

= Saverne Tunnel =

The Saverne Tunnel ( French : Tunnel de Saverne ) , also known as the Ernolsheim @-@ lès @-@ Saverne Tunnel ( French : Tunnel d 'Ernolsheim @-@ lès @-@ Saverne ) , is a twin @-@ bore , high @-@ speed rail tunnel in western Bas @-@ Rhin , France . It carries the LGV Est line of France 's TGV high @-@ speed rail network through the narrowest part of the Vosges mountain range , beneath Mont Saint @-@ Michel and adjacent to the Saverne Pass . The tunnel consists of two bores , containing one railroad track each , that are connected by passageways every 500 metres ( 1 @-@ 600 ft ) . The LGV Est crosses the 270 m ( 890 ft ) Haspelbaechel viaduct near the western end of the tunnel . The tunnel was excavated by a tunnel boring machine between November 2011 and February 2013 . Civil engineering work on the tunnel ended in April 2014 and it will open with the rest of the second phase of the LGV Est in July 2016 . The total cost of the tunnel was approximately ? 200 million .

= = Background = =

The Saverne Tunnel was constructed as part of the second phase of the LGV Est européenne ( often shortened to LGV Est ) . When completed , the line will connect Paris and Strasbourg ? the principal city of the Alsace region and home to several European institutions , including the Council of Europe . The first phase across 300 kilometres ( 190 mi ) of relatively flat land from Vaires @-@ sur @-@ Marne ( near Paris ) to Baudrecourt ( near Metz and Nancy ) opened in 2007 . The second phase traverses 106 km ( 66 mi ) of rougher terrain from Baudrecourt to Vendenheim ( near Strasbourg ) . When opened , the line will reduce travel time between Paris and Strasbourg from 2h20min to 1h50min and reduce travel time from Luxembourg City to Strasbourg from 2h10min to 1h25min . The Saverne Tunnel crosses the northern Vosges at its narrowest point and is adjacent to the Saverne Pass , which already contains the A4 autoroute , Departmental Route 219 , and remnants of an ancient Roman road .

The line was originally built for Réseau Ferré de France ( RFF ) , which owned and operated the infrastructure of the French national railway network . In a government restructuring of the French railroad network , RFF was merged into SNCF on 1 January 2015 and is now a subdivision of SNCF known as SNCF Réseau .

= = Construction = =

The tunnel was part of the Lot 47 segment of the LGV Est for the contracting and construction . Lot 47 consisted of the Saverne Tunnel , the adjacent Haspelbaechel viaduct , and an additional 3 @-@ 3 kilometres ( 2 @-@ 1 mi ) of the LGV line through the communes of Danne @-@ et @-@ Quatre @-@ Vents in Moselle and Eckartswiller , Saint @-@ Jean @-@ Saverne , and Ernolsheim @-@ lès @-@ Saverne in Bas @-@ Rhin . In September 2010 , RFF awarded a ? 184 @-@ 3 million design @-@ build contract for Lot 47 to a consortium of 13 companies , led by Dodin Campenon @-@ Bernard . The Saverne Tunnel was built by Spie Batignolles and Dodin Campenon @-@ Bernard , at a cost of approximately ? 200 million .

The two bores of the Saverne Tunnel were excavated with a 110 m ( 360 ft ) , 2 @-@ 200 @-@ tonne ( 2 @-@ 400 @-@ ton ) tunnel boring machine ( TBM ) , manufactured by Herrenknecht . The TBM was used to excavate 3 @-@ 820 m ( 12 @-@ 530 ft ) of the 4 @-@ 200 m ( 13 @-@ 800 ft ) tunnel , the remainder consisting of false tunnel constructed at both ends . The TBM was christened Charlotte ? in honor of a girl from a nearby village ? in a ceremony on 25 October 2011 . It began excavation of the first bore on 10 November 2011 from the eastern side of Mont Saint @-@ Michel and completed the first bore over a month ahead of schedule on 19 June 2012 . For the first bore , 1932 rings were installed , using 15 @-@ 456 precast concrete lining segments ( 8 per ring ) . The TBM excavated 307 @-@ 000 cubic metres ( 10 @-@ 800 @-@ 000 cu ft ) of earth at an average speed of 20 m ( 66 ft ) per day .

Excavation of the second bore began on 26 September 2012 and finished on 25 February 2013 .

The 730 @, @ 000 m<sup>3</sup> ( 26 @, @ 000 @, @ 000 cu ft ) of earth excavated during tunneling was used to construct embankments in nearby sections of the LGV Est line . In total , 30 @, @ 960 precast concrete lining segments were used . Concreting of the final interconnecting passage was completed on 24 June 2013 , marking the end of construction of the tunnel walls . On 14 April 2014 , civil engineering work on the tunnel was completed , but railroad signaling and equipment still needed to be installed .

Service on the LGV Est line was originally scheduled to begin on 3 April 2016 ; however , a fatal accident that occurred elsewhere on the new line in November 2015 during commissioning tests has delayed the scheduled opening of the line until 3 July 2016 .

= = Characteristics = =

The tunnel lies beneath Mont Saint @-@ Michel , beside the Col de Saverne , and within the Northern Vosges Regional Nature Park , a Natura 2000 site .

It is located close to the border with the department of Moselle and within three communes of the department of Bas @-@ Rhin : Eckartswiller , Saint @-@ Jean @-@ Saverne , Ernolsheim @-@ lès @-@ Saverne .

The tunnel is part of the LGV Est high @-@ speed rail line , which will connect Paris with Strasbourg . The line is also a part of the Main line for Europe trans @-@ European high @-@ speed rail line from Paris to Bratislava , Slovakia .

The tunnel is 4 @, @ 200 m ( 13 @, @ 800 ft ) in length and consists of two bores , each carrying one rail line flanked by a maintenance walkway and an emergency evacuation walkway . The two bores are connected every 500 m ( 1 @, @ 600 ft ) by an interconnecting passage . The tunnel has been built for a maximum speed of 350 kilometres per hour ( 220 mph ) ? 320 km / h ( 200 mph ) in commercial operation . It will be remotely monitored from the SNCF Réseau command center at Pagny @-@ sur @-@ Moselle .

Adjacent to the western portal , the LGV Est traverses the 270 m ( 890 ft ) Haspelbaechel viaduct , which travels up to 35 m ( 115 ft ) above the Haspelbaechel valley .