Jernbaneverket

On track

GLIMPSES OF THE NORWEGIAN NATION RAIL ADMINISTRATION'S ACTIVITIES IN 2014

New trains on new tracks

50,000 metres of new tracks provide a "parking space" for 100 new trains in the Oslo area, but more trains and more frequent departures for the public required considerably larger efforts from Jernbaneverket.

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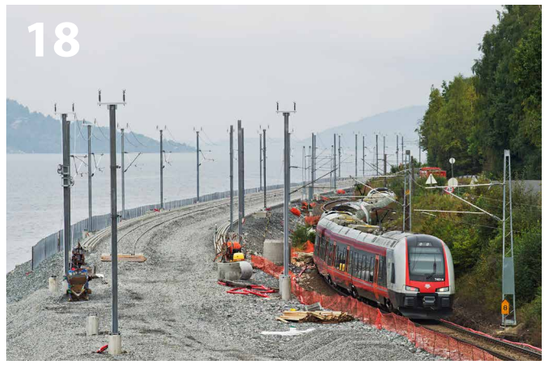

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Better equipped for the future

Restructuring and improvement processes were key for Jernbaneverket in 2014. With a new organisation in place from 1 April last year, the organisation has become better equipped to meet stricter requirements and expectations through efficient efforts. The work to further develop the organisation is still not over. We will continue the work through the streamlining scheme "A simpler and more efficient railway", in order to become even better at planning and implementing more tasks.

In 2014 Jernbaneverket initiated and continued large and important public transport projects. Among other things the construction work for The Follo Line project has commenced in Oslo and Ski and the InterCity project entered into four large consultancy contracts in late autumn.

Extensive maintenance work was carried out in 2014, including replacement of 88,000 sleepers and 42 kilometres of rails. Substantial initiatives were started on the Dovre Line, Bergen Line and Nordland Line to make the railway more resilient against climate challenges. Mountains and side areas was secured, embankments were reinforced and extended and culverts and trenches were extended in many places.

The popularity of trains as a means of transport is on the increase and we want our customers to be happy. For this reason we implemented several initiatives in 2014 to make the travel experience and in particular time spent in stations even better for train users. Wireless networks, no-smoking stations and telephone solutions for blind and visually impaired passengers are some of the initiatives. Additionally, several bicycle parks were built to make it more attractive for people to use their legs on the way to and from the stations.

The goal of 90 percent punctuality in passenger traffic was reached in 2014 and the number of hours of delays went down by around 10 percent compared to the previous year.

Planning has also been a central topic in 2014. Together with the Norwegian Public Roads Administration, Jernbaneverket was appointed to evaluate a shared route for the Ringerike Line, with reduced planning time, and proposed a shared development for E16 Skaret–Hønefoss. Jernbaneverket was also assigned with major studies such as Oslo-Navet and the next National Transport Plan. We have also developed a perspective assessment "The railway towards 2050", which addresses the topics of metropolitan traffic and goods traffic, two areas where the railway can contribute to solving key transport challenges for the future. You can read more about the perspective assessment on page 22-24 of this annual report.

E Enger
Director General

- Major route restructuring from 14 December 2014
- Additional and more frequent train departures
- Everyday improvements for work commuters

1.2 million working hours invested to bring more trains

50,000 metres of new tracks, 100 new switch points and 34,000 metres of new overhead lines. Intense work made it possible to add an additional one hundred trains per day through Oslo from 14 December last year. Rail services were also greatly improved in Trøndelag and Southern Norway.

New turning and parking areas for trains, such as at Lillestrøm (above) and Eidsvoll, were important factors in the major rearrangement of routes.

It was in 2008 that NSB launched the "2012 Timetable". The core of the plan was to have departures every ten minutes at hubs and every fiteen minutes for local trains between Asker and Lillestrøm, but also improved rail services for other key areas in Eastern Norway.

The reason was that a new double track had just been built in the West Corridor as well as the Gardermoen Line. But where would the trains turn and park? And was there enough space for the new NSB trains, which are much longer than the old trains?

It became clear that the major re-arrangement of routes would necessitate an investment totalling billions when it came to infrastructure: This included around thirty infrastructure initiatives, ideally with new tracks where the trains can park and turn, but also a great deal of complicated technical signal works. In order to manage this, we had to relocate one million cubic metres of mass and 1.2 million working hours were put in on behalf of Jernbaneverket.

The result was a gradual route restructuring, fully implemented from 14 December 2014.

Full trains. Parts of the new off -peak timetable were implemented as early as December 2014. Since then NSB's passenger numbers have rocketed up. From 2011 to 2013, NSB experienced a 15 percent increase in the number of journeys in Eastern Norway. The growth has simply continued and NSB passed 50 million journeys in Eastern Norway before the end of the year. More departures, more evenly distributed frequency and increased seat capacity have resulted in substantial numbers. 2,800 additional seats during peak periods are quickly filled up.

Always a train. Trains now depart Asker, Sandvika, Lysaker, Skøyen, Nationaltheatret, Oslo S and Lillestrøm every ten minutes.

> "In total 144 more trains will pass through the Oslo tunnel each day compared to now."

Passengers can now simply memorise the time for "their" station and forget about the timetable.
The local train between Asker and Lillestrøm via the Drammen Line and Groruddalen runs every fifteen minutes.

Waiting for Høvik. The service will become even better when Høvik station is operational. As soon as the turning facility in the same location is ready with a new, approved signal system, more trains will be able to go through the Oslo tunnel and turn at Høvik.

Flytoget will also gain an additional westbound departure and Lysaker will be served by four airport express trains every hour.

In total 144 more trains will pass through the Oslo tunnel each day compared to now. During the hours with the most dense train traffic we will be able to manage 23 trains per hour in each direction, compared to the current 20," says Unit Manager Timetabling Jan Harald Dammen from Jernbaneverket.

Nine trains to Gardermoen. Train commuting between Skien and Lillehammer is split into two. The train from Skien goes to Eidsvoll whereas the train from Lillehammer has Drammen as the final station. This initiative will result in departures every ten minutes for trains stopping at hubs in the Asker–Lillestrøm section.

Together with the Kongsberg–Eidsvoll line, the initiatives will result in three NSB trains between Drammen and Gardermoen each hour. Additionally, there are three airport express departures from Drammen and three from Oslo S.

Southern Norway. A departure frequency of two hours has also been implemented for the trains between Oslo and Stavanger. Until the timetable change five trains were running between Kristiansand and Oslo on working days. After the timetable change eight trains are running.

In addition there are now seven regional train departures between Kristiansand and Stavanger, one more departure than previously.

The Arendal Line must also not be forgotten. The frequency has been increased so that all trains, with the exception of the overnight train, still meet at Nelaug.

"Increased frequency provides work commuters with an improved daily routine and strengthens residential and working regions along the Sørland Line," says Ketil Solvik-Olsen, Minister of Public Transport.

Trøndelag. People in Trøndelag have also been given a better rail service. All of the trains now normally run to Melhus and 12 of the departures run all the way to Lundamo. Many citizens south of Trondheim now benefit from a much better rail service to Værnes or a more comfortable journey to and from work.

Weight record on the Ofoten Line

136,000 tonnes move along the Ofoten Line, every day. Last year the old weight and scale records were emphatically broken.

The 42 kilometre Ofoten Line constitutes only around one percent of the Norwegian railway network but the line transports an impressive 60 percent of all goods transported by rail in the country. New records have been set every single year in recent years. 2014 was no exception: The measuring station at Haugfjell measured a daily volume of 136,000 gross tonnes in March, 15,000 tonnes more than the old daily record from February 2013.

The Permanent Way Superintendent on the Ofoten Line, Knut Karlsen, can also boast record figures for the year overall:

"In 2014 the total load on the Ofoten Line was 33.8 million gross tonnes. In 2013 the corresponding figure was 32 million tonnes, compared to 28.3 million tonnes in 2011. If we take an isolated look at ore alone, 19.8 million tonnes were transported on the Ofoten Line in 2014, split between 18.3 million tonnes from LKAB and 1.5 million tonnes from Northland. This is the highest figure since 1979 (22.3 million tonnes), while the record of 22.6 million tonnes dates back to 1973.

"Our forecasts indicate that we will reach approximately the same level in 2015 as we did last year," Knut Karlsen says.

"In 2014 the total load on the Ofoten Line was 33.8 million gross tonnes. If we take an isolated look at ore alone, 19.8 million tonnes were transported on the Ofoten Line in 2014."

All ready for passing on Bjørnfjell

Following a busy run-up, the new passing loop on Bjørnfjell on the Ofoten Line was put into service during the middle of September. Three 1,100 metre tracks are having a major impact on capacity and traffic flow.

"During the summer last year, we carried out developments costing 150 million Norwegian kroner," explains Project Manager Lisa Lindholm. Due to the climate, hectic efforts are necessary during the brief summer season. The project has spanned three years and the final sum will be around 280 million Norwegian kroner. The Bjørnfjell passing loop has become twice as long as before and the works are part of the essential capacity expansions on the Ofoten Line. The passing loops at Katterat and Straumsnes had already been completed and there is now full activity in the Rombak passing loop, which will be complete in 2015.

The main contractor for the engineering has been Leonhard Weiss and TP Maskin has been responsible for the substructure. Several subcontractors have also been involved as well as Jernbaneverket's own employees.

... and soon at Rombak. Whilst the Bjørnfjell passing loop was completed last year, work on the Rombak passing loop are currently under way. Rombak will also be extended in the same way as the other stations, with a passing loop of 1,100 metres in order to allow for the passing of two ore trains. The main contractor at Rombak is PEAB and the fully extended passing loop is scheduled to open for traffic in 2015.

The following has been developed

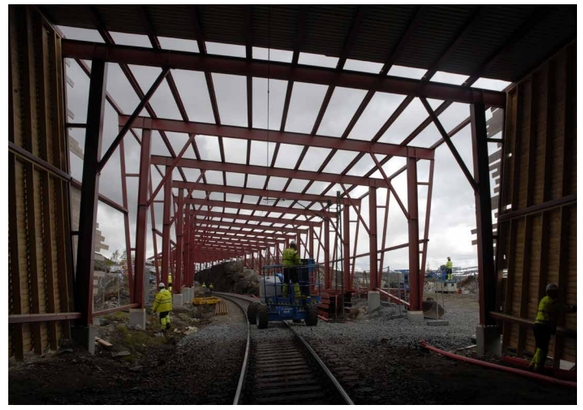
- Three 1,100 metre tracks with 60 kilo rails
- 60-kilo rails and concrete sleepers from the Swedish border to west of Bjørnfjell station
- New overhead line system
- Dead-end track for work trains from track 1
- New 220 m platform for track 1
- Road along the line, 1 km
- Underpass under the tracks
- New conduits and new cables
- Five new switch points
- New snow superstructure above the switch points at the eastern end of the station

No snow at the border, guaranteed!

The new border structure on the Ofoten Line is 289 metres long and designed as a strong steel structure. The structure will protect train traffic against vast volumes of snow on a challenging mountain section.

"It is completely necessary to have a snow superstructure up here," explains Steven Holdahl. He has been the Project Manager for a structure that commands respect! All of the steel elements have been transported up and welded together on the mountain. The concrete foundations are solid and each span is 10.5 metres. In other words it has been dimensioned for any snow weights imaginable whilst also ensuring adequate space inside along the track for work and temporary storage of equipment when needed.

"The old structure was in such a bad state that we had begun worrying about it collapsing," Holdahl explains. The work commenced in 2011. To prevent the line from being out of service during the development period, the plan was to construct the new structure on the outside of the old one before demolition. However, the old structure was in such a bad state that this idea had to be scrapped and demolition was initiated as soon as possible. One half of the new border structure was then erected in summer 2013 and the remainder in 2014.



As indicated by the name, the border structure is situated right at the border with Sweden. Many train passengers will have seen the Norwegian and Swedish colour indicators inside the structure at the point where the national border is passed. These indicators are now being renovated and will be re-installed.

About the border structure

- Length: 289 m
- Framework of steel, cladding consisting of untreated fir heartwood
- Walkway across the roof dimensioned for snowmobiles (for the Red Cross Search and Rescue Corps)
- The structure continues on the Swedish side (older structure)
- Cost: approximately 17.5 million Norwegian kroner
- Contractor: NLI Constructing

- 632 new parking spaces
- New bicycle parks
- Improved customer information

How everything will become even better

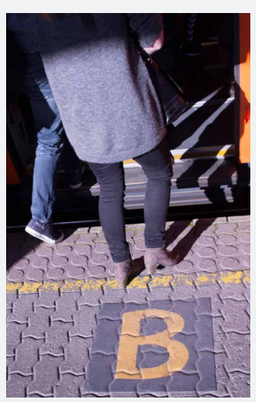
Jernbaneverket aims to encourage more people to travel by public transport. A number of initiatives will contribute to achieving this aim.

Free WiFi

In May, customers at Oslo S and Drammen were able to access free internet for two hours at all platforms, in front of the large information screens and at the airport express terminal. Users can access the internet quickly as Jernbaneverket does not require the user to identify themselves using their mobile telephone number or e-mail address. The solution has been well received by customers. Next up for free WiFi are Skøyen and Lysaker followed by Asker and Oslo Airport.

Punctuality for my train

In March 2014 Jernbaneverket launched a new internet service providing accurate punctuality figures for each departure and each route. Customers can therefore easily check whether there are any specific departures more exposed to delays than others and, where applicable, choose a different train. The service received a warm welcome from the Norwegian Consumer Council.



Improved customer information at stations

Time spent in stations is a crucial part of the journey and it is important to ensure that customers can easily navigate the stations and easily access customer and traffic information.

Eight stations already had sector marking on the platforms and in 2014 Jernbaneverket introduced such marking at a further five stations. The marking makes it easier for customers to find their carriage and see where it will stop. They can then ensure that they are on the right part of the platform and the train stop time at the station can be reduced, improving punctuality. 28 stations in Akershus and Hordaland have also received new speaker systems and new information screens.

Parking facilities

Last year a total of 632 new parking spaces were established at stations. Where there is especially heavy pressure on parking spaces and Jernbaneverket finds that the spaces are used by others than those travelling by train, a parking voucher scheme will be introduced. With eight new stations in 2014, parking voucher are now in use at 24 stations.

Much of the growth in public transport must be accounted for through cycling and walking and Jernbaneverket is facilitating this by building bicycle parks and providing bicycle stands at the stations. In 2014, new bicycle parks opened up in Drammen, Sandefjord, Gulskogen and Moss and bicycle stands were provided at a number of stations.

No-smoking stations

On 1 September Jernbaneverket introduced no-smoking stations as a direct result of the change to the Norwegian act relating to harm from tobacco. Signs have been installed at all entrances and platforms and all ashtrays have been removed. A no-smoking station area provides a better environment for customers, both those with and without allergies – young and old alike.

Timetable information by phone - 02009

In November Jernbaneverket launched a new real-time timetable information line for customers. The solution provides information about platforms, departure and arrival times for all passenger trains for each of the 337 stations or a section you are interested in. If you want, the information can be sent to your mobile phone. The service has been developed especially for those who are blind or visually impaired but also provides a great supplement to Jernbaneverket app, Togtider (Train schedules), the passenger train companies' apps and websites and printed timetables.

- 70,000 wooden sleepers replaced in four years
- 80,000 wooden sleepers still waiting to be replaced

Express trains: The track reconstruction train runs on a belt alongside the track and is more than 500 metres long, with carriages carrying both new and old sleepers. A mounted crane removes the old sleepers and installs the new ones. Everything else is just as efficient: the ballast train follows behind to replenish with new ballast and while the rails are moved to the side the sleepers are replaced and the ballast levelled. Finally the rails are adjusted and welded at the correct temperature to prevent buckling and rail breakages.

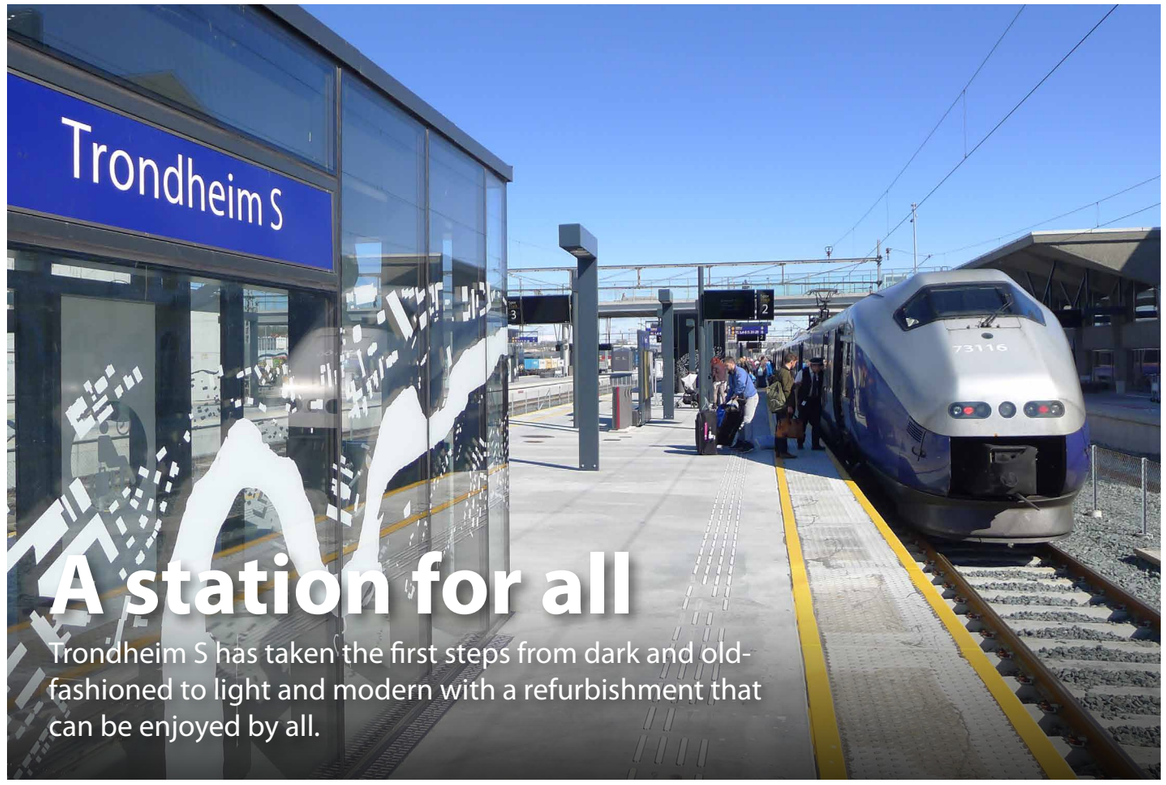
The transformation

In the space of just one night, 1,200 metres of the Røros Line are transformed into a railway track you could only have dreamt of.

The mystery does however have a solution: The track reconstruction train (SPOT). In June 2014 this German wonder train is picking up aged, grey-black and partially rotten creosoted sleepers in Atna for the fourth summer running. The advanced SPOT leaves behind a never-ending row of concrete sleepers that illuminate the summer night. Signal fitters, engineers, safety guards, track workers and the operator of the yellow wheel loader are working against the clock. The sound of track ballast hitting steel pierces the silence and creates an echo in the blueish black hills.

Over the course of four years 70,000 wooden sleepers have been replaced by concrete sleepers with "fast clip" fixtures between Hamar and Røros. Fifteen years ago, few rail fitters in Østerdalen would have been able to imagine that the Røros Line would get concrete sleepers back when the line was under threat from closure.

1,200 metres in just one night. With a propulsion of more than 200 metres per hour, SPOT manages to renew 1,200 metres after the last train has passed in the evening and before the first train is scheduled to pass on the brand new sleepers only seven hours later. This meant that only ten night shifts were necessary in June last year before the sleeper renovation on the Røros Line was completed. 70,000 out of 150,000 wooden sleepers have been replaced by concrete sleepers. There is still 50 km or 80,000 old worn wooden sleepers waiting to be renewed. Depending on the maintenance budgets the plan is to replace the rest of the sleepers by 2017. "In 2014 the money only stretched to ten days of work with the track reconstruction train on the Røros Line," says Project Manager Jon Lillegjære. But he is now excited that there is substantially more money and is keen to increase the efforts for sleeper replacements in 2015 and 2016.



A station for all

Trondheim S has taken the first steps from dark and old-fashioned to light and modern with a refurbishment that can be enjoyed by all.

The first step on the road towards a new and modern hub for public transport at Trondheim S was taken in June 2014. Rom Eiendom's new building "Trapphuset" is currently under construction and from winter 2016 the service to travellers will be supplementet with a restaurant.

The first development stage under the direction of Jernbaneverket has resulted in the upgrade of the station to its current standard. Among other things this means that it is more accessible to all.

Improved service for passengers. New screens, both inside the station hall and out on the platforms, show train arrivals and departures. The speaker system and induction loops also contribute to making it easier for everyone to orient themselves and easily and quickly find their way to the right train.

Improved user experience for everyone. Trondheim S was constructed in a different era and appeared dark and outdated before Jernbaneverket decided to renovate. During the planning stage, emphasis was placed on ensuring that the results would be functional and that the station would have a modern appearance.
The walls in the staircases and shelters are made of glass, with prints of Trondheim City from a bird's eye view. Light and modern premises now characterise the station and a simpler layout helps people feel safe when here.

"Jernbaneverket is fully underway with the planning of the next development stage due to commence in 2018."

Previously the only access to the trains was via ramps which were too steep to be accessible to all. At the newly rebuilt station, passengers can choose between stairs or lifts to get to the platforms and trains. The path to the train has also been marked to allow blind and visually impaired people to find their way.

The station hall has also been greatly improved. Light surfaces and new benches turn the waiting room into a pleasant place to be until the new station hall is ready after the second development stage.

Updated infrastructure. Railway engineering works at the station are also ensuring updated infrastructure, including new electro-technical facilities. The works have been necessary for the trains to arrive and depart as scheduled.

2018 is the next goal. Jernbaneverket is fully underway with the planning of the next development stage due to commence in 2018. When the development works are complete, both those travelling by train and everyone else will be able to enjoy Trondheim's new public transport hub.

Arendal Line has become ultra-modern

Remote controls and speed monitoring are among the initiatives that have made the Arendal Line one of the most modern railway sections in the country. It is no surprise that there was a celebratory mood at Arendal station when the line opened as a remote controlled section this January. An extensive upgrade to the 36 kilometre section has now been completed.

"The upgrades have been essential in order to continue having traffic on the Arendal Line," says Regional Director Stian Wesøy of Jernbaneverket, who was happy to declare that the schedules were also met. The section was ready on 30 January, after the line had been closed for a couple of weeks to complete the final works and test the new system.

The main task of the Arendal Line is to link the Arendal area with the Sørland Line, which collects significant traffic from there. In the 1980s the future of the Arendal Line was just as uncertain as it was for many of the other branch lines, but with time it was decided that the line would be electrified rather than closed down. In 1996 the line was opened for electric operation.

"Technically, the Arendal Line has now become a very modern line," Wesøy says.

The final sum for upgrading the 36 kilometre line will be around 75 million Norwegian kroner. Now around 15 trains run on this section every day on working days.

News on the Arendal Line

- CTC remote control system. This means that traffic is managed by train management in Kristiansand. The safety level for the section has therefore become even higher.
- Speed monitoring system (FATC). Emergency brakes can now be applied to trains if they pass a stop signal. Speed can also be monitored by the system during travel.
- Axle counters in the track measure where the trains are and check whether the entire train passes the signals.
- The line has become more accessible for maintenance (the section can be released for maintenance as soon as the train arrives at Nelaug or Arendal).
- The train sets can be switched in or out, more quickly and easily.
- New switch point at Arendal station.

New workhorses "know everything"

In January next year Jernbaneverket's first two maintenance machines for multidisciplinary use will arrive in Norway. Higher speed, greater strength and twice as much lifting capacity are amongst the innovations.

Jernbaneverket has entered into a contract with the German company Windhoff GmbH for the procurement of new rolling stock machinery for the maintenance of tracks and overhead lines. This is the first time that machinery has been purchased for use for both track and overhead line works.

The agreement covers 11 new machines that can be used for all types of track maintenance and for lighter maintenance and troubleshooting work in overhead lines. The first two machines are due to arrive in Norway in January 2016 and will be subject to a one-year trial run before the serial delivery commences in March 2017. The agreement also includes an option to purchase an additional ten machines.

"These will be our first multidisciplinary machines," says Lars Haagenrud at the Machine Centre in Infrastructure Transport. The machines will be supplied customised for use in the future ERTMS sections. ERTMS (European Railway Traffic Management System) is the new common European signalling system that will replace the old signalling technology. "The new machines are also much better in respect of working environment and safety than the current machines," Haagenrud adds.

Positive experiences. "Both Austria and Switzerland have a large number of similar multidisciplinary machines in service. Both of these countries have railway sections that can be compared to ours, with many curves and large climbs and descents. They also have snow-filled winters and we are certain that we have made a good choice," says Haagenrud.

Line and overhead line maintenance. The new machines represent a strong improvement in Jernbaneverket's machine fleet for maintenance of the line, the difference is especially noticeable in comparison to the oldest machines (loading tractors). The new machines can maintain a top speed of 100 km/h, have more engine power (500 kW) and twice as much lifting capacity in the crane.

Multidisciplinary machines will not replace the current cable carriages for overhead line maintenance but will be a supplement.

Bridge renovations on the Sørland Line

On the Sørland Line Jernbaneverket has more bridges to maintain than on any other line.

"Bridge renovation work on the Sørland Line commenced several years ago," says Arne Bujordet, Project Director for Region South. The works comprise a number of different measures from the replacement of sleepers, rails, walkways and railings to renovation of steel, concrete, walls and abutments.

"It is a challenging task to keep maintenance momentum going when we know that the Sørland Line has a total of 512 bridges," says Bujordet. The bridges on the Sørland Line are of a number of different types. The oldest part has a number of stone arch bridges, while concrete bridges dominate to the west of Kristiansand. There are also a great deal of steel bridges across the entire line.

All of the bridges are inspected in accordance with a scheduled inspection programme.

Complete renovation. The major initiatives this year include the complete renovation of the three steel bridges at Launes, just to the west of Egersund.

"All of the steel on the bridge will be sandblasted and painted in order to preserve the bridge structure," says Project Manager Kurt Jensen.
There is no randomness involved with the work. First the entire bridge is covered up to prevent substances from the works ending up in the river below.
The entire structure is then cleaned before all of the steel is sandblasted, bit by bit. It is then cleaned again before applying epoxy paint and two top coats. Any damage that is identified will be rectified.
Three bridges at Launes are situated right out towards the sea where impact from weather and wind is greater than usual. Even after this year's renovations, the framework span, on one of the bridges, a structural element with a high load-bearing capacity in relation to weight, must be replaced before long due to the climate impact.

- 7 of 10 bridges complete
- 7 tunnels to complete
- Focus on safety

Peak production

2014 was a brilliant year for production in connection with the double track development between Farriseidet and Porsgrunn. A total of 10,000 linear metres of new main tunnel and 3,700 metres of new escape tunnel were driven in the section, distributed across seven different tunnels. In addition, ten bridges are also being built, totalling 1,500 metres in length.

At the end of 2014, seven of the bridges were virtually complete. In addition, two wildlife passages and 23 concrete portals are also being built.

Gigantic bridge across Hallevannet. Hallevannet bridge is the longest bridge in the Farriseidet–Porsgrunn project. It will be 436 metres long, 20 metres high and will have a span of 167 metres.

The reason for the long span is that the bridge will cross Hallevannet outside of Larvik, which is a reserve drinking water source. The bridge foundations can therefore not be placed in the water and the bridge must be constructed using the cantilever method.

The cantilever method means that a bridge pillar is constructed at each end and that a formwork carriage is installed on each pillar. The bridge is then cast in either direction until it meets in the middle.

The solid bridge structure that is being erected is a double-track railway bridge, meaning that it is 16 metres wide. 13,000 m^3 of concrete and 3,300 tonnes of reinforcement are being used and the construction time has been estimated to two years.

Plenty left to do. Finishing the works in the tunnels will take place continuously as and when the tunnel driving is complete. During this process the tunnels will be prepared for railway engineering installations such as tracks, overhead lines, emergency lighting and signals.

The tunnel interior will be clad with prefabricated concrete elements, like those used in the Holm–Nykirke project. The installation commenced in 2014 and will continue for the duration of 2015. The seven tunnels require 37,000 concrete elements in total to provide protection against water and frost.

Systematic safety work pays off. An example of systematic safety work in the project is the scheduled subject weeks that have been introduced. Over a period of two weeks additional attention is given to a subject of importance to safety. Example subjects include tidy workplaces, use of personal protective equipment, machine certificates and storage and use of explosives.

The investment has brought solid results for both employees and progress. The aim was an LTIF rate (a measure for the number of injuries resulting in time off per million hours worked) of four or less in 2014. However, the systematic safety work resulted in an LTIF rate as low as 2.1.

The size of Hallevannet bridge outside Larvik is impressive. The concrete bridge will be cast four metres at a time from both sides and will meet in the middle.

The pictures show the development site at Solum (furthest to the left) and Ønna bridge at the furthermost part of Langangen.

Farriseidet–Porsgrunn

- Involves 70 employees from Jernbaneverket
- Approximately 660 employees from contractors and consultants
- In 2014, production costs totalled nearly 2 billion Norwegian kroner and the signing of the first railway contracts were also prepared.
- Anticipated in 2015: Around 1.5 billion Norwegian kroner.
- The estimated final cost is 6.6 billion Norwegian kroner (2014)

- 23,000 concrete elements to protect against water and frost
- coordination meetings ensure progress

Blast at the beginning of the journey

Secretary of State Bård Hoksrud detonated the final blasting to provide breakthrough and 12 kilometres of continuous tunnel in Holmestrand in March last year. 2014 was also the year during which the station hall inside the mountain transformed from a dark and gloomy place to a thriving construction site full of professionals.

Hoksrud's final detonation also marked the start of the work to clad walls and ceilings in the new tunnel with a total of 23,000 concrete elements. More than 80 percent of the elements were put into place in 2014. In the station hall work was also carried out for the casting of walls, technical structures, escape routes and a number of other, smaller projects.

In total in 2014, railway engineering contracts were entered into for nearly 700 million Norwegian kroner as well as a 300 million Norwegian kroner contract for the substructure for the tracks.

From concrete to engineering. Several railway engineers were engaged in order to manage the volume of new contractors and subcontractors.

"We hold regular coordination meetings in which we identify when and where the various stakeholders will work and in this way attempt to prevent one person's work from creating problems for another," explains Project Director Stine Undrum.

Much technology. The switch points have been installed and earthing of the concrete elements has commenced. The telecommunication masts have been erected at both ends of the tunnel. A one kilometre trial section has been created between two technical structures. Here everything will be completed before work continues.

"This method places demands on the construction managers, but it also means that we spend less time on the rest of the technical structures," Undrum explains.

Sad chapter. In spite of the systematic safety work, two serious accidents took place in 2014.

"In October we first had an accident involving serious injury, followed by a fatal accident. Both of the accidents took place in the Fibo contract but were unrelated. Following the fatal accident we discovered that many of the personnel lifts had been altered. Going forward Jernbaneverket will demand that overview lists are kept for the lift inspection history. The lift must not be used if it has not passed the annual inspection. All safety advisers have also been trained in how to inspect the lifts," Undrum concludes. When the Norwegian Labour Inspection Authority carried out an inspection at Jernbaneverket following the fatal accident, the conclusion was that Jernbaneverket had fulfilled its duties as the developer and principal enterprise.

In August the station hall looked like this.

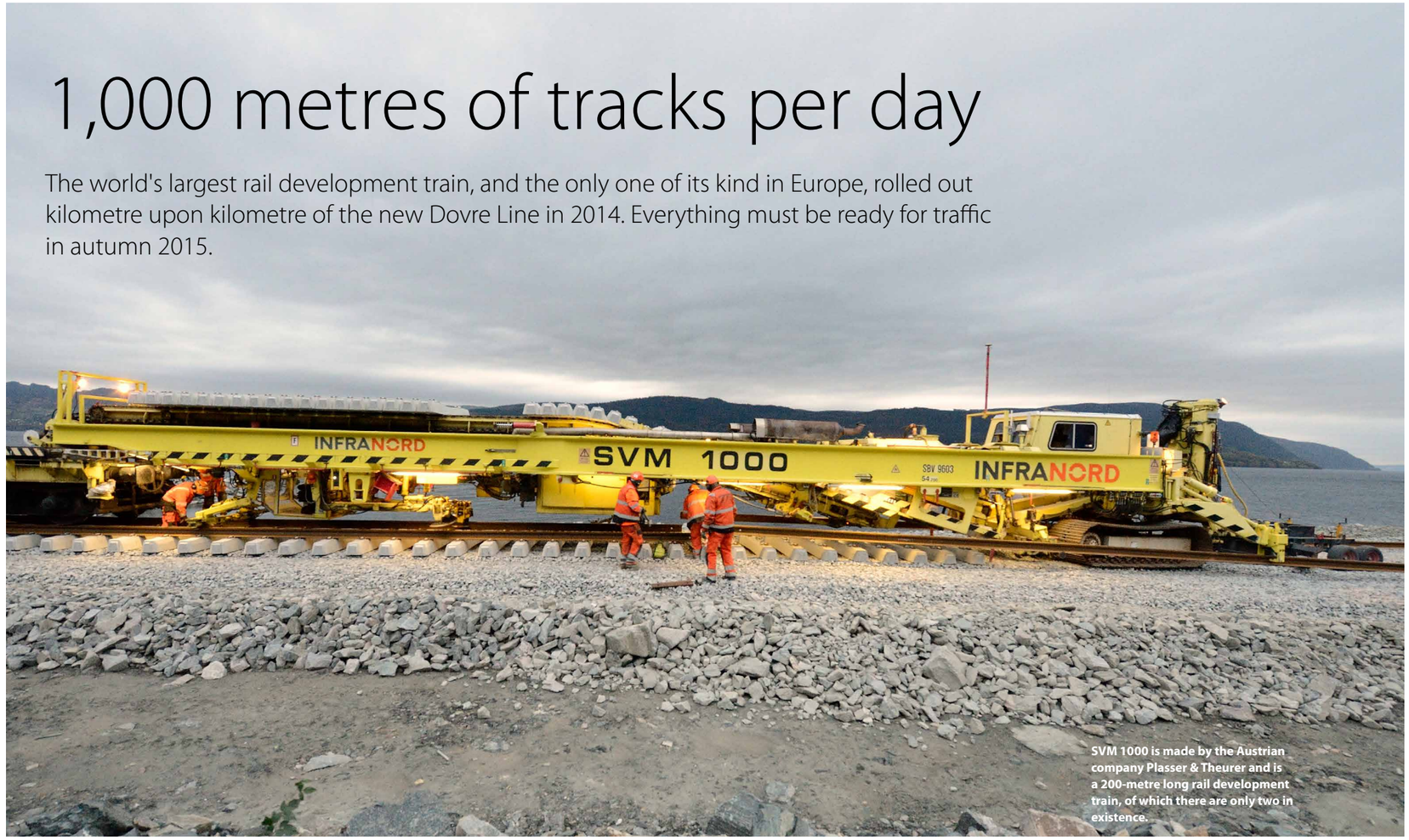
Holm–Nykirke

- 14.2 km long section
- 12.3 km in tunnel
- Station hall inside the mountain
- 72 employees from Jernbaneverket and around 550 workers from contractors and consultants
- Production costs in 2014: 1.3 billion Norwegian kroner
- Budget for 2015: 1.3 billion Norwegian kroner
- Final cost forecast: 6.3 billion Norwegian kroner
- Completion 2016

Walls and ceiling in the Holmestrand tunnel being clad with concrete elements. More than 80 percent of them were put into place in 2014. This is how it looked in November.

1,000 metres of tracks per day

The world's largest rail development train, and the only one of its kind in Europe, rolled out kilometre upon kilometre of the new Dovre Line in 2014. Everything must be ready for traffic in autumn 2015.



SVM 1000 is made by the Austrian company Plasser & Theurer and is a 200-metre long rail development train, of which there are only two in existence.

On the Joint Project E6-Dovre Line along Mjøsa, Jernbaneverket and the Norwegian Public Roads Administration is collaborating in the construction of 22 kilometres of the four-lane E6 and 17 kilometres of the double-track Dovre Line. The E6 officially opened on 13 December 2014, but a road stub of three kilometres is set to open in June 2015. The total cost of the project is 10.1 billion Norwegian kroner and it is the largest and longest development project in Norway so far.

"We have set a number of records in the Joint Project, including when it comes to the short construction time. Since the official commencement in April 2012, 1,500 people have worked on the project," says Project Manager Anne Braaten from Jernbaneverket. An efficient and accurate work machine such as the track development train SVM 1000 is worth its weight in gold when constructing a lot in a short period of time.

Efficient construction. "This machine has allowed us to build up to a kilometre of track each day. 70 percent of the double track was constructed in 2014 and two kilometres were laid in spring 2015," says Rune Gihlemoen, Technical Construction Manager for tracks in the Joint Project.

Advanced dispenser. "It takes much less time to build a railway using a rail development train than it does to do so manually, but logistics are key. The 120-metre long rails produced in Austria were unloaded along the track by Jernbaneverket's long rail transportation train before the construction started. Every night during the construction period a train loaded with sleepers would also arrive from Hønefoss.

"The rail development train is like an advanced dispenser that is filled with sleepers and rails and dispenses practically a complete railway track," Gihlemoen explains.

Coordinated work team. Six people operate the SVM 1000. They check that the small plough situated at the front distributes the ballast evenly and feed the sleeper dispenser with sleepers from a transport crane that moves back and forth. They cut the 120-metre long rails with sparks flying, splice them with great precision and ensure that they are put into place. Ballast stone is then added and compacted and the rails are welded. This will allow the trains to fly past on perfect tracks when the Dovre Line opens to ordinary train traffic in 2015.

Further planning. The railway section from Langset to Kleverud in the Joint Project is part of the InterCity development in the direction of Hamar. Planning of new double tracks both to the north and south of the Joint Project is fully underway. In the National Transport Plan for the period 2014-2023, the sections from Venjar south of Eidsvoll (13 kilometres) to Langset and from Kleverud in Stange to Sørli (16 kilometres) have been prioritised with requested commencement of construction in 2018.

"In spring 2015 the area development work was fully underway and we are hoping for approval of the local zoning plans during summer 2016. According to the NTP the continuous double track from Venjar to Hamar will be ready in 2024. The travel time from Oslo to Hamar will then be 52 minutes compared to one hour and 20 minutes as is currently the case," explains Anne Braaten.

Full speed from Værnes to Hell

The preparations for the construction of a new railway bridge across Stjørdalselva commenced in spring 2014. 640 million Norwegian kroner will be invested in the Hell-Værnes section over the next three years.

In 2014 the project carried out preparatory works including the establishment of rig areas and relocation of cables and pipes, as well as sheet metal piling, piling and loose mass works in the river. A new double track bridge will be constructed in summer 2015. The plan is for the bridge to be completed during 2015 and for it to be ready for train traffic in late autumn 2017.

Double track and more. The project will construct three tracks from the Gevingåsen tunnel, two of which will run past the stop at Værnes and one for the Meråker Line. Track 3 will be a main through track for the Nordland Line. The new tracks will provide better passing patterns for trains, improved capacity and the possibility to park more trains. Trains on track 3 will be able to drive at significantly higher speeds which will result in time savings.

A new side platform will be constructed to the west of the station building at Hell and the station will also be equipped with a new signalling system.

6,000 metres of new rails and 15 new switch points will be supplied. In other words: there are some busy seasons ahead before Hell-Værnes can be put into operation.

The old railway bridge across Stjørdalselva dating from 1902 will be replaced by a modern railway bridge designed by the French architect Jean Francois Blassell.

The Follo Line project:
- Longest railway tunnel in the Nordic region
- Ski to become a modern public transport hub
- The old Østfold Line will be upgraded

Everything set for the longest railway tunnel in the Nordic region

"The Follo Line will be important to so many people that the high costs are justified," said the Minister of Transport and Communications, Ketil Solvik-Olsen. Parliament agreed and the project is now on track for real.

On 17 June 2014, the Norwegian parliament gave the formal green light for the Ministry of Transport and Communications to implement the investment project "new double track Oslo-Ski", the innermost part of the InterCity development to the south-east of Oslo. The Follo Line will be finished in December 2021, which is considered a short delivery time for such an extensive project.

Great interest. With the parliamentary order in place, tender documents were submitted to companies nationally and abroad. Just over 30 companies from all over Europe and Asia participated in the preliminary qualification. The bids were evaluated by the Follo Line Project under strict security management before the first of the large contracts for the main works was awarded and signed in February this year.

Activity has been high in the development areas in order to complete the preparatory development works.
Ten contracts have been entered into with Norwegian contractors. The construction of two access tunnels of nearly one kilometre each in the Åsland development area and extensive redevelopment of Langhusveien in Ski represent the two largest contracts for the preparatory works.

Minister of Transport and Communications Ketil Solvik-Olsen, Project Director Erik Smith, Assistant Director General of Jernbaneverket Gunnar G. Løvås and Project Manager, Tunnel TBM, Anne Kathrine Kalager on the day when the Follo Line Project received the go-ahead from the Minister.

Important past. In Oslo, at Åsland and at Ski, archaeologists have identified cultural heritage objects. At Ski one of the largest ancient settlements in Eastern Norway was identified. Near the Medieval Park in Oslo almost 100 graves were identified. According to the archaeologists the excavations will provide new answers as to how life was led between the 1200-1300s and several hundred years after that.

As a result of the new Follo Line the Medieval Park in Oslo will be given a new lease of life with a green area almost doubled in size. The planning of the new park landscape will be carried out in consultation with the Municipality of Oslo and the Directorate for Cultural Heritage.

Full speed ahead. At the development site in Åsland the contracting partnership Acciona-Ghella will come in after being awarded the contract for driving of the long tunnel using a tunnel drilling machine. The Italian/Spanish joint venture is now ordering the four drills and before long it will start driving the 20 kilometre long railway tunnel – the longest railway tunnel in the Nordic region.

The Follo Line will substantially improve rail services for everyone living in the southern corridor, with both greater capacity in the section and halved travelling time between Oslo and Ski.

Projects around the country

Jernbaneveret is blasting, building and improving the railway in many places across the country. Here you can see where the activity is at its peak. Additionally there are a number of smaller maintenance tasks that have not been indicated on the map.

All set for drilling of the new Ulriken tunnel

In May Jernbaneverket's first contract for tunnel driving using the tunnel drilling machine (TBM) was signed.

A joint venture between the Norwegian company Skanska and Strabag from Austria was awarded the drilling contract. The new tunnel is being constructed in parallel with the existing tunnel and will double the capacity in the section.

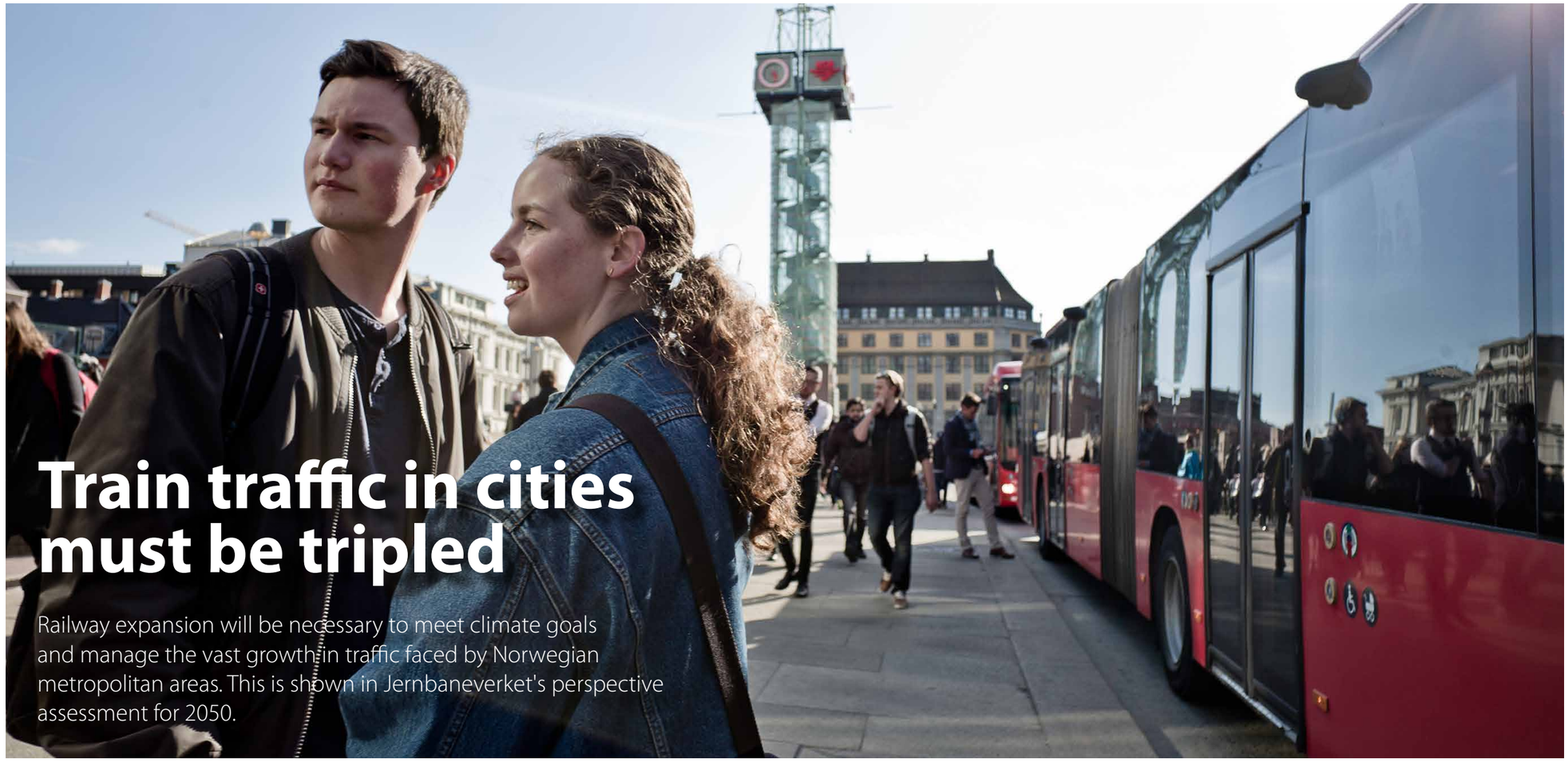
In August we celebrated the 50-year anniversary of the existing Ulriken tunnel and took the opportunity to also mark the start of developments for the new tunnel. Both Secretary of State John-Roger Aarset and Assistant Director General of Jernbaneverket Gunnar G. Løvås took the trip across the mountain, but it was the Station Master from the opening in 1964, Ragnar Blomdal, who had the honour of detonating the first symbolic blast. For the occasion he was dressed in his old uniform from the time and fulfilled his task in style. The 93-year old can be seen deep in conversation with host Finn Tokvam in the picture.

The first proper tunnel blast was detonated in November following a few months of groundworks in order to ensure access to the actual mountain. The first 800 metres of the tunnel will provide space for passing and will be blasted in a traditional manner before the tunnel drilling machine takes over towards the end of 2015.

Arna–Bergen double track

- 7.8 km of new Ulriken tunnel
- 1.3 km of new track from Bergen station to the tunnel
- New signal and safety system
- Renovation of Arna station and existing tunnel
- Commencement of construction: 2014
- Scheduled completion: 2021
- Cost: 3.5 billion Norwegian kroner
- Involves 30 employees from Jernbaneverket (31/12/2014)
- Consultants and contractors: 36 FTEs
- The project's production costs in 2014 were 330 million Norwegian kroner

- More people need to use public transport in metropolitan areas
- More frequent, quicker and more punctual trains are necessary



Train traffic in cities must be tripled

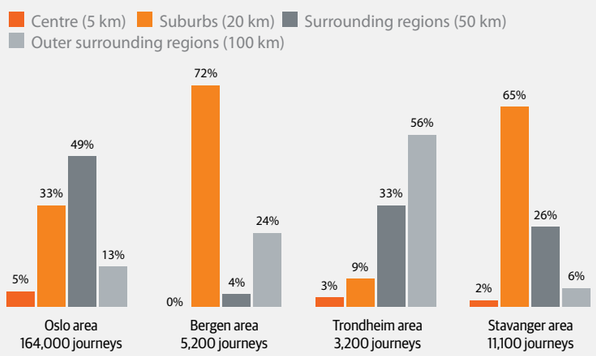
Railway expansion will be necessary to meet climate goals and manage the vast growth in traffic faced by Norwegian metropolitan areas. This is shown in Jernbaneverket's perspective assessment for 2050.

Traffic growth in cities must be managed through public transport, cycling and walking.
It is therefore necessary to carry out a double track expansion in the four largest metropolitan regions; Oslo, Stavanger, Bergen and Trondheim. Three times as many people would then be able to take the train to and from work. Trains would run more often, faster and be more punctual," says the Director General of Jernbaneverket, Elisabeth Enger.

Double tracks resulting in trains every ten minutes. Trains running every ten minutes during the day and more frequently during rush hour could become the new reality. For this to happen, railway capacity in metropolitan cities would need to be expanded further in consultation with the cities and other public transport providers. For longer distances it would be relevant to have quarterly or half-hourly frequencies, depending on the market. It will be crucial to develop double tracks in the following areas:

- Central Eastern Norway
- Separate double tracks for local trains and regional trains in the Oslo area, including the new Oslo tunnel
- The Voss Line
- Trøndelag
- The Jæren Line

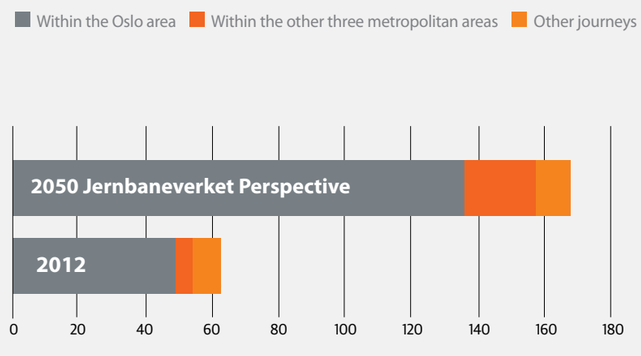
CURRENT JOURNEYS TO/FROM THE CITY CENTRE DISTRIBUTED BY START/TARGET AREA FOR THE JOURNEY



Source: NSB and Flytoget

RAILWAY JOURNEYS PROJECTED UNTIL 2050

Millions of journeys each year



National Transport Plan, action programme and the national budget

The National Transport Plan (NTP) is a report to the Norwegian parliament (white paper) and represents the government's ten-year plan for transport. The current NTP was adopted by the Norwegian parliament in June 2013 and applies to the period 2014-2023.

Jernbaneverket's action programme explains how the priorities in the NTP will be implemented in the form of specific initiatives.

The final decisions concerning railway projects are set out in the national annual budgets. The projects are funded through the national budgets.

A new NTP is prepared every four years. Extra attention is therefore paid to the projects included in the first four years of the plan, and to how much money is planned to be spent on these. The parts that have been planned for the final six years will be processed again before the next plan is presented in four years. The NPT is not a binding ten-year plan, but does give quite detailed indications of the direction that Norwegian transport policy ought to take.

NTP 2014–2023 envisages significant investment in the railway. In total, a framework of NOK 168 billion is proposed for the ten-year period. This will fund both the construction of new lines and the operation and upgrade of existing lines.
A significant amount of money has been allocated for the study and planning of developments even further into the future. The studies addressed in the article will be important in the planning of the next national transport plan. The transport agencies, Norwegian Public Roads Administration, Jernbaneverket, Avinor and the Norwegian Coastal Administration will prepare the basis for NTP 2018-2029 together. It will be presented in February 2016.

About the perspective assessment

- Jernbaneverket's perspective assessment "The railway towards 2050" is an assessment of future transport needs and how the railway can be developed to meet these needs. The assessment forms part of the working basis for the next National Transport Plan.
- "The railway towards 2050" focuses on two areas: Metropolitan traffic and freight traffic. These are the areas with the greatest societal need and the greatest opportunities. Nine out of ten journeys take place in metropolitan areas.

- Passenger traffic can be tripled
- Freight traffic doubled by 2050
- 12 freight terminals will be put up for tender

2050:

More freight on rails into and out of the country

The perspective assessment carried out by Jernbaneverket shows that more freight traffic can be moved to the railway if the capacity is increased and the international connections are strengthened.

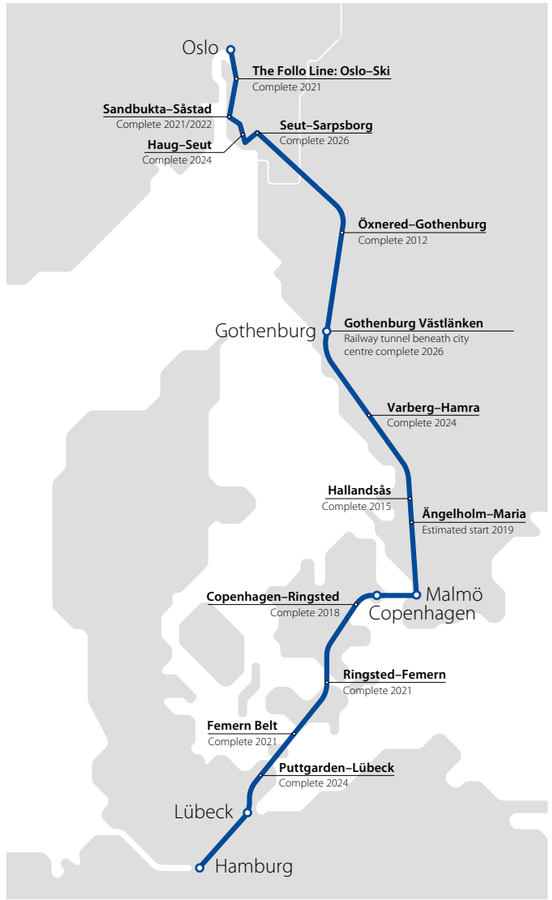
Freight trains have a high market share in Norway but continue to lose out to heavy goods vehicles on the roads. Calculations also find that there will be twice as much freight traffic in 2050 compared to now.

Stronger investments in international transport will therefore be essential. Both Sweden and Denmark are about to forge closer links to the continent through new railway links for freight trains. Among other things, the Fermern Belt rail link between Denmark and Germany is set to open in 2021. The line will facilitate 79 more freight trains per day between the continent and the Nordic region.

"If Norway establishes a more efficient connection to the new Nordic freight link, we will be able to move more heavy goods traffic to the railway. If freight arrives in Norway by train it will also continue by train within Norway," says the Director General of Jernbaneverket, Elisabeth Enger.

Jernbaneverket's calculations indicate an overall investment need of around 500 billion Norwegian kroner by 2050. From this, 400 billion will be allocated to passenger traffic and around 100 billion to freight traffic.

A large increase in freight on the railway would require increased capacity in the Norwegian railway network. Among other things, this would involve passing loops for longer freight trains (750 metres), double tracks on the Ofoten Line and new, fully equipped terminals in Bergen, Trondheim and the Oslo area. Jernbaneverket is also considering electrifying the Solør and Røros Line, linking the Gjøvik and Dovre Lines and establishing reloading solutions for the Bergen and Sørland lines.



Forestry saved by the Numedal Line

Forestry in Numedal is completely reliant on the railway. There is therefore great local satisfaction at the upgrades to the Numedal Line.


November 2014: New sleepers to arrive at Svene.

The Kongsberg–Svene section opened to traffic again in in November. The first goal in the work to equip the line for freight traffic was therefore met.

"This is incredibly important to us," says the General Manager of Moelven Numedal, Rune Frogner. The lumber mill at Flesberg is completely reliant on the railway and the railway improvements with new sleepers are crucial to the company's future. "If we didn't have the railway I am fairly certain that our company would need to fold," Frogner says.

Large ripple effects. Jernbaneverket's reopening of the line to Svene means that the timber can now be loaded at the site and the transport distance by road is reduced. However, complete renovation of the line all the way up to Flesberg will be key. "Only then will we be able to load chips and timber directly onto the railway there. This is something we need," says Frogner. He emphasises that it is not only the future of Moelven Numedal that relies on the railway but largely forestry in the entire Numedal region. "I think the railway is more important than people realise. In our catchment area forestry has an annual turnover of around 250-300 million Norwegian kroner. Without railway transport from here forestry would be unlikely to be profitable," says Frogner. In actual fact Moelven Numedal has to transport timber and chips all the way to Gävle in eastern Sweden. It would not be possible for that route to be profitable by road," he says.

Until the line is fully open all the way to Flesberg, the Numedal company transports most of the chips by road to the Sokna facility, where they are loaded onto trains.

"The makeshift solution means increased costs and we need the train to Flesberg to be back in operation as soon as possible," Frogner notes.

Someone else who is very happy with what is now under way is General Manager Geir Marstein of Svene Pukkverk. "Normally, 35 percent of our sales are supplies for the railway and are loaded directly onto the railway from the ballast facility here," Marstein says. As a result of the derailment this spring and the line being closed for renovation, these deliveries have been lost. Next year looks much better and Svene Pukkverk has secured the contract for delivery of track ballast for the newly built Holm–Nykirke section on the Vestfold Line. This means extensive train traffic from Svene in 2015.

"The reason why we are investing so many resources in this is the major importance the Numedal Line has to both Moelven Numedal and the forestry industry in the region," says Regional Director Stian Wesøy from Jernbaneverket.

More competition for freight terminals

More competition is to ensure better service at the freight terminals. By assignment to the Ministry of Transport and Communications Jernbaneverket initiated a project in 2014 to facilitate more competition between terminal service providers. The operation of all 12 railway terminals in the country will be put up for competitive tendering.

Already in the second quarter 2015 Jernbaneverket set out the basis for the competition for operation of the terminals at Ganddal near Stavanger and Brattøra near Trondheim. Tenderers must first be certified by Jernbaneverket before they can enter into agreements with the freight companies and become authorised terminal operators. The plan is for the two selected freight terminals to already have operators in place from the first quarter of 2016. The remaining ten terminals will be put up for competitive tendering by the end of 2017.


Ganddal Freight Terminal.

- Internet-based switch point monitoring
- Acoustic sensor listens to the trains
- Detector warns of overheating

ERTMS will make signal faults rare, first on the Østfold Line Eastern Line in August this year and with time across the entire country.

New technology – fewer signal faults

New smart technology will substantially reduce the number of signal faults. And a sensor "listening" for faults on the trains has been installed near Drammen.

In the short term, the new technology means smarter and more efficient maintenance. In the long term, all signal and safety systems will be replaced.

Jernbaneverket is due to have the first installation up and running within the "smart maintenance" concept as early as 1 August 2015. The most critical switch points will then be monitored with the aim of reducing faults and thus contributing to ensuring that more trains are running on time. The switch points are first in line as they are among the biggest culprits behind what we colloquially refer to as "signal faults".

"More and more often maintenance is assessed by the condition of the material. This means that we are able to rectify faults and defects in the systems before operations are affected," says Head of Department for Signals and Telecommunications, Sverre Kjenne.

Centre and pilot in Trondheim. Jernbaneverket's operations centre in Trondheim will have a key role to play as the main monitoring centre and alarm recipient. The telecommunication network and "data backbone" along the tracks are already monitored from here. The system is based on renowned software and standards for quality assurance and will be further developed in close collaboration with experts in the various technical disciplines.

In 2008 a test system was installed at Trondheim central station for the monitoring of a total of 16 switch points. The system will be used as a pilot system when the central monitoring system is established.

"Experience shows that active and extensive use of such systems reduces the amount of faults by 30-50 percent," says Tor Johnny Moen, who has been responsible for the internet-based system in Trondheim.

No limits. "The experiences gained in Trondheim will be actively used when we now prepare a strategy for monitoring of switch points," says Project Owner Anna Gjerstad.

"There are no limits with regard to the kind of objects we can monitor but we will initially concentrate on those that cause the most faults," says Sverre Kjenne. "The point machines on the switch points are the clear number one. We know that we have an average of 0.3 faults per point machine per year. Track circuits, used to determine where on the line the trains are at any time will also be given plenty of focus. It is currently very complicated to locate faults linked to track circuits. A third example is overhead lines. "Here we can film and keep an eye on the overhead line to make sure it is in the right position to ensure optimal current transfer to the train," says Kjenne.

> "We are able to rectify faults and defects in the systems before operations are affected."

Covering trains. The trains will also be monitored more than previously. At Huseby between Lier and Drammen an acoustic sensor that listens to the wheel bearings of passing trains has been installed. The system differentiates between different sounds and records which carriages require maintenance with a high degree of accuracy. Faults on the trains are therefore identified before they become critical to the infrastructure. Similar systems will be installed at Skatval in Nord-Trøndelag and on the Ofoten Line this summer. Overheating detectors have also been installed near tunnels. The aim is to stop trains that could cause fires.

Signal faults will become rare. Over time, "signal faults" will become rare. The reason for this is what is known as ERTMS.

With the introduction of this new European signal system, a lot of the old infrastructure that causes what we currently refer to as "signal faults" will disappear, also removing an important cause of train delays. Exterior indicators for red and green lights, large volumes of cables and vulnerable isolated joints will all become superfluous. The train position will be determined by axle counters rather than cables and the train drivers will receive their messages and driving instructions via a screen inside the train.

"But the most important thing about ERTMS is that we will renew the railway safety system, i.e. the actual "heart" of the signal systems. We will also introduce a new, nationwide traffic management system. The system will ensure improved cooperation and communication with train companies and passengers alike," says Eivind Skorstad, Project Director for the implementation of ERTMS.

ERTMS will be operational on the Østfold Line Eastern Line, from August this year. According to Jernbaneverket's signal plan, the system will be established on the entire railway network no later than 2030. The first suppliers will be pre-qualified during 2015.

More efficient than required

"Simple and efficient" is the name of a streamlining scheme that will enable Jernbaneverket to develop the railway of the future in the most efficient way possible. Initiatives are being implemented in a number of business areas.

Jernbaneverket has identified the greatest potential for improvements in the way in which we work within the following four areas:

- Traffic management
- Operations and maintenance
- Planning and development
- Support functions

Specific initiatives and timeframes for each area have been adopted. Some of the initiatives chosen are not necessarily the easiest for measuring short-term effects but the Director General is clear about Jernbaneverket having a responsibility to give more back to society of the continuously increasing resources it benefits from. In other words, more of the funding will be used for maintenance and improvements of railway lines and less will be spent on administration.

Goals and background. The national transport plan for 2014-2023 is based on Jernbaneverket streamlining its own activities by 10-15 percent by 2023, but Jernbaneverket has even higher ambitions for itself. The aim is to become eight percent more efficient by 2017. In line with the streamlining scheme "A simple and efficient railway", there will be direct cost reductions and productivity improvements with the same resource consumption as previously. To a large extent the solution will be the implementation of new technology but will also include more efficient planning and organisation of projects and human resources.

The goal of all the initiatives is to be able to handle an overall growth in activity without increasing the resource consumption for administration. The total savings have been estimated at 1,150 million Norwegian kroner by 2023.

Traffic management

In 2014, savings of 3 million Norwegian kroner have been realised as part of this sub-scheme. An anticipated streamlining saving of around 12 million Norwegian kroner is expected in 2015.

More efficient traffic management includes:

- The implementation of the European Rail Traffic Management System (ERTMS)
- More than halving the number of dispatchers in the 63 manually controlled stations as more stations become remote controlled
- The implementation of a new web-based tool for route planning and booking of train routes.
- Automatic, digital issuing of route orders to train drivers via tablets
- Electronic shift planning for traffic controllers and others who work shifts
- Improved remote control software, which may reduce the number of Traffic Control Centres nationwide
- A new system for customer and traffic information, providing better information but necessitating fewer employees.
- Removal of manual procedures for property management and operations and maintenance of property

Operations and maintenance

In 2014, savings of 15 million Norwegian kroner have been realised in the sub-scheme and savings of around 55 million Norwegian kroner are anticipated in 2015.

More efficient operations and maintenance includes:

- Correct positioning of emergency teams and equipment
- Improved utilisation of time allocated for work on the tracks
- Possibility of long-term planning and more rational operations through multi-year funding for renewal works
- The right expertise at the right place and good transfer of expertise to new employees and apprentices
- Correct and more standardised equipment fleet
- Reduced vehicle use
- Good maintenance management and measuring of productivity through systematic improvement work
- Secure access to the correct documentation
- Good overview within procurement, warehousing and logistics

Planning and development

The first effects from this sub-scheme are anticipated in 2015 with a saving of around 25 million Norwegian kroner.

Efficient planning and development includes:

- Efficient planning processes to ensure rational implementation of development projects
- Increased use of prime contracts for maximum utilisation of the supplier market
- Standardised technical solutions such as 3D project engineering for an improved visual overview
- Cost reduction through standardisation of sealing methods for tunnels
- Clarification of the fire concept principle for tunnels
- Cost reduction through space-efficient solutions for the placement of cables, technical structures and other railway technology

Support functions

In 2014, savings of around 60 million Norwegian kroner have been realised through renegotiation of supplier agreements and initiatives resulting in a lower requirement for support employees. In 2015 an additional 90 million Norwegian kroner are anticipated in streamlining savings.

Efficient support includes:

- Reduced costs for ICT through standardisation and improved control
- Improved utilisation of the transfer capacity in Jernbaneverket's own telecommunications lines
- Standardised and simplified finance management processes
- Simple document management with good system solutions
- Less safety guard hire where appropriate
- Improved procurement agreements
- Reduced travel costs through increased use of video conference equipment
- Release of more time for professional activities through simplified timekeeping and other administration relating to employment

33 level crossings removed
Teaching children to be safe around trains

122 level crossing initiatives

75 million Norwegian kroner are spent annually to secure and remove level crossings and the number of accidents appears to be decreasing.

Road culvert under construction on the Dovre Line at Tømten. Pedestrians will be given a separate underpass to the side.

"A plan has been created to secure and remove level crossings. The aim is to halve the number of level crossing-related accidents."

Last year, Jernbaneverket completed initiatives on 122 level crossings and 33 of them were closed down.

Removing or securing as many level crossings as possible is one of Jernbaneverket's key investment areas within safety work, as they account for around one third of the death risk associated with railway traffic. Thankfully the trend shows a reduction in the number of accidents.

"Safety work is continuous work and we work actively to reduce the number of accidents," explains Level Crossing Coordinator Tore Voss Fagervold. "A plan has been created to secure and remove level crossings. The aim is to halve the number of level crossing accidents and the main initiative will be to remove or secure so-called insecure level crossings with gates currently used by motor vehicles," he continues. Private level crossings with gates are only found in areas where only a small number of people usually cross the tracks. Nevertheless, this type of level crossing does constitute the majority of level crossings in the country. All traffic across such level crossings requires great caution.

Three private level crossings with gates at Jessnes to the north of Hamar were among those that were closed down last year and replaced by an underpass. The crossings were previously agricultural crossings but were used by local cottage owners until 2014. "The old level crossings were replaced by a concrete underpass. When private level crossings are removed we generally remove several in the same area to steer traffic to an underpass or bridge," explains Project Manager Werner Moen.

Level crossings

- The railway network has a total of 3,566 level crossings
- Nearly 700 of these can be found on lines without regular traffic
- Around 1,150 are temporarily out of service
- 450 have been secured using lights, claxons and barrier signals
- Around 200 level crossings are closed to motor traffic
- 1,050 are either agricultural crossings (700) or crossings with gates (approximately 300) that are in daily use by motor vehicles

Lukas visits the Norwegian railway museum

The mascot Lukas the Lion is an important educational tool used by Jernbaneverket in its work to raise awareness amongst children about the use of level crossings. He celebrated his birthday during spring 2014 at the Norwegian railway museum at Hamar.

When the employees at the Norwegian railway museum were asked by Communications Consultant and "lion mum" Carin Petterson from Jernbaneverket whether the museum could host Lukas the Lion's birthday party in spring 2014, there was nothing but positive responses. Lukas the Lion had previously visited the museum during the "railway museum day" in autumn 2013, chatting with children and adults about trains and safety.

Invitations to the birthday celebrations were issued through advertisements and children were given the chance to get to know Lukas and what he is interested in – railway safety.

On 5 April 2014 everything was ready for the birthday celebrations with squash and buns ready to be served. The birthday party also featured drawing, colouring and treasure hunts with prizes. Lukas the Lion's next show at the museum was over two days in June in connection with the "nursery days" at which all nursery children in Hamar are invited to spend a day at the museum. It was an exciting event to be part of and several of the children said that they had also been to the birthday party.

During "children's day" in October, Lukas the Lion greeted everyone outside of the museum as they arrived. Lukas also made guest appearances at various events in Arna and Åndalsnes during autumn 2014.

Increased safety on the Eastern Line

During summer the Østfold Line was subject to a complete transformation. Not only have the stations along the Eastern Line been modernised but safety has been increased at all levels.

In May 2007 when a trial section was to be chosen for the implementation of the ERTMS signalling system, the choice was the final section of the Østfold Line. The common European system for rail traffic management was therefore tested initially between Rakkestad and Sarpsborg, with the official opening of the trial section taking place in December 2013.

The summer job. Five stations were rebuilt during summer 2014. In addition to initiatives to increase safety for passengers and neighbours of the railway, all technical installations in the current station buildings were removed and established in a new technical structure.

While the new signal system and remote control system for the section mean increased safety in future, the most visible safety initiatives can be found in the new user-friendly stations. The platforms are at least 220 metres long, the stations have been given a universal design and have been equipped with new underpasses or overpasses. At Spydeberg the overpass bridge will be ready in June 2015 and the underpass at Askim with stairs and lifts opened in December. A new overpass bridge was subsequently designed at Mysen as well. It will be complete in October-November 2015.

Level crossings. In the most traffic-heavy hubs in the small towns and villages in inner Østfold there were previously slightly chaotic conditions. Cars, prams and schoolchildren were crossing the level crossings together, on the same narrow roads without any pavements. The new road barrier systems that are used at level crossings have separate pedestrian paths and barriers to protect pedestrians from road traffic. In addition, the claxons from the system are aimed at pedestrians while motorists find more benefit from the light signals to alert to approaching trains. With a new platform height of 76 cm and a solid fence between the tracks at the stations, illegal and dangerous crossing of the tracks is also greatly reduced.

- Reduction of dangerous trespassing on the track
- Forest felling keeps wildlife away from the track
- Spawning grounds identified prior to construction commencing

Far fewer animals hit by trains

Despite there being many more trains running, the number of animals hit by trains has not been this low since 2005.

1,447 animals were hit on Norwegian railway lines in 2014, around 700 less than the previous year. This is likely linked to Jernbaneverket having systematically felled trees along railway lines over the last five years.

"Even if there are more factors affecting the number of animals hit by trains, we're confident that the forest felling has contributed to this happy outcome," says Maintenance Director Odd Erik Berg. Vegetation was cut and cleared at a total cost of 50 million Norwegian kroner in 2014.

Other relevant factors include variations in snow volumes and pasture conditions, but Jernbaneverket has observed a downward trend in recent years, since the forest felling project was implemented for real. The exception was 2013 when there was an increase. The average for the last ten years is 1,861 animals hit, while the 2014 figure was 1,447.

In spring 2014 an action plan was adopted in respect of collisions with moose, domesticated reindeer and sheep for the period 2014-2017. Jernbaneverket collaborates with the sheep and reindeer industries on local initiatives. Among the things offered is financial assistance to relocate reindeer flocks across the railway track to new pasture areas. Jernbaneverket can also provide funding for sheep fencing along most lines provided that the industry itself carries out repairs and maintenance of the fencing.

On the Bergen Line electric fencing has been erected along several sub-sections in Hallingdal, something which has been found to be effective for keeping moose away from the track.

Moose collisions top the statistics with 32 percent of all animals hit being moose. This is followed by venison (21 percent), domesticated reindeer (16), sheep (15) and deer (5).

The following has been done at Kråkstad, Tomter, Spydeberg, Askim and Mysen:

- Fencing of the station area and fences between the tracks to prevent illegal crossing of the tracks.
- Universal design with ramps and stairs, handrails and extensive illumination of the entire general area.
- Central platforms have been removed and new platforms have been established on either side of the tracks (76 cm high and with a minimum length of 220 metres)
- New overhead line system
- New road barrier system with separate walkway/barrier for pedestrians
- Askim has been given a new general public underpass with stairs and a lift
- Mysen has been given a new stabling track with train heat and a new overpass bridge
- Spydeberg will be given a new overpass bridge.
- Remote controls maintain the current safety levels without local dispatchers

Bergen–Arna: Taking the pulse of the river

Storelva is Hordaland's best salmon river. That will also be the case when the work to broaden and extend the river culvert below Arna station has been completed.

To prevent the fish stock in the river from being destroyed, Jernbaneverket has identified and recorded fish and spawning grounds in the river. The same type of study will be conducted when the construction works are complete to establish whether the fish are equally happy afterwards.

"I would like to praise the project management who take environmental responsibilities this seriously. The identification was not ordered by the environmental authorities, but Jernbaneverket still chose to implement it," says Environmental Consultant Silja Oda Solheimslid, who has been hired from Cowi AS.

- 2-metre culverts against flood damage
- Researching climate adaptations
- Putting ground heat to use

Ready for wet and wild weather

"This is how it should be done," applauds Hydrologist Steinar Myrabø from Jernbaneverket to the Project Manager for the new E6 through Gudbrandsdalen, Øyvind Moshagen from the Norwegian Public Roads Administration. Never has a European road been built to withstand wetter and wilder weather. The development is taking place in close cooperation with Jernbaneverket.

Øyvind Moshagen from the Norwegian Public Roads Administration (left) and Steinar Myrabø from Jernbaneverket demonstrate the dimensions of the culverts that are now being used to manage the flood water from the tributaries in the steep terrain.

Gigantic two-metre culverts are one of the initiatives for managing flood water from the high hillsides in Gudbrandsdalen that will protect both the new E6 and the Dovre Line. The cooperation will be the model for the rest of the country.

"The costs for drainage and water management in the E6 project have more than doubled due to the new requirements in the standard for roads and railways," says Project Manager Øyvind Moshagen. "We have modified streams, extended bridges across smaller waterways and added more and better initiatives with regard to safety.

In light of the experiences from the floods in 2011 and 2013, the new road has been dimensioned for a 200-year flood plus a safety margin of one metre, from which the Dovre Line will also benefit.

Across agencies. It was in 2012 that Jernbaneverket, the Norwegian Public Roads Administration and the Norwegian Water Resources and Energy Directorate started a four-year long collaborative project called NIFS (natural hazards, infrastructure, floods and landslides). Three pilot projects were established across the agencies and sector regions in Gudbrandsdalen to handle floods and water that has gone off course.

"The key for reducing flood damage on the Dovre Line and E6 through Gudbrandsdalen is about keeping control in the tributaries. The Lillehammer–Otta E6 project demonstrates how it should be done," Myrabø says. He praises Moshagen and the Norwegian Public Roads Administration for how the new European road is being built.

Like a dam. "In buiding a new E6 we have an excellent premise for handling larger water volumes that will pass both the road and the railway," Moshagen says and adds: "We are just as vulnerable if something unforeseen happens far up in the valleys that results in rivers and large streams changing course and ending up somewhere where neither the E6 nor the Dovre Line is prepared for large water flows."

This happened in Gudbrandsdaleen during the last two floods when it resulted in substantial natural damage totalling several hundred million Norwegian kroner and causing the railway to be completely closed for several weeks. The substructure of the Dovre Line acted as a dam and collapsed after several decades of inadequate maintenance and upgrades.

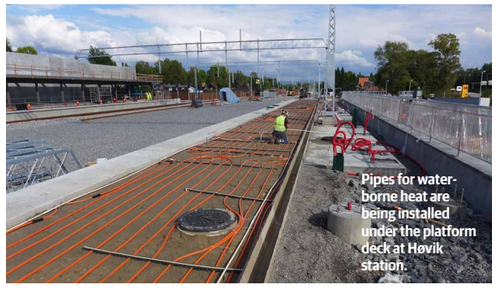
> "The key for reducing flood damage on the Dovre Line and E6 through Gudbrandsdalen is about keeping control in the tributaries."

Optimism. "If culverts, drainage routes and streams had been maintained better the extent of the damage would have been much smaller in 2013," Myrabø claims. "But when we see how the E6 project at the Lillehammer–Otta section has learned from the experiences of the last two floods, there is definitely grounds for optimism. It is entirely possible to get up to date with the maintenance backlog on the Dovre Line," the hydrologist says.

New technology – new possibilities. Drone-based technology opens up new possibilities for monitoring and notification of landslides and floods threatening the railway. Robust solutions for use in adverse weather conditions and over long distances are not yet available as off-the-shelf products and further development of the technology will be necessary before it can be used in everyday work.

Research and climate adaptations. The NIFS (naturfare.no) research project is looking for good, efficient and future-oriented solutions to handle natural hazards and emphasises the development of useful tools for everyday use. One example is the field manual for floods and landslides, designed to provide support for both experienced and inexperienced professionals and consultants following up on flood and landslide incidents in the field. The manual is designed to help them with their assessments and ensure that they work safely. The manual became available in spring 2015.

The NIFS project is now entering its final year but the next big investment within climate adaptation research has already been planned. Jernbaneverket participates as one of 18 parties in a new centre for research-oriented innovation, SFI Klima 2050, which, over the course of eight years, will study climate adaptation of buildings and infrastructure. The centre's ambitions are to develop expertise at a high international level in order to reduce societal hazards linked to climate changes, increased precipitation and flood water in developed environments. SINTEF is the host institution for the centre, which is partly financed by the Norwegian Research Council.



Pipes for water-borne heat are being installed under the platform deck at Høvik station.

Stabekk and Høvik create their own heat

Stabekk and Høvik are the first stations in Norway to harvest platform heating from their own land. Energy consumption is thereby reduced by around two thirds, which is good for both finances and the environment.

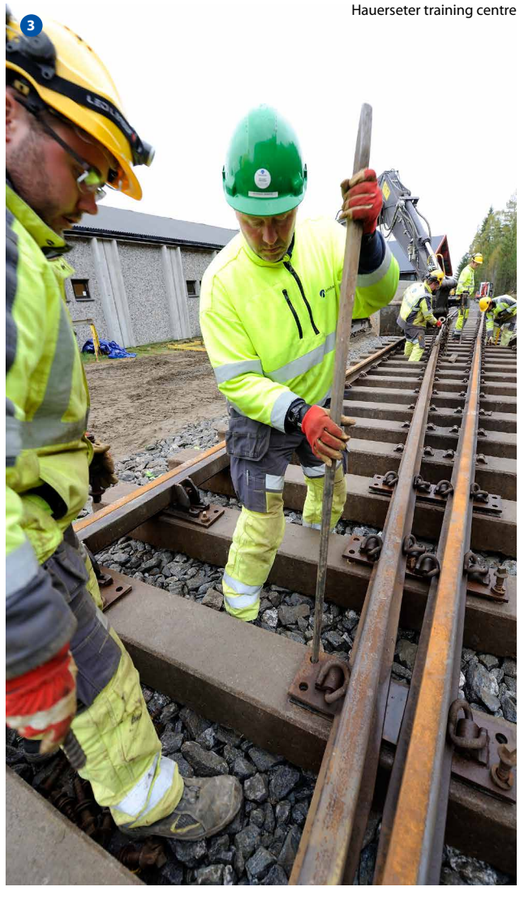
30 energy wells under the parking area at stations are being used as the heat source for a heat pump, providing sufficient heat to keep the platforms ice-free during winter. Water is routed down into the 300 metre deep wells, further heated using heat pumps and sluiced over to a system for water-borne heat under the platform deck.

The investment costs associated with the installations are large but lower maintenance costs and reduced energy consumption mean that it is worth it over time. This applies regardless of whether heating cables are compared to electrical heating or shovelling and gritting. Geothermal heat is also low-emission form of energy and in this case it would not have been utilised for any other purpose. The experiences from Stabekk and Høvik will inspire investments in geothermal heat in connection with future station upgrades.

Jernbaneverket is drilling for geothermal heat. Traditional snow shovelling and gritting will soon be history at the stations in Høvik and Stabekk.

2014

Hauerseter training centre



January–February

11 January: Train traffic management on the Ofoten Line has been streamlined. Electronic distribution of timetable information via PCs and tablets directly to train drivers has replaced paper-based information and makes the working day easier.

January/February: The snow is falling heavily and it is a challenge to keep it away from the railway in Eastern Norway, the Bergen Line and the Sørland Line. Jernbaneverket's Di3 train with ploughing equipment is running continuously and a large snow plough from the mountain stretch on the Bergen Line must be shipped south to the Sørland Line.

1 **26 February:** The Kongsvinger stabling facility, with enough space to park five Flirt trains, is officially opened by Secretary of State Bård Hoksrud from the Ministry of Transport and Communications. The facility is crucial to the development of the Kongsvinger Line and implementation of the new timetable.

March

4 March: Jernbaneverket launches a new net-based service with punctuality data for each individual train departure and route.

2 **6 March:** More than 200 viewers turn up to watch Secretary of State Bård Hoksrud fire the final blast of explosives at the Holmestrand gate. With this, a continuous 12-kilometre long tunnel has been build past Holmestrand.

14 March: Jernbaneverket enters into a new agreement concerning assistance services at Oslo S.
The guard service at the stations will now help people with various functional impairments find their train.

April – May

3 **1 April:** Jernbaneverket's new organisation comes into force. The aim is to simplify and streamline business. Less money will be spent on administration and more money will be allocated to work "out on the track".

In order to develop and ensure sufficient railway engineering capacity and expertise for the future, both internally and elsewhere in the railway sector, Jernbaneverket establishes a strategic staff unit, the Competence Centre, which will also be responsible for the Norwegian railway school.

24-25 May: MiniØya children's festival in the Tøyen Park in Oslo is visited by Jernbaneverket's mascot. Lukas the Lion is a train driver and explains to the children that he gets scared when people do not look out for the train.

June

4 **18 June:** The construction and civil engineering industry, led by the Minister of Labour and Social Affairs, Robert Eriksson, sets mutual goals for an injury-free industry. Director General of Jernbaneverket, Elisabeth Enger, signs a charter in which Jernbaneverket commits to being a leading construction client organisation when it comes to HSE and safety at the construction sites.

July

July: In summer 2014 train punctuality is lower than usual as a result of buckling and record heat. Jernbaneverket decides to focus more on prevention in summer 2015.

August

5 **August:** Trondheim–Støren marks its 150-year anniversary on Saturday 16 August, and Director General of Jernbaneverket, Elisabeth Enger, has the chance to have a dance with "Bør Børson".

September – October

24 September: The Norwegian Railway Inspectorate authorises an exemption from the regulations relating to train operations, allowing longer and more efficient work sessions on several line sections without remote control until 1 October 2019.
Prior to this, Jernbaneverket had proposed the inclusion of new measures in work instructions in order to uphold safety.

6 **October:** Vast precipitation volumes and the 200-year flood in Western Norway wash away the ground underneath the railway at several locations. Following intense, 24/7 efforts, the Bergen Line is able to open again after a few days whereas the damage to the Flåm Line takes longer to rectify. In Romsdalen, the Mannen mountain is threatening to slide and results in the Rauma Line being closed for three weeks.

28 October: Jernbaneverket and Østlandssamarbeidet (the Eastern Norway Cooperative) arrange a conference about the InterCity development. Several politicians voice their support for completing the development by 2030 to stay ahead of population growth.
NSB's customer satisfaction survey shows that train passengers are happier with traffic information and station areas for which Jernbaneverket is responsible.

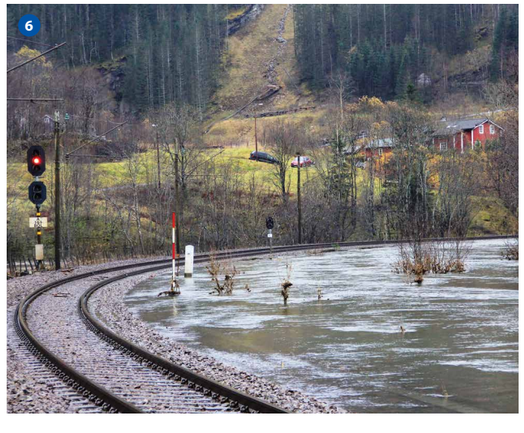
November – December

15 November: Jernbaneverket is ready for winter. Heavy yellow machinery and nearly 1,500 employees are ready to clear platforms and 4,000 kilometres of tracks.

Parliamentary negotiations result in an additional 380 million Norwegian kroner for the operation and maintenance of the railway. This enables Jernbaneverket to tackle the maintenance backlog in 2015 and demonstrate that further investments are worthwhile.

23 November: Jernbaneverket and NSB initiate full-scale function testing of the new electronic distribution system for timetable information, FIDO. The system will be put into use by traffic management across the entire country in 2015.

18 December: Jernbaneverket signs the contracts to ensure the transfer of operational responsibilities and the facilitation of more competion between operators at the railway freight terminals.



161 years of Norwegian railway history

1854 The first railway line in Norway (Kristiania–Eidsvoll) opens.

1890–1910 1,419 kilometres of tracks are built in Norway.

1909 **The Bergen Line** is completed. The price was the equivalent of an entire national budget.

1938 **The Sørland Line** to Kristiansand opens.

1940–1945 **German forces assume control of NSB** Restrictions on energy consumption give the railway a near-monopoly on transport. The railway network is expanded by 450 km using POWs.

1952 Funds are granted for the **electrification of the railway network** under the motto "Away with the steam" ("Vekk med dampen").

1969–1970 The 1952 electrification plan is completed.

1996 NSB is split into NSB BA and Jernbaneverket.

1999 **The Gardermoen Line.** The first high-speed railway in Norway is a success.

2000 The tragic **Åsta accident,** the third big railway accident in Norway in 50 years, leaves its mark on the railway at the turn of the Millennium.

2004 NSB and Jernbaneverket celebrate the **150-year anniversary of the railway together**

2005 **The largest development project** within Norway, the double track between Sandvika and Asker, opens.

2007 In Jæren, the **Ganddal freight terminal** near Sandnes is completed in December. In total, about 100 development projects worth NOK 2.2 billion were completed.

2008 The Oslo Project for the renewal of the railway network through Oslo starts in spring.
The introduction of a new **travel guarantee scheme** is approved.

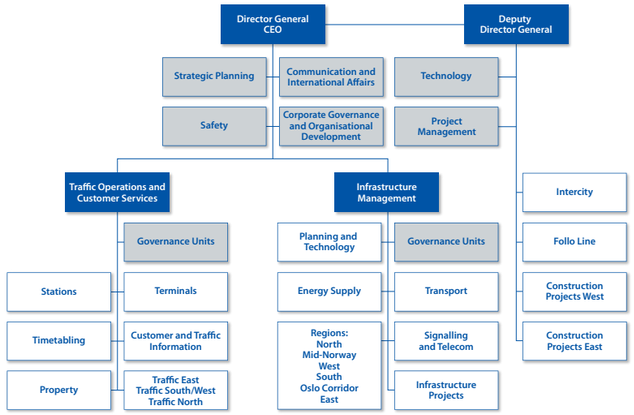
2010 A decision is made to build a dual tunnel in what will become **the longest railway tunnel in Norway** on the Follo Line, the 22 km new double track that will be built between Oslo and Ski.

2012 The punctuality of train traffic is better than for years, with **nine out of ten trains running on time.**

2013 The national transport plan for 2014-2023 is presented, according to which an investment of **168 billion Norwegian kroner will be spent on the railway in the next ten years.**

2014 Full route restructuring allows more trains from December.

2015 Changing railway sector. The Norwegian government presents a railway reform proposal.

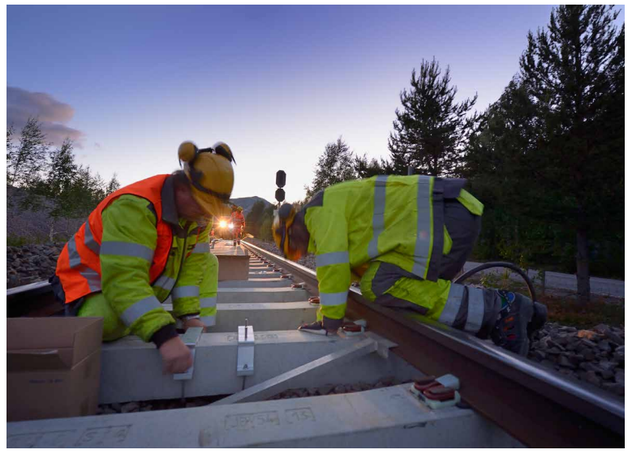


About Jernbaneverket

Jernbaneverket plans, constructs, operates and maintains the Norwegian railway network and is responsible for traffic control. Among other things, traffic control entails distributing available track capacity to the different train companies, timetabling, train management and public information at the stations. Jernbaneverket is a subsidiary agency of the Ministry of Transport and Communications.

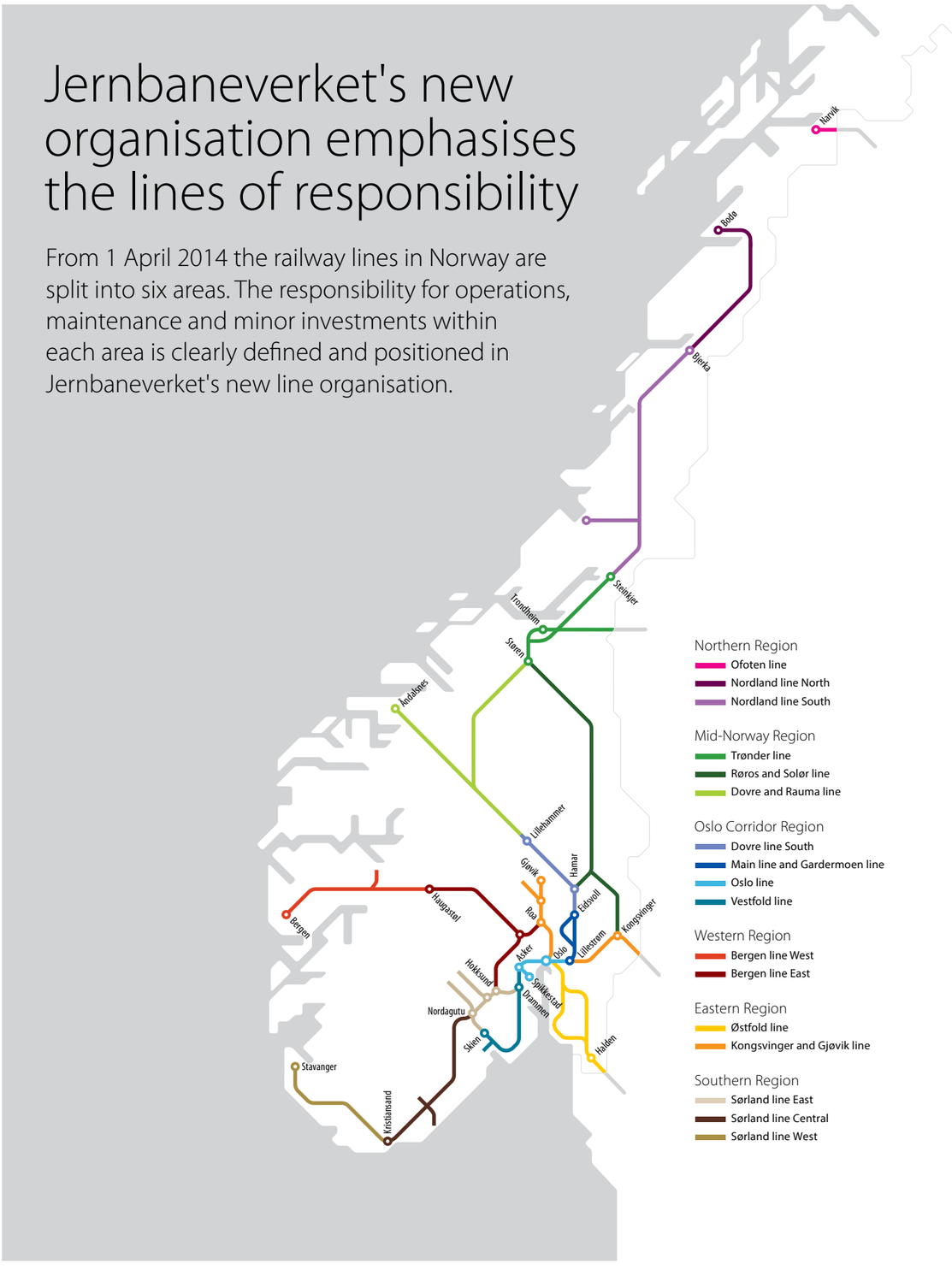
Jernbaneverket is managed by the Director General, Elisabeth Enger. In 2013 a new organisation was adopted. From 1 April 2014 Jernbaneverket consists of the following main divisions: Infrastructure Division, Traffic and Marketing Division and the staff of the Director General of Jernbaneverket, as well as the major development projects that report directly to management via the Deputy Director General.

Jernbaneverket employees are spread across much of the country and have a broad range of professional expertise. In Jernbaneverket, you can find dispatchers, traffic controllers, railway fitters, land consolidation graduates, construction managers, architects, geotechnicans, supervisors, environmental advisers, engineers and track coordinators, to mention some of the many occupations represented. As of 31/12/2014 the number of employees in Jernbaneverket was 4,039.



Jernbaneverket's new organisation emphasises the lines of responsibility

From 1 April 2014 the railway lines in Norway are split into six areas. The responsibility for operations, maintenance and minor investments within each area is clearly defined and positioned in Jernbaneverket's new line organisation.



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