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ÖBB tunnel projects and respective safety aspects

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17-21 Sept. 2024

Vienna, Austria
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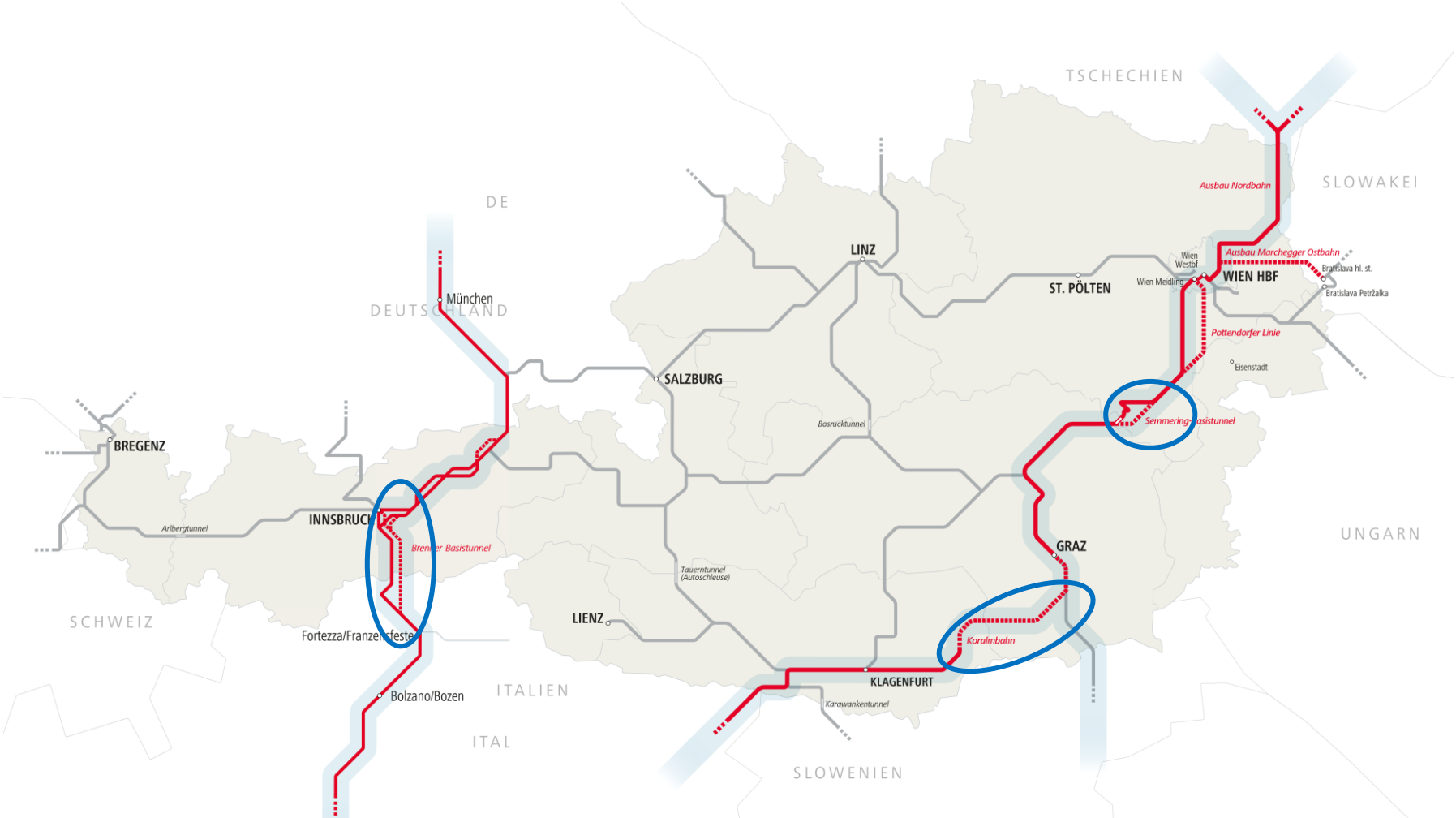
Major tunnel projects in Austria



Major tunnel projects in Austria

	Semmering base tunnel	Koralm tunnel	Brenner base tunnel
start of construction	2012	2008	2007
start of train operation	2030	2025	2032
tunnel progress	99 %	100 %	79 %
future travel time reduction	- 30 min	- 75 min *	- 60 min
scheduled maximum speed	230 km/h	250 km/h	250 km/h
tunnel lenght	27 km	33 km	64 km
distance between cross passages	500 m	500 m	333 m
number of emergency stations	1	1	3
service tunnel	no	no	yes
service tunnel / shaft	2 shafts	2 shafts	4 tunnel

* compared to bus

The new Southern Line

Northern Line 2022-2030

Marchegg eastern railway 2016-2025

Vienna main station 2010-2015

Freight Centre Vienna South 2013-2017

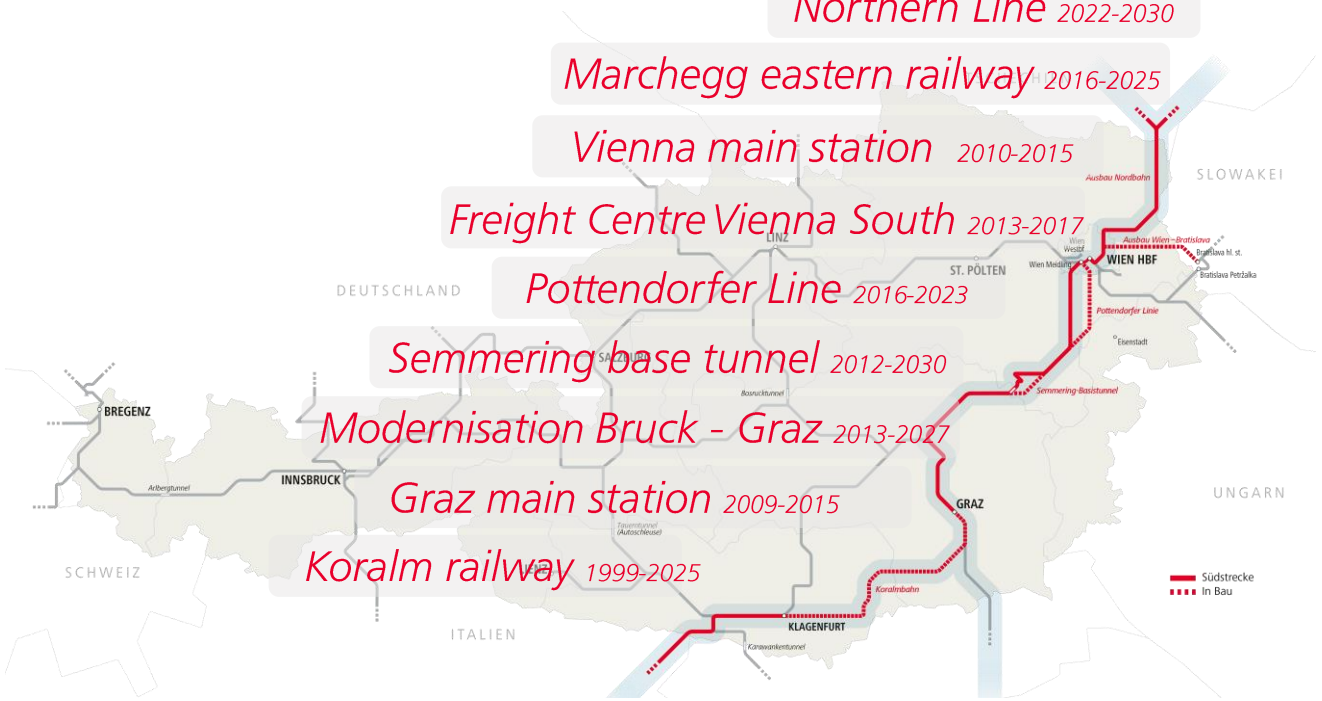
Pottendorfer Line 2016-2023

Semmering base tunnel 2012-2030

Modernisation Bruck - Graz 2013-2027

Graz main station 2009-2015

Koralm railway 1999-2025



The Semmering base tunnel

The 27-km-long Semmering base tunnel between Gloggnitz (Lower Austria) and Mürzzuschlag (Styria) creates a fast and safe connection between Vienna and the South of Austria

- 27 kilometres long
- 2 single-track tunnel tubes
- Construction time: 2012 - 2030
- Maximum speed: 230 km/h
- Reduction of travel time between Graz and Vienna: 50 min

The Koralm railway

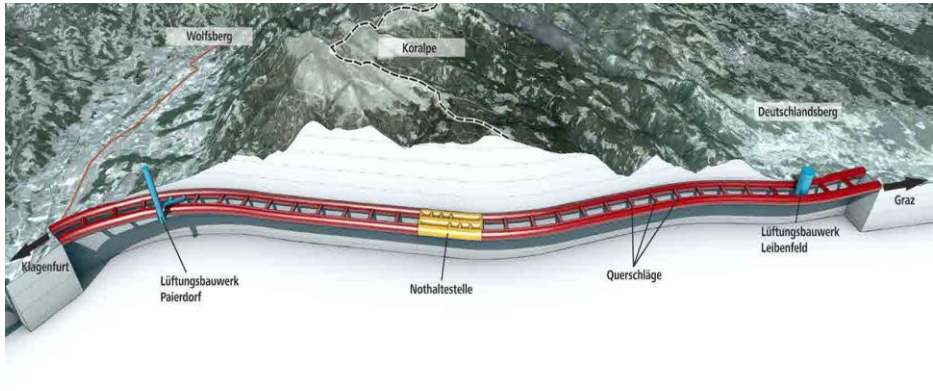
The Koralm railway line between Graz and Klagenfurt is among the most important transportation infrastructure projects in Europe. The fastest travel time between Graz and Klagenfurt will be reduced to only 45 minutes.

- 130 kilometers overall length
- 23 modern train stations on the new line
- 250 km/h possible maximum speed
- 2 track electrified high-performance line
- Construction time: 1999 – 2025
- Passenger and freight train operations

The Koralm tunnel

The 33-km-long Koralm tunnel crosses the mountain massif of the Koralpe, which at places rises up to 1200 metres above the line. The two tubes of the tunnel represent the latest technical standards.

- 33 kilometres long
- 2 single-track tunnel tubes
- Every 500 metres cross passages
- 25-50 metres distance between the tubes



The Brenner base tunnel

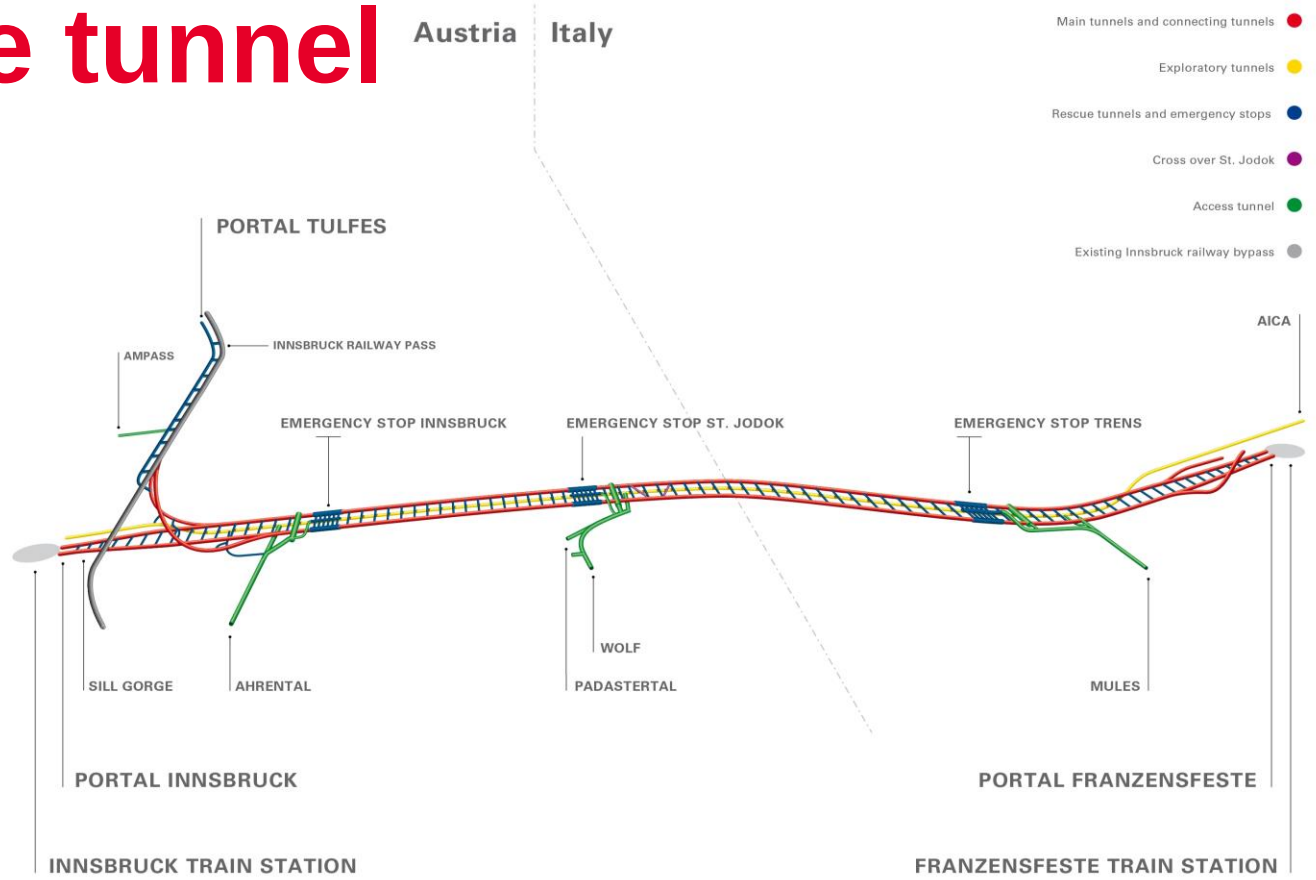
78,6%
excavated

230 km
Tunnel system

73 km
Railway tunnel

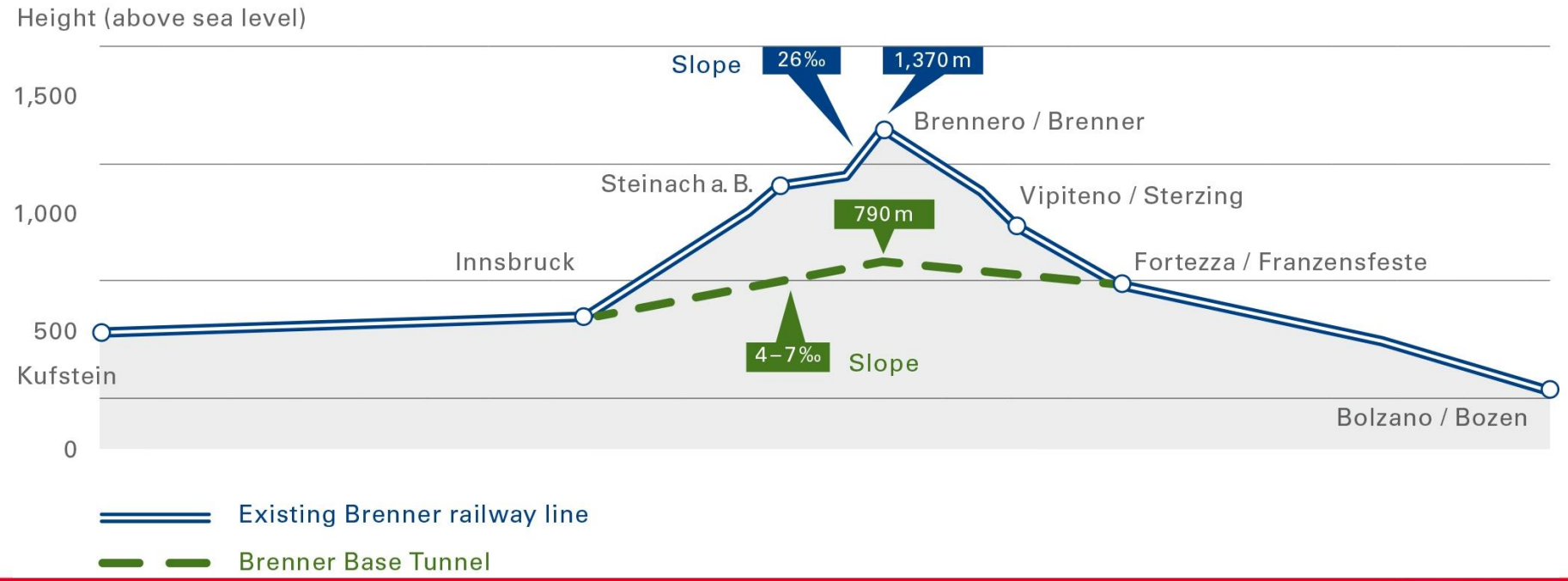
56 km
Service tunnel

44 km
Other tunnels



The Brenner base tunnel

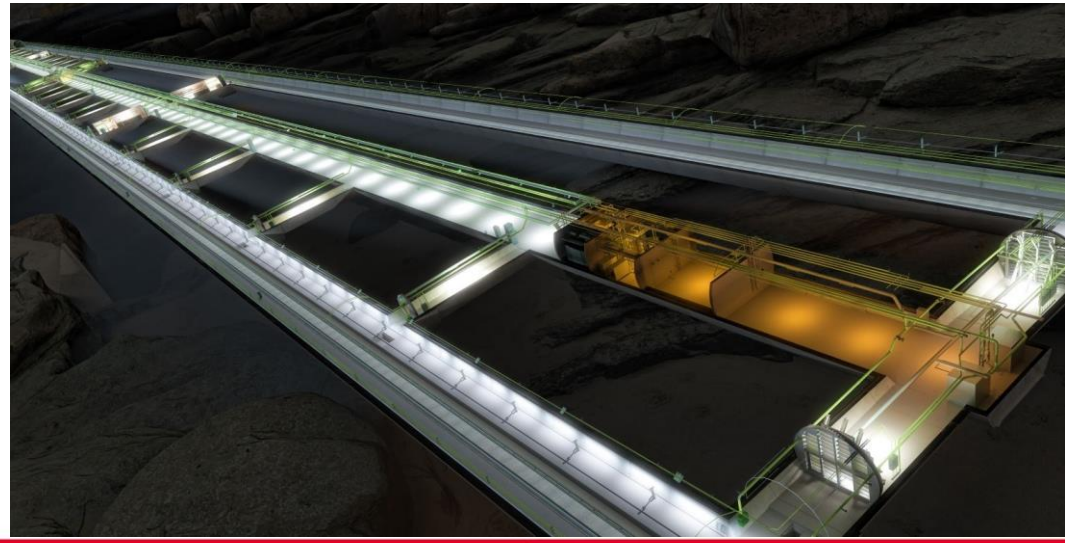
Altitude profile Brenner railway line / Brenner Base Tunnel



Safety as a guiding principle at ÖBB

Safety is one of the guiding principles of ÖBB, in all we do.
A constant increase in measures to improve safety in operations is illustrated by our major tunnel projects.

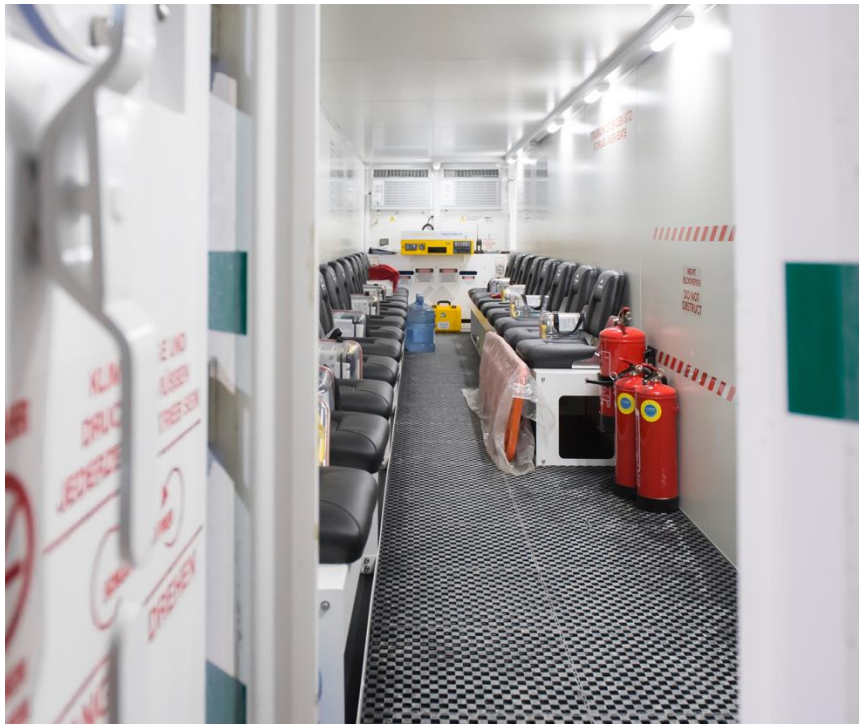
- Each of these 3 tunnels are equipped with two tubes and an emergency stop
- This guarantees maximum safety in operations and for our passengers



Safety precautions during construction

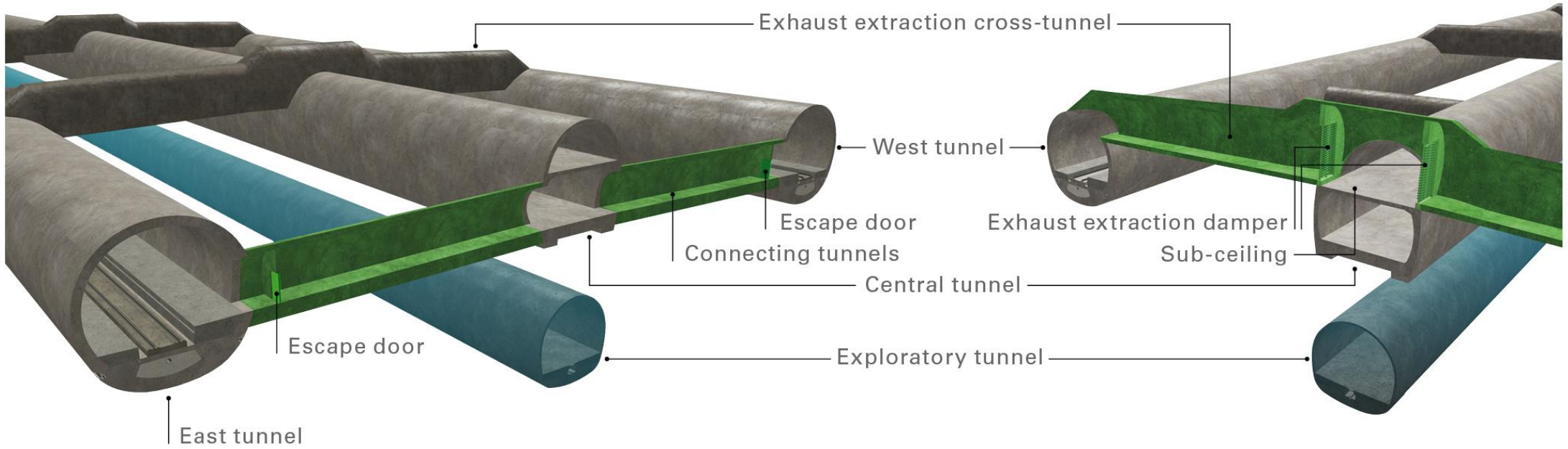
- Tracking devices and oxygen self-rescuer
- safety trainings for construction site personnel
- Health and safety executive
- Refuge chambers
- emergency phones, alarm systems and communication equipment
- Safety personal
- Emergency power supply
- Atmospheric monitoring and ventilation

Safety precautions during construction



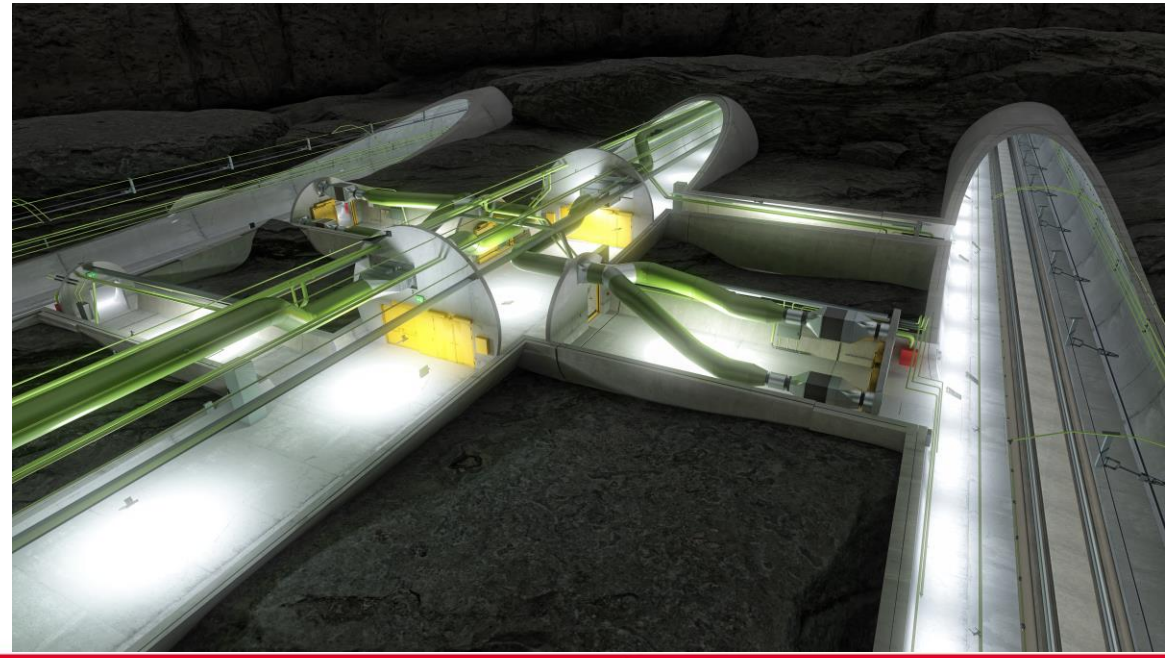
Tunnel Safety – Brenner base tunnel

Detailed view of connecting tunnel and exhaust extraction cross-tunnel



Tunnel Safety - emergency stops

- In case of an emergency, the second tube is used for evacuation and then to continue safe operations
- All new lines are equipped with the European Train Control System (ETCS)
- Emergency stops in the long tunnels increase safety



Tunnel Safety during operation

- State-of-the-art ventilation systems
- Detailed evacuation plans
- Extinguishing water systems in the emergency stops
- Lighted handrails and emergency fire doors in the tunnels
- Acquisition of modern service & rescue trains

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Thank you for your attention!