

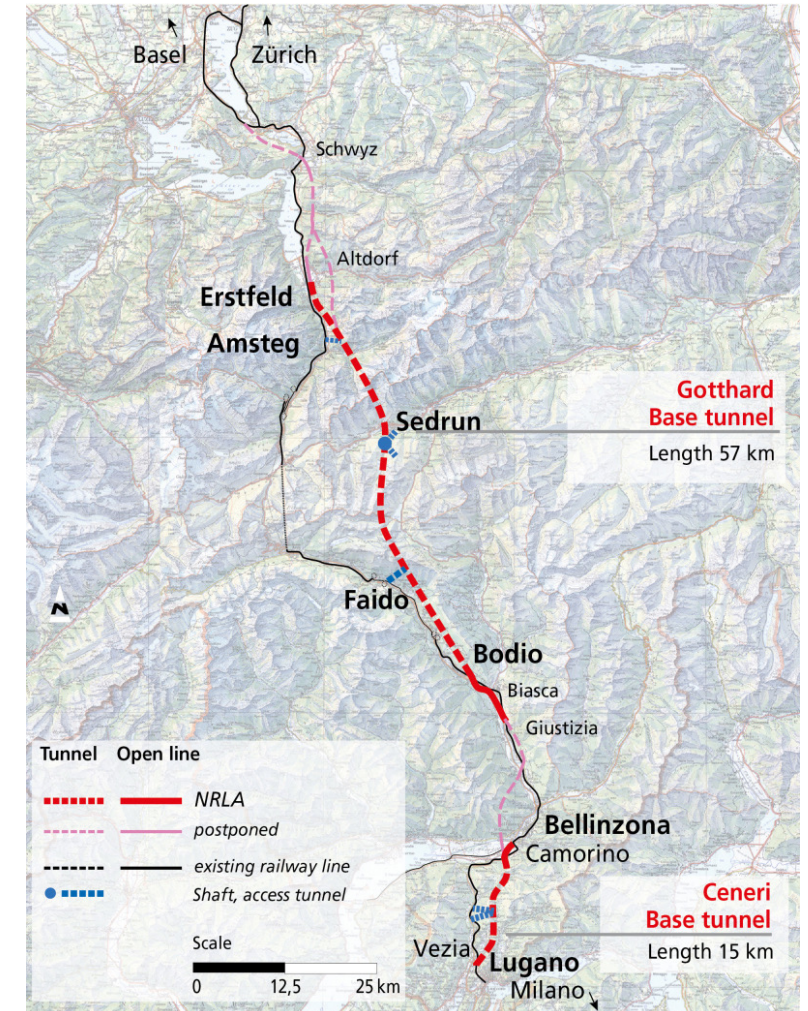


# Gotthard Base Tunnel

POWERING THE WORLD'S LONGEST RAILWAY TUNNEL

# Need for the Tunnel

- The old Gotthard railway line dates from 1882 and is an important trade route through the Alps from northern to southern Europe. Every year around 26 million ton of freight is transported by trains along the route and that volume is only increasing.
- With next to no gradient, the new twin-tube Gotthard Tunnel can bear longer, heavier trains than the old line and will increase capacity to 260 freight trains a day, compared with 180 on the existing line.
- The new line will also reduce the route between Altdorf and Bellinzona by 30 kilometers, allowing trains to travel more quickly through the Alps. Passenger trains will depart every half an hour, taking 20 minutes to travel through the tunnel at speeds of up to 250 km/hr.
- The line will be completed by the opening of the Ceneri Base Tunnel, after which time the journey between Zurich and Milan will be shortened by nearly an hour.
- Safety is key when operating a 57 km long train tunnel. Continuous and interruptible power is vital to all systems that guarantee the safe pass while traveling through the Gotthard Base Tunnel.



## INTRODUCTION

# Need for Dynamic UPS system for experienced supplier

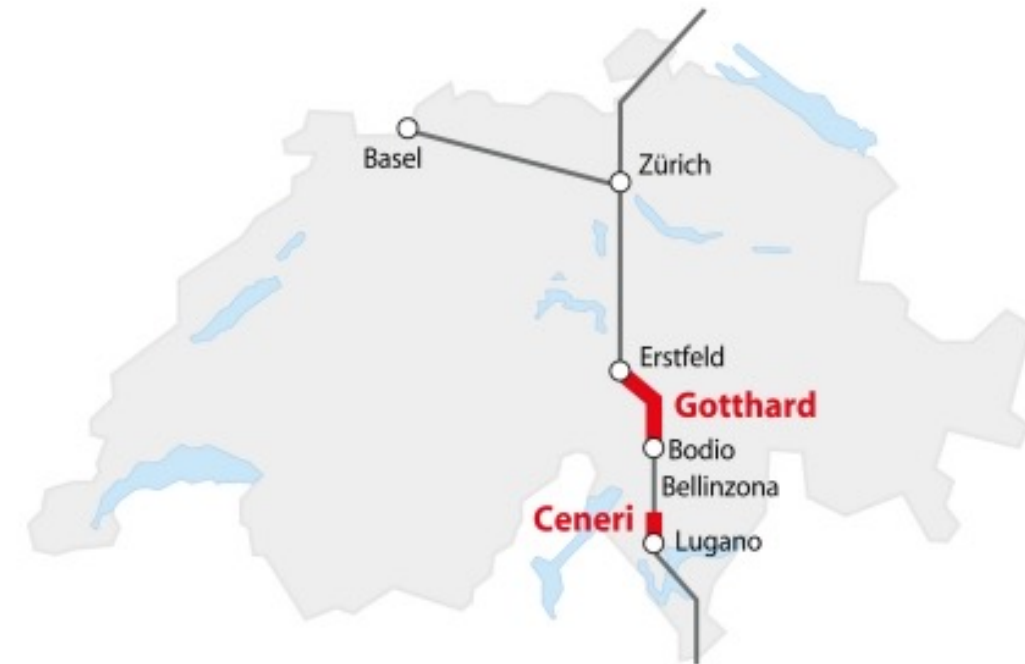


- In case emergency strikes all systems like; ventilation, air conditioning, fire and smoke alarms, fire extinguishing, emergency lighting, video, radar systems, emergency communication systems, antennas, signaling need continuous and clean power supply through the entire tunnel to safeguard passengers and staff.
- At day one of the project, it was clear that only a single shaft Dynamic Rotary UPS solution was robust and powerful a to power the entire tunnels distribution and many kilometers of power cabling.
- Based on HITEC's experience in tunnel projects and having a solid service organization in place in Switzerland. The complete turn-key delivery and maintenance of the Dynamic UPS solution has been awarded to HITEC and its local partner.



# Gotthard Base Tunnel

Country	Switzerland
Client	AlpTransit Gotthard AG (ATG)
Owner	Swiss Federal railways (SBB/CFF)
Line	AlpTransit
Tunnel route	Zurich to Lugano (45 minutes shorter)
Tunnel use	Passengers and Cargo
Tunnel type	Railway Twin Tube
Project cost	€ 8,9 / \$ 9,5 billion
Total man-hours	More than 4 million
Workforce up to	2,400
Construction	1999 - 2016

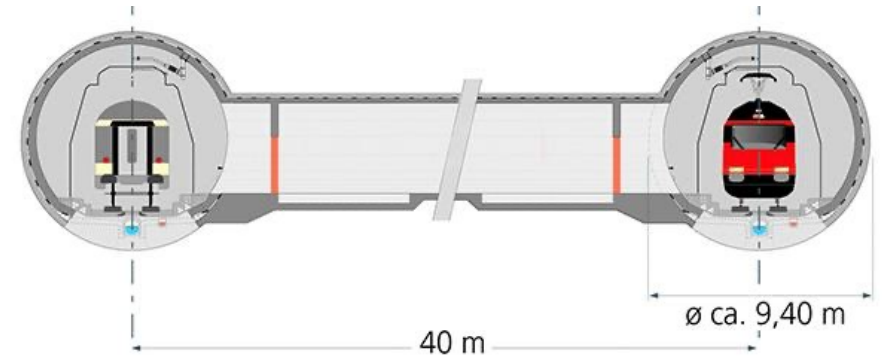




The 10m - diameter drill-head

# Gotthard Base Tunnel

Length	57,104 m (35.5 mi)
Depth	2,450 m (8,040 ft)
East-West crosscuts	178
Highest elevation	549 m (1,801 ft)
Lowest elevation	312 m (1,024 ft)
Trains a day	300
Operating speed	Up to 250 km/h (160 mph)





## ELECTRICAL INSTALLATION DETAILS

# Gotthard Base Tunnel



Electrified at	15 kV 16,7 Hz
Emergency power ring	6 kV
UPS voltage	400 V
Dynamic UPS power	10 x HITEC UPS
Power cables	3200 km
Data cables	2600 km

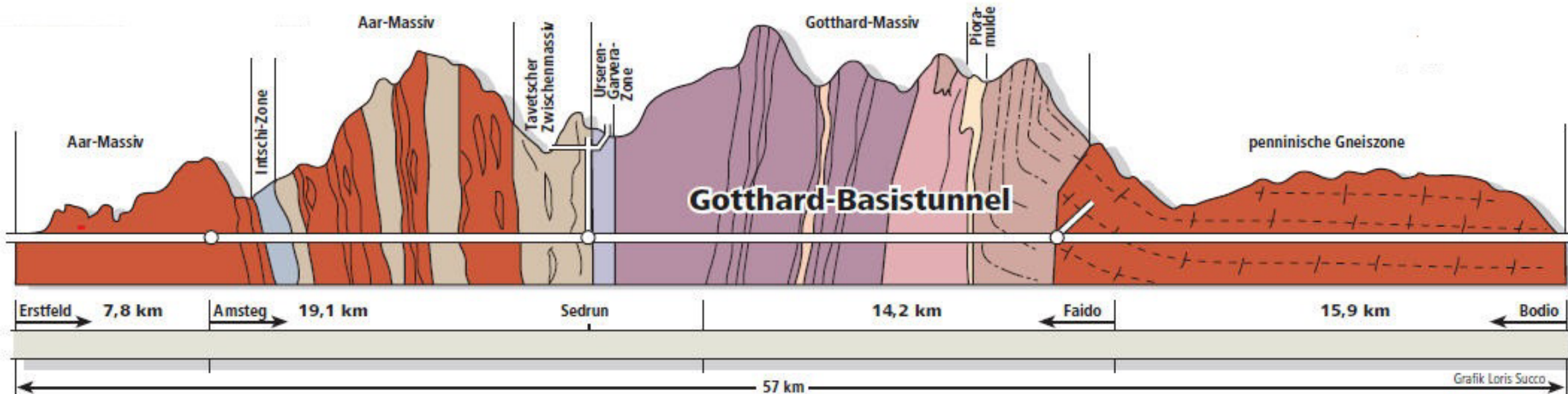
# Gotthard Base Tunnel

First idea	1947
Start study	1961
Start drilling Tunnel East	November 4, 1999
End drilling Tunnel East	October 15, 2010
Start drilling Tunnel West	March 23, 2011
End drilling Tunnel West	October 31, 2014
Start testing on	October 31, 2015
Finish testing on	May, 2016
Official inaugurated	June 1, 2016
Operational	December 11, 2016

# Project Challenge

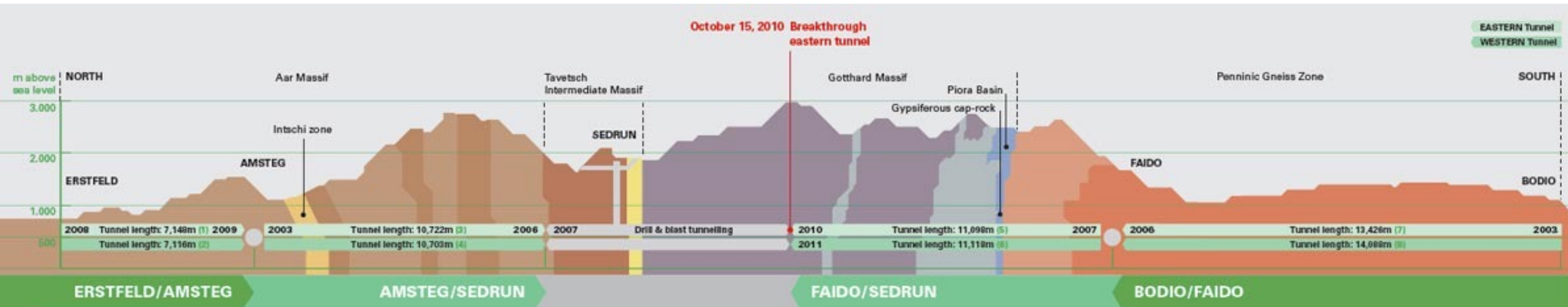
The Gotthard Base Tunnel in Switzerland connects Erstfeld in the north with Bodio in the south. It comprises two 57-kilometre single-track tunnels linked by connecting galleries every 330 metres. Two multifunctional stations in Faido and Sedrun, each with emergency stopping points and two track switches, divide

both tunnels into almost equally long halves. The passenger trains have a top speed of 250 km/h, reducing the traveling time between Milan and Zurich to under 3 hours and doubles the haulage capacity on the Swiss North-South Axis to 40 m tons of goods.

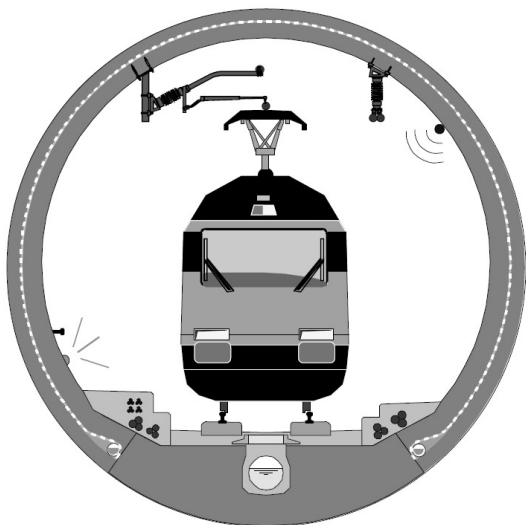


# Project Solutions

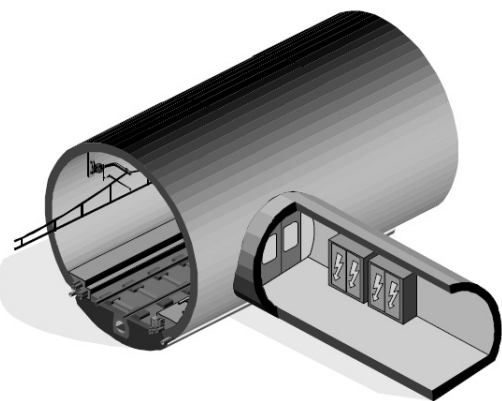
- **Erstfeld** 2 x 1000 kVA (800 kW) in new building at 469 m
- **Amsteg** 2 x 1000 kVA (800 kW) in existing building at 520 m
- **Sedrun** 2 x 1600 kVA (1280 kW) in new building at 1500 m
- **Faido** 2 x 1750 kVA (1400 kW) in new building at 750 m
- **Bodio** 2 x 1750 kVA (1400 kW) in new building/container at 325 m



# Power Supply Train & Tunnel



- The train's power supply system in the tunnel, consists mainly of substations, cables, switches and catenary. It is worth noting that the Swiss federal railways' own high voltage network is to be used because of the incompatibility between the 16,7 Hz traction system and the usual 50 Hz public power grid.
- The tunnel's 50 Hz power supply in the tunnel used by most pieces of technical equipment (signalling, telecommunication, lighting, etc). For high safety and reliability, this fully redundant network is connected to the 50 Hz public power grid at all portals and intermediate accesses.





RAILWAY TECHNOLOGY BUILDINGS  
ARE DYNAMIC UPS CENTRES



# Dynamic UPS Integration



- The primary power supply 16 kV at 50 Hz comes from the feed points in Bodio, Faido, Sedrun, Amsteg and Erstfeld.
- Each location is equipped with two HITEC Dynamic UPS systems that is powering the 6 kV Emergency supply ring.
- The Dynamic UPS systems provide the emergency power for all installations in the tunnel, both from the grid and from a Emergency supply system to Traffic, Monitoring and Safety systems that are managed through the Tunnel Control Centers (TCC) at the north and south portals.



# Powering the Safe Journey

- Ventilation & Air conditioning
- Fire and smoke alarms & Fire extinguishing
- Hazardous materials recognition
- Lightning “more than 10.000” (lightning system for pedestrians)
- Video and radar systems
- Communication & emergency call systems
- Special antennas or leaky feeders for radio transmission
- Signaling, Control Electronics and monitor devices
- Tunnel Control Center with 200.000 Sensors (70.000 data points)
- 924 Medium Voltage Switchgear cubicles installed
- 250+ Transformers installed

# Project Summary

- Safety is key while operating a tunnel.
- Having a robust and powerful continuous and interruptible power is crucial.
- Continuous support and experience from a Dynamic UPS supplier is crucial through the design, build and the entire lifecycle of the tunnel.
- As the original inventors of Dynamic UPS systems with over 65 years experience HITEC became the partner of choice for this and many more tunnel projects around the globe.



This safe journey is  
powered by



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