

= Bømlafjord Tunnel =

The Bømlafjord Tunnel (Norwegian : Bømlafjordtunnelen) is a subsea road tunnel under Bømlafjorden which connects the island of Føyeno in Stord to the mainland at Dalshovda in Sveio , Norway . The tunnel is 7 @. @ 82 kilometers (4 @. @ 86 mi) long and reaches 260 @. @ 4 m (854 ft) below mean sea level . It carries three lanes of European Road E39 and is part of the Triangle Link , a fixed link which connects Sunnhordland to Haugaland . Plans for the tunnel arose in the 1980s ; construction started in 1997 and the tunnel opened on 27 December 2000 . The tunnel was built using the drilling and blasting method , with two teams building from each end . The tunnel runs through an area composed mostly of gneiss , phyllite and greenstone . The tunnel is the longest subsea tunnel in Norway and was the second @-@ deepest in the world until 2008 . It is still (2013) the deepest point on the E @-@ road network . The tunnel was a toll road from the opening until 30 . April 2013 . In 2012 the tunnel had an average 4 @, @ 084 vehicles per day .

= = Planning = =

The background for the Triangle Link was the desire to have a fixed link between the islands of Stord and Bømlø . The first documented proposals were made in the 1960s and involved building a pontoon bridge across Stokksundet . Following the 1982 opening of the Vardø Tunnel ? the first subsea tunnel in Norway ? Engineer Finn Nitter d.e. proposed a fixed link between the two islands . It would have crossed Digernessundet on a suspension bridge and continued along a causeway and low bridge onwards to a 2 @. @ 2 @-@ kilometer @-@ long (1 @. @ 4 mi) subsea tunnel under Spissøysundet and a low bridge over Gassasundet . In addition , a 7 @. @ 5 @-@ kilometer (4 @. @ 7 mi) long tunnel would have been built from Føyeno to Ulveråker in Sveio . The company Johannes Sørli launched an all @-@ tunnel proposal in 1985 , estimated to cost 700 million Norwegian krone (NOK) and which would have resulted in 18 kilometers (11 mi) of subsea tunnel connecting Bømlø , Stord and the mainland . An inter @-@ municipal committee was positive to the proposals , while Josef Martinsen , director of Hordaland Public Roads Administration , stated that the project was unrealistic . The limited company Ytre Sunnhordland Bru- og Tunnelselskap AS (SBT) was founded in October 1986 by the municipal authorities of Bømlø , Stord , Fitjar and Sveio , Hordaland County Municipality and five banks .

In December 1986 , the Public Roads Administration recommended a bridge . A report published by SBT in 1987 considered detailed plans for a subsea tunnel to the mainland , which was followed up by seismic surveys in the fjord . SBT changed its name to Sunnhordland Bru- og Tunnelselskap , and a majority of the board shifted towards being in favor of a fixed link . The Norwegian Coastal Administration stated that they would not allow a pontoon bridge , as it would interfere with ship traffic . On 26 June 1987 , SBT 's board decided to work towards getting permission to collect advanced tolls on the ferry services . On 16 September , they unanimously supported the triangular proposal , which was estimated to cost NOK 660 million . This was criticized by Hordaland Public Roads Administration , who stated that it would take longer time to plan , and thus complete , the Triangle Link .

From 1988 , environmental groups started opposing the Triangle Link . The most active was the local chapter of the Norwegian Society for the Conservation of Nature , who stated that the road would have a negative impact for local boat traffic to the recreational islands of Føyeno and Nautøy . They therefore recommended that the municipalities select a pontoon bridge . Another opponent to the project was the Action Committee Against a Hasty Construction of the Triangle Link , who wanted to delay the decision until after the 1991 municipal elections to ensure that the municipal councils had backing in the public . Also Gisle Tjong , a local citizen , opposed the project , stating that the risk was too large and that it was uncertain how long the tolls would last . He argued that the tolls could just as well last 60 as 15 years . Instead , he wanted to use advanced tolls and fuel fees , place the income in the bank and then pay the whole fixed link with the saved @-@ up funds . Most of the opposition against the project was from Stord , while in Bømlø there was near consensus in favor of the project . The exception was in southern Bømlø , where there was concerns that their

ferry service to the mainland would be terminated , which would result in considerably longer driving time to Haugesund . Concerns were also raised regarding people with fear of tunnels and proposals were made to keep a ferry service for such people .

The Triangle Link was passed by the various municipal councils in February and March 1988 . Hordaland Public Roads Administration still supported a pontoon bridge , and stated that two and a half years of work on a master plan had been wasted . A new master plan for the Triangle Link was published in early 1989 . It recommended that the Langevåg ? Buavåg Ferry , which connected to southern Bømlo , remain , but that the other four ferry services be terminated . During late 1989 , advance tolls on the ferries was approved by the municipal councils and the county council , who recommended that collection start from 1 July 1990 . However , the start date was not supported by the national government and the issue placed on hold .

In July 1992 , the master plan was passed by the Council of State . On 10 December 1992 , Parliament approved advanced payment of tolls on the ferry , which were made effective from 1 January 1993 . Ticket prices increased with between NOK 10 and 12 . This resulted in protests from the ferry employees who stated that they would have to collect the tolls which would remove their jobs ; Norwegian Seafarers ' Union representatives stated that they considered suing the state . Work on the development plan started in 1992 . It included safety and environmental improvements which increased the project 's cost by NOK 200 million , and it was made subject to consultative statements in May 1994 . A report on the Coastal Highway (E39) was published in 1995 , which recommended that the Skjersholmane ? Valevåg Ferry be removed . Following a dispute regarding the impact of the bridge landing on Stord , SBT proposed building a culvert on Digernes as a compromise to avoid a new plan which could have postponed the project several years . On 11 June 1996 , Parliament decided with 144 against 20 votes to build the Triangel Link . The original name proposed for the tunnel was Sunnhordlandsporten (" The Portal to Sunnhordland ") , but this was changed to Bømlafjordtunnelen .

= = Construction = =

Geological sampling was undertaken by the Norwegian Geological Survey and Grøner , and included both core samples and reflection seismology . Late core samples showed that the tunnel would have to be located 30 meters (98 ft) further down than originally planned to avoid deposits . The tunnel construction was awarded to two companies : the contract starting from Dalshovda in Sveio and was worked by the Public Roads Administration , while the tunneling from Føyeno was worked by NCC . Both used the drilling and blasting method . NCC was awarded the contract after bidding NOK 175 million for the job . Construction from Sveio started on 16 September 1997 and from Føyeno on 6 March 1998 . In all , 625 @ , @ 000 cubic meters (22 @ , @ 100 @ , @ 000 cu ft) of earthwork was extracted . The earthwork from the Føyeno side was transported by barge to Austevoll and used to build the Austevoll Bridge . The earthwork from the Sveio side was used to build roads and a golf course in the area . In average , the tunnel was built at a speed of 55 meters (180 ft) per week , with the record being 96 @ . @ 7 meters (317 ft) . Between 30 and 40 people worked with the tunneling on each team . The lowest point was reached on 5 May 1999 and the breakthrough took place on 2 September 1999 , five months before schedule . Construction involved injection of 282 tonnes (278 long tons ; 311 short tons) and spraying of 14 @ , @ 900 cubic meters (530 @ , @ 000 cu ft) of gunite .

The tunnel was budgeted to cost NOK 496 million , but ended up costing NOK 487 million . It opened along with the Stord Bridge on 27 December 2000 . Six hours before the opening , the bottom of the tunnel was used for a wedding . The toll company held a course for people with fear of tunnels to master their fears , with 60 people participating . The official opening took place on 30 April 2001 . When it opened , it was the longest and second @ - @ deepest subsea tunnel in Europe and Norway , after the Hitra Tunnel .

= = Specifications = =

The Bømlafjord Tunnel is 7 @, @ 860 meters (25 @, @ 790 ft) long and crosses Bømlafjorden as part of European Route E39 . To the southeast , the tunnel begins at Dalshovda in Sveio . It runs under Bømlafjord , then passes below the island of Otterøya and continues under the fjord again before ending on the island of Føyeno . The tunnel is 11 meters (36 ft) wide and has three lanes . As the tunnel has a significant slope , two lanes runs uphill and one runs downhill . It has a height of 4 @, @ 7 meters (15 ft) and has its deepest point at 260 @, @ 4 meters (854 ft) below mean sea level . Safety measures include fire extinguishers , emergency telephones and break @-@ down pullovers every 250 meters (820 ft) . There are turning points for trucks every 1 @, @ 500 meters (4 @, @ 900 ft) and lights and barriers at the entrances to notify drivers if the tunnel is closed . It features radio coverage and a system to register the position and key information about all vehicles in the tunnel . All the emergency equipment is connected to the Public Roads Administrations central in Bergen . The tunnel has mobile telephone coverage . In 2011 , the tunnel had an average 3 @, @ 966 vehicles per day .

The Triangle Link is partially financed with tolls , with toll collection taking place at Føyeno . It is constructed as a grade @-@ separated intersection , resulting in that any car passes through the plaza once , with cars driving along E39 drive straight ahead through the plaza , while cars to or from Bømlø need to use the interchange . The toll station uses the Autopass toll collection , which allows passage without stopping , in addition to manual collection . Passengers , pedestrians , bicycles , motorcyclists and mopeds are free . As of 2011 , the fees are NOK 85 for cars and NOK 270 for trucks . Frequent travelers can prepay for at least 40 passings to the toll company , and receive a 40 percent discount . It is estimated that the tunnel will be paid off and the tolls removed in 2012 or 2013 .

The tunnel runs through an area with complex and varied geology . It runs through two rock complexes , the Halsnøy Basement Rock on the Sveio side , and Hardangerfjord Cover Complex on the Stord side . Both were created during the creation of the Caledonian orogeny 500 million years ago . The Halsnøy Basement Rock consists of Precambrian rock with elements of gneiss of both sedimentary and magmatic origin . They range between granite gneiss to mylonite . In the area between the two complexes , there is some amount of gabbro . At the lowest point , the tunnel runs through a section of phyllite , which continues to be the dominant species until the tunnel reaches Otterøya . Below the island the tunnel reaches a section of greenstone , before it higher up again runs through more phyllite .