= Jarlsberg Tunnel =

The Jarlsberg Tunnel (Norwegian : Jarlsbergtunnelen) is a 1 @,@ 750 @-@ meter (5 @,@ 740 ft) long double track railway tunnel which runs through Frodeåsen in Tønsberg , Norway . Located on the Vestfold Line , the tunnel was built as part of the 7 @.@ 8 @-@ kilometer (4 @.@ 8 mi) double @-@ track high @-@ speed segment from Barkåker to Tønsberg . It is located just north of Tønsberg Station and runs between Frodegata and Tomsbakken . Most of the tunnel is blasted , although 223 meters (732 ft) is in a concrete culvert . Planning of the tunnel started in the late 1990s . Several railway interest groups advised against building the isolated segment of upgraded track without a complete plan for upgrading the entire line . Construction started in April 2009 and the new section and the tunnel opened on 7 November 2011 . It was the fourth segment of the Vestfold Line to be upgraded .

= = Specifications = =

The Jarlsberg Tunnel runs roughly north ? south through Frodeåsen , a hill just north of the town center of Tønsberg . The northern entrance is located at Tomsbakken , beside County Road 35 and the southern entrance is located at Frodegata in the town center . Just south of the tunnel lies Tønsberg Station . The tunnel is 1 @,@ 750 meters (5 @,@ 740 ft) long , of which 1 @,@ 560 meters (5 @,@ 120 ft) is blasted through bedrock and 223 meters (732 ft) is concrete culvert . The portal on the Tønsberg side is 73 meters (240 ft) long .

The Jarlsberg Tunnel constitutes the southernmost part of the 7 @.@ 8 @-@ kilometer @-@ long (4 @.@ 8 mi) double @-@ track segment of the Vestfold Line between Barkåker and Tønsberg . It is electrified at 15 kV 16 2 ? 3 Hz AC , has an NSI @-@ 63 signaling system and is dimensioned for 200 kilometers per hour (120 mph) . The crosscut serves as an emergency exit . The railway tunnel crosses 2 @.@ 5 to 3 @.@ 0 meters (8 ft 2 in to 9 ft 10 in) above the Frodeåsen Tunnel , a twin @-@ tube tunnel of County Road 300 . The tunnel 's single crosscut serves as an emergency exit . The line is owned and maintained by the Norwegian National Rail Administration .

= = History = =

The Vestfold Line opened in 1881 as a narrow @-@ gauge railway . Although later converted to standard gauge and electrified , the line retains poor capacity and many curves . The only previous tunnel north of Larvik is the 288 @-@ meter @-@ long (945 ft) Smørstein Tunnel , which was completed in 1921 . In the early 1990s , work started on increasing speed , capacity and reliability by building shorter sections of double @-@ track with higher permitted speeds . During this period , there was very little investment funding for railways ; thus the Vestfold Line was split into a series of small segments , each which was planned individually . Between 1995 and 2003 , three sections with a combined length of 23 kilometers (14 mi) were opened . The segment between Barkåker and Tønsberg was the fourth section of the line to be upgraded . When later projects are completed , it will allow travel time from Tønsberg to Oslo to be reduced from 90 to 60 minutes .

Initial planning of the segment between Barkåker and Tønsberg considered 13 different initial route proposals . However , no analysis for possible rights @-@ of @-@ way south of Tønsberg or north of Barkåker were considered . In September 1999 , the government presented their proposal for National Transport Plan 2002 ? 11 , which included three segments on the Vestfold Line : Holm ? Nykirke , Barkåker ? Tønsberg and Farriseidet ? Porsgrunn . When Parliament passed the plan in February 2001 , the Barkåker ? Tønsberg segment was prioritized second on the Vestfold Line , after a new passing loop at Nykirke . National Transport Plan 2002 ? 11 proposed that construction start in 2005 , but by November 2002 , the National Rail Administration delayed the plans , following investment cuts by Bondevik 's Second Cabinet . In response , Minister of Transport Torild Skogsholm stated that she was considering financing the project as a public ? private partnership paid through a surcharge on tickets fares .

The route will give a time saving of between three and four minutes for trains heading north of

Tønsberg , but two minutes of these will be saved by changing the direction the trains run through the loop through town . Thus , passengers traveling southwards from Tønsberg experience a two @-@ minute increase in travel time . The plan to make an isolated investment in the Barkåker ? Tønsberg section was criticized by several pro @-@ railway interest organizations , including Norsk Bane , For Jernbane , the Norwegian Society for the Conservation of Nature as well as the Norwegian State Railways (NSB) ? who operates the train service . All recommended that the National Rail Administration place the investments on hold until more of the Vestfold Line was planned . NSB 's Tom Ingulstad called the plans " troublesome " and stated that the trains would have nearly no time or reliability @-@ gains from the investment . If the authority instead had built more double track in connection with the existing segment at Sande , trains could more efficiently catch up any delays before reaching Drammen .

Long @-@ term plans for the line imply that the line will need to allow a through speed of at least 250 kilometers per hour (160 mph) and be built so trains do not need to stop or slow down at all stations . The National Rail Administration had at the time of construction not made any plans for a route south of Tønsberg ; estimates from Norsk Bane show that Tønsberg will not be able to allow high through speeds and that a new through line would have be built with a different right @-@ of @-@ way , entirely avoiding the Jarlsberg Tunnel . Alternatively , the route would have to feature slow speeds or large encroachments on the local environment . By binding the Vestfold Line to run via Barkåker , it is not possible to build a high @-@ speed line with stations serving population centers such as Horten , Åsgårdstrand and Eik . For Jernbane advised against building the Barkåker ? Tønsberg segment and instead recommended that the authorities wait until the entire Vestfold Line was planned .

Following the appointment of Stoltenberg 's Second Cabinet in 2005 , the government started working with longer projects and increased funding . The go @-@ ahead for the project was given by Minister of Transport Liv Signe Navarsete on 31 March 2008 , with the entire project from Barkåker to Tønsberg estimated to cost 1 @.@ 37 billion Norwegian krone (NOK) . The main civil engineering advisor for the project was Norconsult . Six bids were issued to building the main segment , which included the tunnel and 2 @.@ 6 kilometers (1 @.@ 6 mi) from Tomsbakken to Barkåker Industrial Park . The bidders were a joint venture between Reinertsen and Leonard Nilsen , Veidekke , Skanska , Hæhre Entreprenør , NCC and Mika . The contract was awarded on 5 March 2009 to Reinertsen / Leonard Nilsen , who had the lowest bid , NOK 377 @.@ 9 million , NOK 158 million less than the most expensive , from Mika . The joint venture was structured so Leonard Nilsen built the tunnel and Reinertsen the above @-@ ground section .

Construction of the project started on 16 March 2009 ; work on the tunnel started in April and the first blasting began on 11 May . Construction ran from a crosscut in the center of the tunnel and outwards ; average speed was 35 to 40 meters (115 to 131 ft) per week . Work on casting the concrete portals started on 18 September . For four weeks , starting in January 2010 , blasting was performed above the Frodeåsen Tunnel , and on each occasion that the 100 or so blasts were executed , the road was closed for safety reasons . Following a public naming competition , the National Rail Administration announced on 5 February 2010 that the tunnel be known as the Jarlsberg Tunnel . The first breakthrough of the tunnel was achieved on 30 June 2010 . The second and final breakthrough took place on 1 September . Construction proceeded without any injuries and nearly without any complications . The tunneling resulted in 235 @,@ 000 tonnes (231 @,@ 000 long tons ; 259 @,@ 000 short tons) of earthwork , which was used to build the above @-@ ground section north of the tunnel . The last concrete casting was laid on 20 January 2011 .

Laying of the track was performed by Wiebe , signaling was installed by Norsk Jernbanedrift , Structon Rail installed the overhead wire , and YIT installed the power supply and telecommunications systems . The tunnel has the NSI @-@ 63 relay @-@ based signaling system , although it is scheduled to be replaced by European Rail Traffic Management System shortly after 2015 . The last six weeks before opening , the Vestfold Line was closed to allow the new and old sections to be connected . This was the most hectic part of construction , as it saw the tracks south of the tunnel be rearranged to allow trains to operate the opposite direction through the loop in Tønsberg . The work was performed by Reinertsen and took 100 @,@ 000 man @-@ hours .

The tunnel and the segment Barkåker ? Tønsberg opened on schedule on 7 November 2011 . The segment cost NOK 1 @.@ 5 billion , which was within budget . However , at the time of the opening , double track was still not laid from the tunnel to Tønsberg Station . Previously , trains crossed each other at the passing loop at the closed Barkåker Station , with one train having to wait for the other . With the competition of the new segment , trains could pass at any point between Tønsberg and Barkåker , allowing increased reliability . However , the signaling system was not installed at the time of opening , so the tunnel remained only operated with single track , although a temporary signaling system allowed it to be used as a passing loop . If used as such , speed was limited to 70 kilometers per hour (43 mph) .