AlpTransit Gotthard San Gottardo

LZ01-370506-v2

Project data – raw construction Ceneri Base Tunnel

Lengths, depths and distances	
Total length of the entire tunnel and passage system	39.780 km
Length of the Ceneri Base Tunnel, north portal Camorino to south portal Vezia	
• East tube	15.452 km
• West tube	15.289 km
Length of drive of main lot from Sigirino	
East tube	12.124 km
East tube north drive	6.123 km
East tube south drive	6.001 km
West tube	11.151 km
West tube north drive	5.793 km
West tube south drive	5.358 km
Length access adit Sigirino (FIS)	2.308 km
Length inward drive Vigana	
East tube	0.766 km
West tube	0.749 km
Length overground section Nodo di Camorino • Track Lugano-Bellinzona (Km 153.938848 - Km 228.183473): L = 3,352.53 m • Track Bellinzona-Lugano (Km 153.938848 - Km 227.677318): L = 2,818.67 m • Track Bretella Locarno-Lugano (Km 226.214818 - Km 227.677318): L = 1,028.36 m	7.200 km
Length inward drive Vezia	
East tube	0.339 km
West tube	0.303 km
Length overground tunnel Vezia	
East tube	0.223 km
West tube	0.188 km

Drive	
Conventional Driving	
Total length driven by drilling and blasting (entire tunnel, cross-passages, exploration tunnels, caverns, etc.)	37.49 km 94.2 %
Excavation diameter in conventionally driven tunnel sections	8.76 to 9.96 m
Excavated surface area in the conventionally driven tunnel sections (incl. cavern)	to 366 m²
Daily advance rate with conventional blasting Length of blast Maximum advance rate Average advance rate in favourable rock conditions Average advance rate in unfavourable rock conditions	 0.5 to 4 m 12 m/wd 5.8 m/wd ca. 2.6 m/wd
Explosive quantity per blast (liquid explosive)	Up to 480 kg
Depth of the blasting holes	Up to 4.3 m
Number of drilled holes per blast	Up to 152 holes
Blasted rock volume per blast	Up to 248 m^3
Explosive type	Emulsion – Tovex SE
Tunnel boring machine drive (TBM) – FIS Sigirino	
Total length driven by tunnel boring machines	2.321 km 5.8 %
Excavation diameter in TBM-driven tunnel sections • Finestra di Sigirino (FIS)	 9.70 m
Average daily advance rate of the tunnel boring machine	16 m/wd
Length of the TBM (incl. backup train)	160 m
Weight of the TBM	1160 t
Driving power of the TBM (10 motors)	3,750 kW
Total installed power	3,000 kVA
Advancing force	15,344 kN (at 250 bar)
Max. permissible press-on force of the drilling head	19,000 kN

Rotational speed of the cutting head	Max. 6.5 rpm
Number of roller chisels in the TBM cutting head	61 chisels
In operation from 15.2.2008 to 04.11.2008	
Heights above sea level and height differences	
Height of top edge of rail at north portal Camorino	216.5 m asl
Height of top edge of rail at south portal Vezia	329.0 m asl
Height difference from north portal at Camorino to south portal at Vezia	112.5 m
Spoil management	
Total volume of excavated rock	7.9 mil. t (100%)
Quality A material => suitable as aggregate for concrete	1 mil. t (13.3%)
Quality B material => for embankments, deposits and recultivation	6.8 mil. t (86%)
Sludge from the drives => hazardous waste landfill	0.1 mil. t (0.7%)
Length of the conveyor belts for transporting the excavated rock	Around 24 km
Concrete	1.1 mil. m^3
Steel rings	4,200 t
Steel mesh	1 mil. m^2
Rock anchors	1,123 km
Reinforcement	20,000 t
Sealing and drainage foil for vault	650,000 m^2
Geometrical parameters of the track inside the tunnel	
Horizontal radius (excl. Vezia junction)	$R_{h,min}$ 5,000 m
Vertical radius	$R_{v,min}$ 25,000 m
Maximum gradient inside tunnel	6.8 ‰
Maximum gradient inside tunnel from Saré junction	12.5 ‰
Travel speed inside tunnel	Max. 250 km/h
Geometrical parameters of the track outside the tunnel	
Horizontal radius	$R_{h,min}$ 300 m

• track Lugano-Bellinzona: $R_{h,min}$ = 850 m • track Bellinzona-Lugano: $R_{h,min}$ = 850 m • track Bretella Locarno-Lugano: $R_{h,min}$ = 300 m	
Vertical radius • track Lugano-Bellinzona: $R_{v,min}$ = 10000 m • track Bellinzona-Lugano: $R_{v,min}$ = 10000 m • track Bretella Locarno-Lugano: $R_{v,min}$ = 20000 m	$R_{v,min}$ 10000 m
Maximum gradient overground section Nodo di Camorino • track Lugano-Bellinzona: 15‰ • track Bellinzona-Lugano: 15‰ • track Bretella Locarno-Lugano: 15‰	15‰
Travel speed overground section • track Lugano-Bellinzona: max. 140 km/h • track Bellinzona-Lugano: max. 140 km/h • track Bretella Locarno-Lugano: max. 80 km/h	Max. 140 km/h
Various facts and figures	
Standard distance between tunnel axes	40 m
Maximum distance between tunnel axes	210 m
Total number of cross passages	48 cross passages
Standard distance between the cross passages	325 m
Number of fixed points for surveying the Ceneri Base Tunnel (incl. overground section, surface area and tunnel)	331 fixed points
Maximum rock overlay	1,040 m
Maximum rock temperature	Approx. 19 °C
Maximum working temperature	28 °C
Persons employed, incl. engineers, geologists, owner, etc.	175 persons
Bench on non-rescue side, height above upper edge of rail	0.15 m / 0.25 m
Bench on rescue side, height above upper edge of rail	0.35 m
Height of overhead conductor above upper edge of rail on overground section	5.20 m
Height of overhead conductor above upper edge of rail inside tunnel	5.20 m

Noise abatement walls • H = 2.5 m, L = 75 m, glass • H = 8.6 m, L = 55 m, concrete • H = 8.5 m, L = 650 m, concrete • H = 3 m, L = 290 m, concrete	1,050 m
Work safety	
Accidents on the underground construction sites of ATG (number of accidents per 1,000 employees per year) • SUVA comparative figure for 2008 The record of the CBT construction sites is below the SUVA comparative figure.	232

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