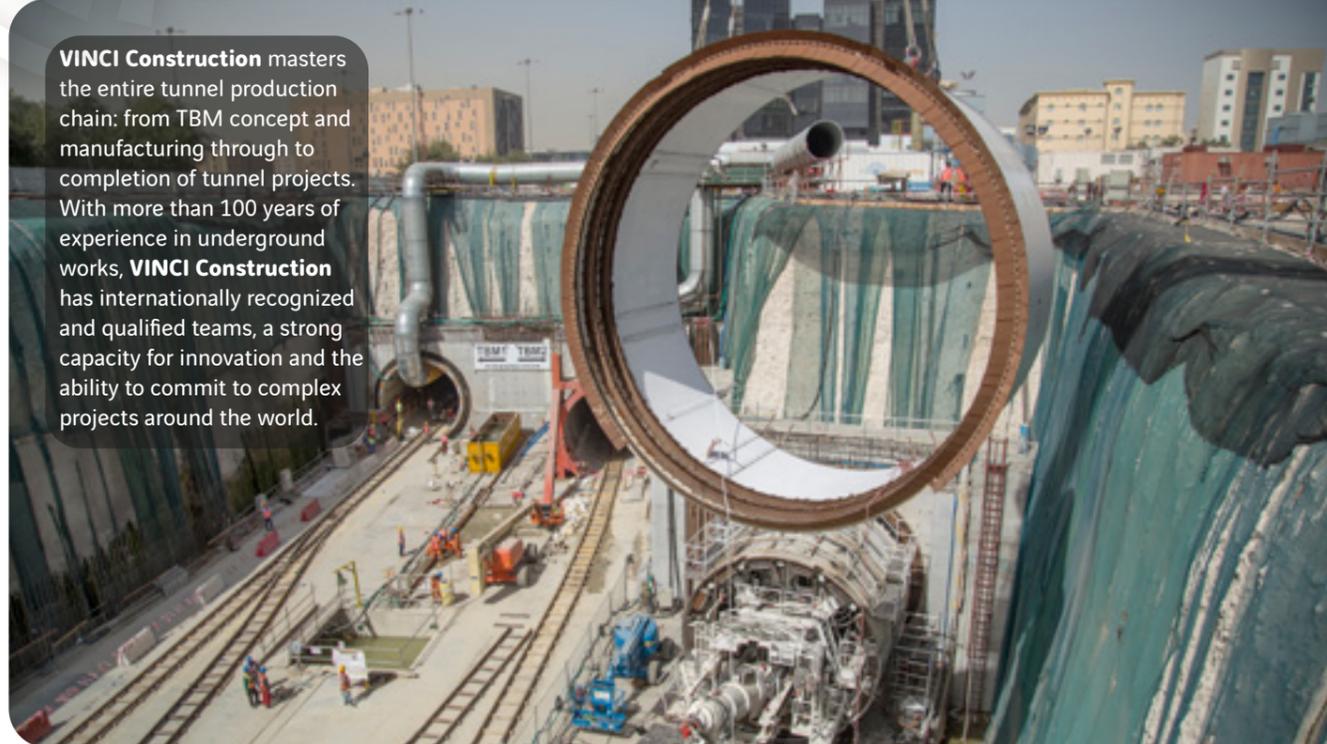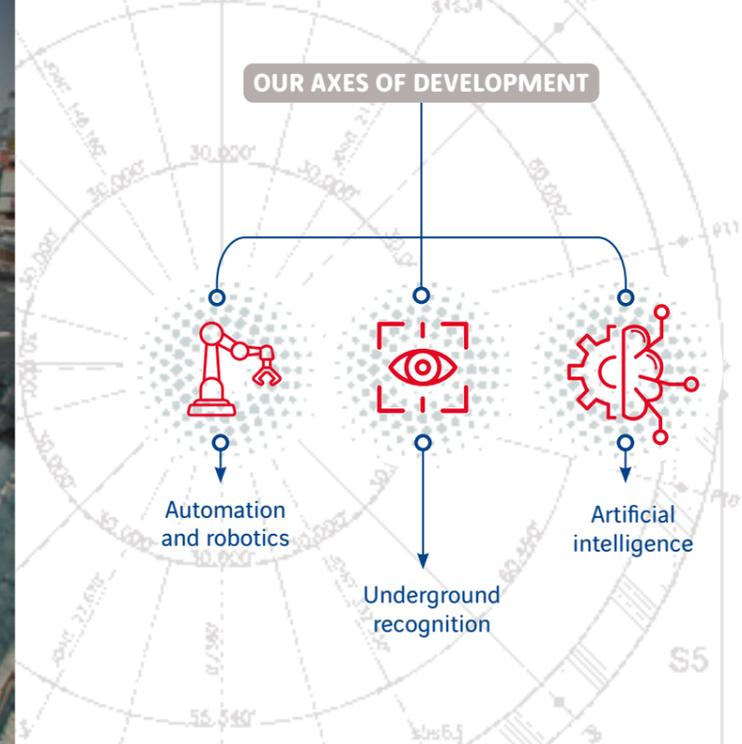VINCI
CONSTRUCTION

TUNNEL FACTORY

Tunneling works:
opening new paths
through innovation and R&D

We enhance reliability, safety, and productivity
of tunneling activities all around the world

VINCI Construction Grands Projets, Bessac, Dodin Campenon Bernard, Sixense and VINCI Construction France created the Tunnel Factory as a cross-functional initiative aimed at preparing the future of tunnels and tunneling.

VINCI Construction masters the entire tunnel production chain: from TBM concept and manufacturing through to completion of tunnel projects. With more than 100 years of experience in underground works, **VINCI Construction** has internationally recognized and qualified teams, a strong capacity for innovation and the ability to commit to complex projects around the world.

OUR AXES OF DEVELOPMENT

- Automation and robotics
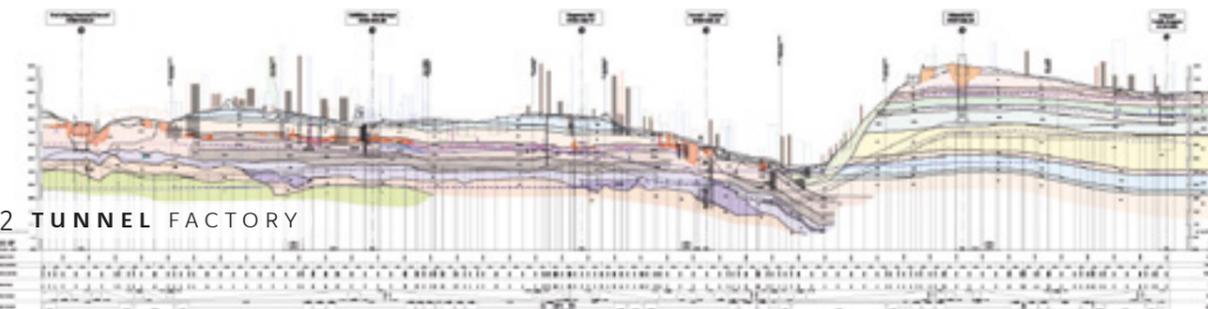- Underground recognition
- Artificial intelligence

Multidisciplinary competencies

We are a transverse team across VINCI Construction dedicated to tunnels and mobilize our resources to work on both short- and long-term R&D projects. Working with our construction sites, we innovate and develop R&D projects in tunneling activities. Our ability to encourage civil engineers, data scientists, and robotics engineers to work together is a feature that drives our missions to successful outcomes.

Our mission

The growth in worldwide tunneling needs with high technological and economic performance associated with the necessity to reduce CO_2 emissions has pushed the Tunnel Factory to focus on how to speed up the construction process and bring new technologies into tunneling activities. Increased safety and better risk management generated by innovation lead to lower costs, higher profitability, and improved Client experience.

Concepts and robots serving humans

Innovation is our core model. Robotics and automation are helping all industries and have a huge impact on construction activities.
Our solutions are increasing operational safety by decreasing workforce exposure. New technologies assist workers in their day-to-day job and repetitive activities.
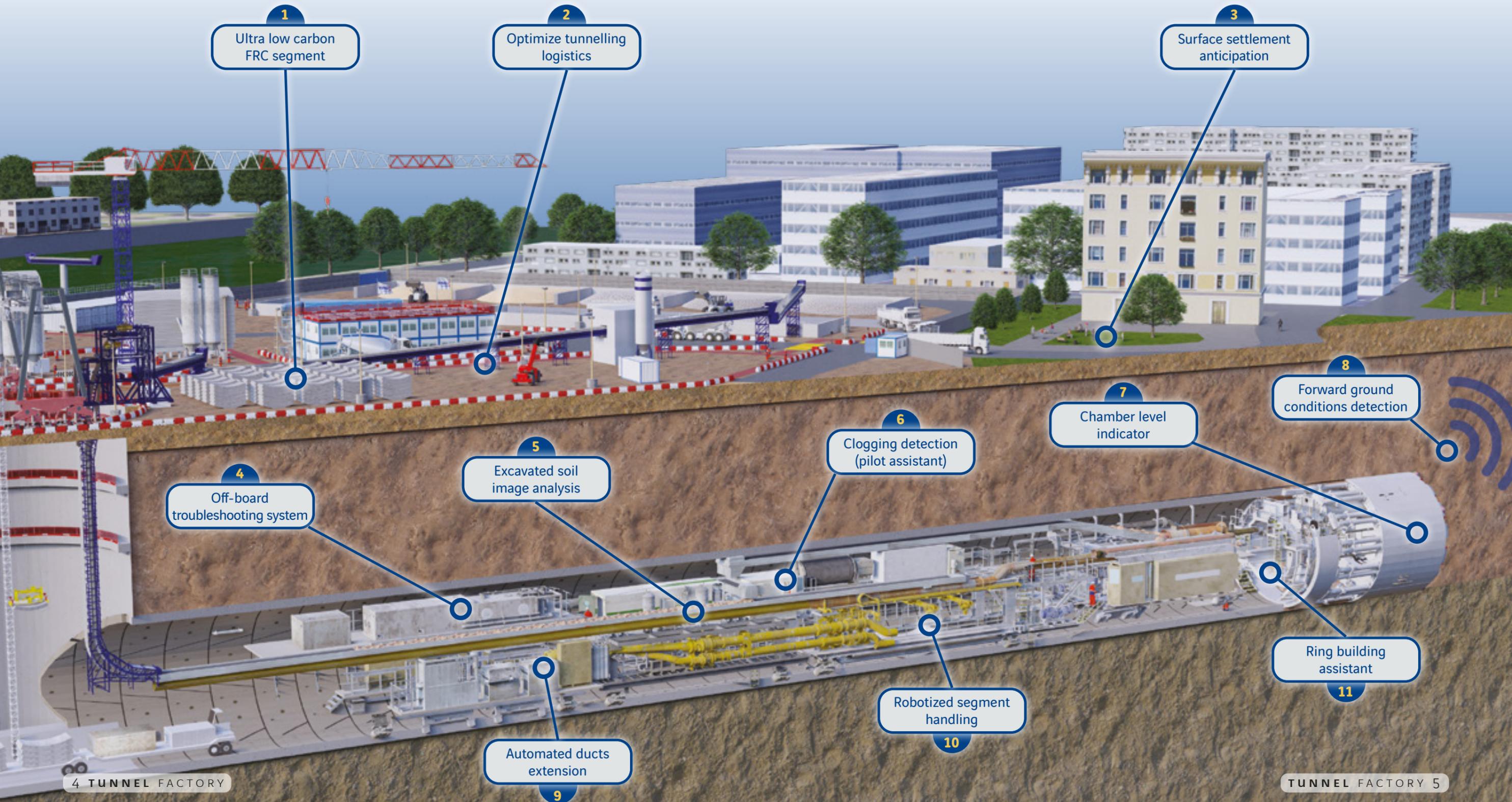
New services based on AI

We integrate machine learning in pilot decisions. We optimize TBM excavation parameters, using our own data and based on our technology, we help pilots to adapt their actions towards the tunnel boring machine facing geological variations.

Increase operations reliability

Exploring new technologies to get accurate information about sub-surface soils is one of our major subjects of development. We adapt TBM driving to the geological reality using image recognition and faster detection of abnormal or changing ground conditions.

Our innovations
boosting activities in all kinds of environments

1 Ultra low carbon FRC segment

2 Optimize tunnelling logistics

3 Surface settlement anticipation

4 Off-board troubleshooting system

5 Excavated soil image analysis

6 Clogging detection (pilot assistant)

7 Chamber level indicator

8 Forward ground conditions detection

9 Automated ducts extension

10 Robotized segment handling

11 Ring building assistant

We develop innovations
addressing the specific needs of construction projects

New services and new tools proposed below can be deployed on construction sites thanks to our dedicated team based in the VINCI innovation hub **LEONARD**

A pragmatic approach: from, with and for construction sites. All our missions are developed in continuous partnership with the field. Our ability to offer a proper solution with a dedicated team goes beyond the project lifetime and allows us to better anticipate future needs.

1 Ultra-low carbon FRC segments

Part of VINCI Construction's commitment to using 90% of low carbon concrete in 2030, an new ecofriendly mix, allowing up to 75% carbon emission reduction, has been developed for precast segments and jacking pipes within the European normative framework.

2 Optimize tunneling logistics

Applying lean methods to better assess the shortfalls in management, logistics and organization on the site allows all tunneling teams to boost their productivity.

3 Surface settlement anticipation

This add-on to the TBM software provides a quick and more reliable evaluation of the surface settlement above and around the machine. It enhances the capabilities of our world renowned Geoscope/Beyond monitoring software.

4 Off-board troubleshooting system

Just like in a car shop, this system is linked to the PLC automation, indicates the origin of the breakdown, and provides an assistance to resolve issues. A proper set-up and training at inception are necessary.

5 Excavated soil image analysis

Created in collaboration with an AI specialist in image processing and using a high performance camera, this indicator displays on the monitoring screen sudden and significant variations in soil aspect and texture.

6 Clogging detection

On the monitoring screen, based on the existing software and sensors of the machine, this AI-based mathematical indicator provides early warning of a clogging event. Through curves and values it gives an indication of a potential clogging situation and provides the pilot with a chance to adapt TBM parameters early on.

7 Chamber level indicator

Using TBM sensors coupled with mathematical analysis, this add-on allows the pilot to quickly assess the level of excavation materials in the chamber.

8 Forward ground condition

Discrepancies between geotechnical baseline reports and ground realities get detected through existing boreholes and reflection of sound waves.

9 Automated ducts extension

The slurry ducts extension robotization keeps workers safe from heavy moving elements. In a fully automated mode, the steel pipes are retrieved from the storage rack, moved into place on the supports, adjusted and clamped.

10 Robotized segment handling

Automating all tasks from segment off-loading from the service train until erection: spacer removal, connector installation, cleaning, and transfer suppresses interfaces between humans and machinery.

11 Ring building assistant

LED glasses provide the erection operator with real-time display of segmental lining 3D geometrical indicators. They help smoothen and shorten the erection time in greater autonomy, yielding higher quality in a safer working environment.