

On track

2012

GLIMPSES FROM THE NORWEGIAN NATIONAL RAIL ADMINISTRATION'S ACTIVITIES

More for the money

In 2012, railway construction maintained a brisk pace. More than 90 per cent of investments went to the supplier market.



Jernbaneverket

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EDITORIAL

"Both the number of apprentices and applicants for available positions are increasing. In 2012, we received 7,663 applications for 459 available positions."

It works!

Major efforts in maintenance and renewals in recent years are showing results. Nine out of ten trains were on time in 2012. This inspires us to continue to make efforts to provide society with more value for money.

The summer of 2012 was the last year with long-term closures of train traffic for extensive renewal and maintenance work in the Oslo region, and we are seeing the results of the efforts.

One measurement of Jernbaneverket's (the Norwegian National Rail Administration) contribution to punctuality is the number of hours of delays caused by infrastructure issues. In 2012, this figure was 8,463 hours. This is a reduction of 2,170 hours compared to the previous year, and is the best result achieved since measurements began. The good result is likely explained by good collaboration with the rail companies, good winter preparedness and fewer faults in the infrastructure where measures were implemented.

2012 also saw several incidents of extreme precipitation, avalanches and landslides that affected traffic. We are happy that our work on preparedness ensured the safety of life and health, in that affected track stretches were closed to traffic in time.

More value for money Record-high investments in new infrastructure were made in 2012. 91.5 per cent of the investment budget was spent in the supplier market, while smaller projects were performed by Jernbaneverket employees.

Large construction contracts have proved attractive for companies within and outside of Norway, and have led to good competition. This clearly shows that predictable financing and good framework conditions are significant to the optimal utilisation of the funds.



Our large development projects have maintained a brisk pace. We also completed the new sidings for turning and stabling trains that needed to be in place in order for us to introduce a new timetable with more trains in Eastern Norway in December.

Using money well. Planning was also a central topic in 2012. For instance, the national transport agencies presented their proposal for a National Transport Plan for the 2014-2023 period in February 2013, and Jernbaneverket's ongoing work on strategy is to enable us to handle increased allocations and several large assignments in the years ahead.

For each krone entrusted to us, as much as possible must be used on the tracks. We therefore hired the McKinsey consulting firm in 2012. By 2014, our organisation of work processes and improved work tools shall ensure optimal resource use.

Extensive activity in the sector has made many people aware of the railway as an attractive place to work. The numbers of apprentices and applicants for available positions are increasing. In 2012, we received 7,663 applications for 459 available positions.

Yes, we are on the right track! However, after a 2012 review of the needs for all lines we know that much remains to be done to catch up with the maintenance and renewal backlogs. Our challenge lies in getting the priorities right and getting more out of the budget we actually have. We are on track for a reliable and future-oriented railway in Norway.


Director General

The train revolution is underway.

Local trains at 200 km an hour. Departures every 10 minutes. Travel times in Eastern Norway up to 20 minutes faster. This will be the new reality for train passengers.

At the end of 2012, the first part of the new timetable was launched. This resulted in more effective train traffic. The train revolution will be completed in December 2014, when the last parts of the rearrangement of routes will be in place.

This will lead to significant improvements in most people's train service. The improvements, which began in 2005, are based on Norway's largest jigsaw puzzle.

"The new clock-face scheduling model is first and foremost the most optimal timetable we can achieve with the current infrastructure. This is the solution that gives the majority of those who travel by train daily a better service", says Nils Hansegård. He worked on planning the train revolution from 2005 until he retired at the end of 2012.

Where to put the first piece of the puzzle? Each hour, only 20 trains in each direction can pass through the Oslo tunnel. The tunnel has only two tracks. The 20 time slots are distributed amongst three airport trains, two freight trains, one long-distance train and 14 local and regional trains. The trains must also be distributed in such a way that they run at regular intervals.

"The Oslo Central station is a bottleneck because we will have trains that must use crossovers to get to the right track", says Hansegård.

Trains that must cross from one side to the other over many tracks impose significant limits on capacity. The Spikkestad Line is a well-known example of this.

The Spikkestad Line ran on the Asker Line before the restructuring. When the trains reached Asker, they had to cross every track at the station to reach the Spikkestad Line. With more trains passing through Asker Station, this would take up so much of the capacity that it would not be possible for more trains to run through Asker. If the Spikkestad trains were to still use the Asker Line, this would have had significant consequences for the timetable for the rest of Eastern Norway, and today's route model would have been impossible to implement.

When making a completely new timetable, it is easiest to start with the

"Jernbaneverket has built new turning sidings and stabling sidings for trains at Eidsvoll, Drammen and Skien, amongst others."

trains that usually run in a specific pattern, such as the Airport Express Train and trains running between hubs and stopping at Asker, Sandvika, Lysaker, Skøyen, Nationaltheatret, Oslo Central station and Lillestrøm. Starting in 2014, these trains will run every 10 minutes.

"We have worked and reworked this route model so many times and so thoroughly that we are left with the most optimal model we could achieve", says Hansegård.



The station area at the old and venerable Eidsvoll station was completely renovated in 2012, as part of the preparation for a new basic route from 2014. Jaroslaw Lewandowski from Implen Norge AS is finishing an eight-metre high sheet pile wall.

Tight timetable. Seven of Norway's ten largest stations are located between Asker and Lillestrøm.

After the 2012 rearrangement of routes, trains now run five times an hour from each hub between Asker and Lillestrøm. Starting in 2014, six trains an hour will be introduced, and with that a ten-minute frequency will have been introduced. The new timetable is very tight; so tight that it requires all trains on the Gardermoen Line to be able to achieve a speed of

200 km/hour. If local trains running at 130 km/hour are allowed onto the track, delays will ensue. To implement this significant change, investments have been made in new facilities at a number of stations to receive the Norwegian State Railways' (NSB) new Flirt trains. NSB has purchased 50 new trains, and 26 old trains will be scrapped.

Jernbaneverket has built new turning sidings and stabling sidings for trains at Eidsvoll and Drammen. In

the time leading up to 2014 and the next expansion of the route model, such facilities will be completed at the Lillestrøm, Ski, Kongsvinger and Høvik stations. New and longer platforms have also been built, or will be built, at a large number of stations. Many pieces of the puzzle must be in place before the trains can start operating on new and faster routes. Jernbaneverket will conclude this work in 2014, at a cost of nearly NOK three billion.

"Many pieces of the puzzle must be in place before the trains can start running on new and faster routes."

- ▶ The train revolution – Norway's largest jigsaw puzzle
- ▶ Costs NOK 2.7 billion
- ▶ Preparing a new basic route from December 2014

FACTS The train revolution

From December 2012

- ▶ Trains every half hour Drammen–Dal (stops at hubs between Asker and Lillestrøm).
- ▶ Trains every half hour Lillestrøm–Asker–Spikkestad (stops at all stations).
- ▶ One train per hour Asker–Kongsvinger (stops at hubs between Asker and Lillestrøm).
- ▶ The Moss–Spikkestad shuttle train is only run to/from Skøyen.

From December 2014

- ▶ Departures every 10 minutes between Asker and Lillestrøm (stops at hubs).
- ▶ Departures every 15 minutes between Asker–Lillestrøm (stops as for local trains).
- ▶ Three trains per hour Drammen–Eidsvoll.
- ▶ The Moss–Skøyen and Ski–Skøyen shuttle trains will be extended to Lysaker/Stabekk.
- ▶ The Østfold Line will see more departures once the Follo Line has been completed.

The measures

- ▶ 11 new sidings for turning and stabling trains: Eidsvoll, Drammen, Skien, Kongsvinger, Moss, Kongsvinger, Lillestrøm, Ski and Høvik.
- ▶ Extension of platforms: Frogner, Moelv, Lier, Dal, Hauer seter, Spikkestad, Heggedal, Knapstad, Skotbu and Råde.
- ▶ The power supply is being upgraded and parts of the signalling system on the Gardermoen Line and Main Line are being modified.
- ▶ Extension of track 13 at Lillestrøm.
- ▶ New signals and a number of other modifications in the Oslo tunnel.
- ▶ The entire operation up to December 2014 is estimated to cost about NOK 2.7 billion.

On track for a greener Norway

Freight transport by rail in a harsh climate such as Norway's is not without its challenges. Cargolink is one of the companies that has succeeded. They actually get you to eat greener.

Karl Ivar Nilsen became the CEO of Cargolink in the autumn of 2011. Up to that point, the company had had deficits of millions of kroner every month. The 2011 loss ended at NOK 66 million, but then things started to improve. In the third and fourth quarters of 2012, the figures changed from red to black, and Nilsen thinks it was a natural disaster that caused the turnaround. In March 2012, a large landslide closed

"With more freight per train, we would have improved earnings by many millions of kroner without incurring extra operating costs."

the Dovre Line, and the line was closed to trains for eight weeks. "The landslide on the Dovre Line was actually the big turnaround for us. We managed to regroup quickly and adapt to the market and the constraints. Our employees worked hard to achieve this. In this way, we maintained our service to our customers, and the market gained confidence that Cargolink could be counted on", says Nilsen.

Transports everything. In collaboration with the business sector, Cargolink wants to transfer more freight from road to rail, and they transport goods for, for example, DB Schenker, Tollpost and Rema 1000. "We transport everything. For example, if you order a television online, it is highly likely that we will transport it. The same is true for the things you have in your fridge", says Nilsen.



In addition to regrouping quickly when the Dovre Line was closed, the organisation has taken a number of steps to remove the red figures from its accounts. Cargolink focused on an increased turnover and lower personnel and material costs. The routines for loading and unloading goods were therefore drilled and the time the freight trains were at terminals was reduced significantly.

Making money on green freight. Though Cargolink has managed to turn red to black, the CEO has strong opinions about what must be done to get more freight on the rails. "Currently, there is more talk of passenger transport than of freight. That is also where the money is going. We have to start thinking more about freight on the railway. If we are to increase the share of freight by rail,

the journey time must be reduced, among other things", says Karl Ivar Nilsen. Journey time, or travel time, is just as important for freight as it is for passengers. According to Nilsen, it is the journey time that makes freight by rail lose market shares compared to freight by road. "We must be able to run longer and heavier trains to increase the degree of coverage per assignment, and we must have more and longer passing loops. It is entirely possible to make money on green freight in Norway, as long as conditions are put in place to enable this", says Nilsen. "With more freight per train, we would have improved our earnings by many million kroner without increasing operating costs. In the final count, society as a whole would benefit", Nilsen argues.

CEO Carl Ivar Nilsen in Cargolink wants shorter journey times and increased market shares for freight by rail.



All-out effort to improve traffic information

Jernbaneverket started to test new displays on the information screens at the Oslo Central station and Nationaltheatret stations in 2012. The new displays are more customer-friendly and provide more information on the train about to arrive, including whether it has single or double carriages, where the entrances for strollers and wheelchairs are, and where the quiet carriage and dining carriage are. At the Nationaltheatret station,

the screen displays are also tied to the sector marks at the platforms. This makes it easier for travellers to stand at the right point on the platform before the train arrives. When the test period for the new displays is over, the solution will be used at all hub stations in the Oslo area. We will also continue to develop the solution, and in time it will be possible to provide better information about where on the line the train is, if it is not on schedule.

New information board at Oslo Central station. In the summer of 2012, a new information board was installed in the station hall at Oslo Central station. The information board measures 60 square metres and consists of 100 LCD screens. The entire board weighs six tonnes and is 513 inches long. The old information board with fluorescent lighting was from 1999. Jernbaneverket decided to replace it when it became difficult to obtain parts for it.

Traffic growth

Train traffic continues to grow. In 2012, more than 60 million train journeys were made in Norway. NSB reports growth on most lines and reached 53.8 million passengers last

year. This is an overall growth of 2.6 per cent. The Airport Express Train reports about six million passengers, which is a new record. The international trains on the Ofoten Line and

Kongsvinger Line operated by SJ (the former Swedish State Railways) come in addition to these figures.



- ▶ The Rauma Line, Dombås–Åndalsnes: 83,800 passengers, +9 per cent
- ▶ The Røros Line, Hamar–Røros: 208,000 passengers, +6 per cent
- ▶ The Dovre Line, Oslo–Lillehammer: 1,354,000 passengers, +5 per cent
- ▶ The Nordland Line, Trondheim–Bodø: 176,800 passengers, +4 per cent
- ▶ The Vestfold Line, Oslo–Skien: 1,721,000 passengers, +4 per cent
- ▶ The Østfold Line, Oslo–Halden–Gothenburg: 1,456,000 passengers, +4 per cent
- ▶ The Flåm Line passed 630,000 passengers, +2.7 per cent

Nine out of ten trains

In recent years, a number of measures have been implemented to ensure that more trains are on time. The train companies have also worked actively on punctuality. Causes of delays are followed up, winter maintenance has been improved with regard to both trains and infrastructure, and there has been a focus on efficient station stops. This has shown results. Freight traffic also saw a clear improvement of punctuality in 2012. The largest freight train company, CargoNet, achieved 82 per cent punctuality.

FACTS What is punctuality, regularity and uptime?

Punctuality, regularity and uptime are measurement parameters that Jernbaneverket must report to the Ministry of Transport and Communications.

Punctuality
 ▶ Punctuality is the number of trains on time at the final station (as a percentage). A train is considered to be on time if it reaches its final station within a margin of three minutes and 59 seconds. For long-distance trains, this margin is five minutes and 59 seconds. The target for passenger trains is for 90 per cent of trains to reach their final station on time, while the target for the Airport Express Train is 95 per cent.

Regularity
 ▶ Regularity is the number of trains that are run as planned according to the timetable (as a percentage). Trains that have been planned cancelled far in advance as a result of work on the tracks, do not count.

Uptime
 ▶ Uptime: The operational stability of the railway is measured in uptime. This is calculated as the ratio of all delays (in hours) for all trains that are run according to the planned total travelling time in the timetable.

See the punctuality, regularity and uptime figures for 2012 in the statistics section.

Measures that work

In recent years, Jernbaneverket has increased its efforts in maintenance and renewal. There are clear results: improved punctuality and fewer faults.

The railway through Oslo must work. Tens of thousands of people travel back and forth to work every day. Local trains, InterCity trains, airport express trains and long-distance trains as well as freight trains must go in all directions into, through and out of this hub in the Norwegian railway system. Therefore, the majority of the work has been done in Oslo, which was also the case in 2012.

Total renewal. Four years ago, a separate project was established in Jernbaneverket with the goal of implementing a total renewal of track, cables and contact lines from Etterstad in the east to Lysaker in the west. In the summer of 2012, the tracks through Oslo were closed for six weeks to allow Jernbaneverket to perform extensive work on its facilities on this stretch. Twenty-four points were replaced at Oslo Central station, two kilometres of track were renewed, tracks 1 to 7 received new contact line systems and several kilometres of new cables were laid and made operational in the Oslo tunnel and at Oslo Central station.

The work that was most visible to passengers was perhaps the replacement of the large information board in the Oslo Central station hall. The renewal project has led to a clear improvement in the punctuality of trains during recent years. In 2012, 90 per cent of trains were on time again, for the first time since 2005.

The Østfold Line. Work on the total renewal of the track on the Østfold Line from Moss to Kornsjø continued

in 2012. This is a large-scale job that will continue for several years. In the course of the year, the preparatory work reached the Skjeberg area, with the cleaning of culverts, trenching and construction of new cable paths. The technical signalling work between Fredrikstad and Sarpsborg was completed. In 2012, the ballast cleaning system was run on the stretch from Råde to just before Fredrikstad. When the preparatory work has been completed and the ballast cleaning system has been run on the stretch, we get a good, stable track for many years.

The Bergen Line. A multi-year programme to improve frost and water safety is being carried out on the Bergen Line. Work started at Bulken in 2011 and is moving west, and the entire stretch from Bulken to Arna will have a better drainage system that can handle more water and which will result in a more robust track. At Hallingskeid, a new snow shed was erected above the track for several

"In 2012, 90 per cent of trains were on time again, for the first time since 2005."

hundred metres. The new shed replaces the old one, which burnt down in 2011, and at the same time it is longer than before, which helps ensure safer winter operations. At the end of May/beginning of June, the new remote control system for the Bergen Line was connected. This results in more stable operations, fewer errors and better information to the public.



The total renewal of the tracks at and around Oslo Central station has had significant effects, but the rest of the rail network also needs renewing.

The Dovre Line. Improvements in the drainage system along the track have also been among the main tasks on the Dovre Line. In 2012, extensive work was carried out, including digging deeper line trenches, cleaning ditches and replacing culverts. The drainage system along the line must be improved in order for the line to be better prepared to handle large amounts of precipitation and flooding, both of which have occurred more often in recent years. Between Dovre and Dombås, a large project with extensive avalanche/landslide protection measures was completed; this project had been ongoing for several years. Work has been completed in the side terrain above and below the track to prevent avalanches and landslides. The 107 metre Skog tunnel between Bergseng and Lillehammer,

- ▶ Nineteen contractors worked on renewals in the Oslo area during the summer of 2012
- ▶ The work has led to improved punctuality and fewer faults

from 1958, was removed during Easter 2012 and replaced by a cut. This was done because there were problems with frequent rock falls and poor rock in the tunnel. A large landslide took place by Snøan in Soknedal south of Støren in March 2012. It was particularly challenging to rebuild the track, which had to be done from the floor of the valley and took eight weeks. A separate surveying programme has been started with the view to improve avalanche/landslide prevention in the side terrain throughout Soknedalen.

The Sørland Line. On the Sørland Line, the contact line system between Egersund and Sandnes dates from 1956 and must be renewed. The work of laying foundations for new masts for the contact line started in the winter of 2011, beginning at

Egersund. In 2012, the work continued towards Sandnes. The renewal of the contact line is important in order to prevent faults and problems with the power supply to the trains. A larger programme is also ongoing that will renew the many steel bridges on the Sørland Line.

"8,800 metres of track were replaced along the Ofoten Line in 2012."

The Nordland and Ofoten Lines. Improving drainage and safeguarding against avalanches and landslides are central to the Nordland Line and several other stretches. In 2012, a

number of large and small measures were completed along the stretches. On the Ofoten Line, rails must be replaced in the curves every summer due to substantial wear from the heavy ore traffic. 8,800 metres of rails were replaced along this line in 2012. At Norddalen, an avalanche shed was extended to better safeguard the track against avalanches and rock slides.

The Tinnos Line. On the Tinnos Line, the stretch to Notodden was reopened in June 2012. The line had been closed for nearly a year after most of the station area at Notodden disappeared in a landslide following extremely heavy rains in the summer of 2011. At the same time, the line was given a new signalling system with centralized and automatic train control.



Yngve Ottesen in Jernbaneverket can work safely in the maintenance train, even though the Airport Express Train passes at 200 km/hr.

Maintenance train on track

In the spring of 2013, Jernbaneverket started operating its new train for more efficient track maintenance. The train set consists of three carriages, making it possible to perform all track maintenance from the train without affecting traffic on adjacent tracks. In this way, maintenance becomes more efficient.

Jernbaneverket has introduced a completely new way of performing track maintenance. By using a special, newly developed train set, it shall be possible to perform all forms of repairs and track maintenance from inside the maintenance train. The new train is like a rolling track workshop that carries all machinery on board. The floor can be opened and the width of the walls can be adjusted out, allowing staff to work inside on the track in all kinds of weather. All the while, train traffic can pass on adjacent tracks, unobstructed by the work; this could previously only be done at slow speeds.

Maintaining new double track. "With this new train we show how we are to maintain the new double track stretches in the future, and it now looks like we are getting an increasing number of these", says Elisabeth Enger,

"The new train is like a rolling track workshop, with all machinery on board."

Director General of Jernbaneverket. "For us to be able to maintain as high a level of operational stability of the track as possible, and absorb future

traffic growth, it is very important to have efficient maintenance and quick completion of the work," she says.

First of its kind. Though similar solutions can be found, for instance in Switzerland and Austria, the Norwegian maintenance train is the first of its kind. The train was developed by the German company Robel Bahnbau-maschinen in collaboration with Jernbaneverket. The train will be stationed at Lillestrøm and will mainly be working between Drammen and Gardermoen. It has been tested on Norwegian track and was put into operation in the spring of 2013. In time, several such sets will likely be purchased.

Pick and shovel on the Bergen Line

There is round-the-clock preparedness to keep the Bergen Line open to traffic year-round. Machinery must often give way to raw, human muscle power.

At Finse, there are always three snow removal coordinators during winter preparedness from December to May. One coordinator is always on duty. On guard against ice and snow. Heavy, yellow machines keep the tracks open, including by ploughing and by using equipment that throws the snow away from the tracks. However, when the ice closes in on the space where the trains must pass, picks and shovels must be used.

"This is nothing", says Erling I. Nesbø, attacking a patch of ice.

"When there is a lot of ice to hack, we bring the whole work team."

Nesbø is the electrical foreman on the mountain stretch between Mjølfjell and Geilo, and he is part of Jernbaneverket's emergency team during winter. The emergency team for the mountain stretch is led by the three snow removal coordinators at Finse. A work team at Myrdal consists of 15 men divided among three shifts. They live at Myrdahl when they are on duty. Four men patrol the mountains from Geilo; two on each shift. They take afternoon trips to Mjølfjell and back, either with a loading tractor (rolling work equipment), or with a rotary snow plough. The most powerful rotary plough is stationed at Myrdal. A similar machine is stationed at Geilo. All points where maintenance crews are stationed also have other rolling stock such as inspection vehicle and loading tractors, as well as wheel loaders and other work vehicles.

Manual work. In addition to snow removal, an eye must be kept on ice formation in tunnels, cuts and drainage systems, and this requires a great deal of manual work. While



patrolling in the mountains, the crew must resort to picks and shovels on a daily basis at points where rotary snow ploughs and other motorised equipment cannot reach. Sometimes ditches and culverts must be "steamed" with high-pressure, high-temperature steam.

An eye must be kept on the snow sheds, especially in late winter and during the spring, when the snow can become very heavy. Sheds must therefore sometimes be reinforced, or the crew must remove snow that would cause the shed to buckle. Chainsaws with long swords are used for this purpose, and the snow is cut into large blocks that are pushed off the roofs. General snow removal is managed by the snow removal coordinator at Finse.

Being prepared. Weather prognoses and observations play an increasingly important role. Jernbaneverket colla-

borates with the Norwegian Meteorological Institute, the Norwegian Geotechnical Institute and the Norwegian Water Resources and Energy Directorate to gather information about weather, avalanche/landslide risks and large volumes of water. A number of Jernbaneverket employees also have training in taking snow profiles as a basis for evaluating the local avalanche risk. Furthermore, employees have sound local knowledge about most conditions along the line, and this competence is also an important part of the preparedness.

If there is information that suggests an increased level of risk along the line, the preparedness level is raised incrementally. If extreme precipitation or an avalanche/landslide risk has been reported, it may be necessary to close the at-risk stretch to traffic for a period. Neither passengers nor staff shall be exposed to harm.

Jernbaneverket renews equipment and rolling stock to get more out of each person-day, but where other equipment cannot reach, muscle power is still in use.

Joint construction of road and rail

Along Lake Mjøsa, from Minnesund and northwards, the Norwegian Public Roads Administration and Jernbaneverket have collaborated on the joint construction of a new highway and a new double track. The E6-Dovre Line Joint Project is currently Norway's largest construction site.



There is teeming activity along a more than twenty-kilometre stretch. At the peak, 1,500 people were at work during the spring

and summer of 2013. The Joint Project will remove a bottle neck and an accident-prone stretch along national highway E6, and this is the last part of a four-lane highway from Gardermoen to Kolomoen at Stange. For the railway, the 17.5 kilometre stretch between Langset and Kleverud is the first step towards double track between Eidsvoll and Hamar.

In line with the National Transport Plan 2014-23, the rest of this stretch is to be completed by 2024 as part of the InterCity expansion. The travel time between Oslo and Hamar will then be reduced to less than one hour. At the same time, there will be departures every half hour and a significantly improved punctuality.

Significant savings. The savings associated with a simultaneous expansion of the railway and road along Lake Mjøsa is estimated to be at least NOK 400 million. The most important factor is that excavated soil from national

"Much of the work consists of blasting and earthmoving."

highway E6 can be used as fills for the double track. Short transport distances also give environmental benefits.

A joint project organisation, large contracts and longer, continuous stretches under construction also contribute to lower costs. We have had good experiences working together.

"We have dispensed with practical challenges. We are construction workers first and foremost, whether

we work in this or that agency, and we learn a lot from each other", says Anne Braaten, who is Jernbaneverket's Project Manager for Eidsvoll–Hamar and the Assistant Project Manager in the Joint Project.

Many nations. The construction site has an international flavour. The Austrian company Alpine Bau won one of the three large site preparation contracts, the German company Hochtief in combination with the Norwegian company Veidekke Entreprenør won another, and the final contract is carried out by the Norwegian company Hæhre Entreprenør. Between all the contractors, there are construction workers from between 15 and 20 European countries on site.

"We make sure that everyone working on the Joint Project has working terms and conditions that are in line with Norwegian laws and regulations. When we surveyed the situation last winter, we found hourly rates below the minimum wage and contracted working hours that exceeded those allowed, among other things. Some of this was probably caused by misunderstandings and uncertainty about the rules, and all of the registered deviations have now been corrected. Nevertheless, we will in any case continue to perform checks", says Anne Braaten.

Moving rock. Much of the work consists of blasting and earthmoving. The Joint Project has been called "the largest earthmoving along Lake Mjøsa since the Ice Age." About 5.2 million cubic metres of rock must be moved, which is equivalent to about 33 times the volume of Oslo City Hall.

At the same time, more than 12,000 cars and 95 trains must pass through the construction area every day. Many

Joint Project



FACTS

The E6-Dovre Line Joint Project

- ▶ **Total budget framework:** NOK 10.1 billion.
- ▶ **Double track:** NOK 4.9 billion.
- ▶ **Four-lane E6:** NOK 5.2 billion.

The railway is funded by annual allocations in the Fiscal Budget. The State pays about 30 per cent of the costs of national highway E6 over the Fiscal Budget, while the rest will be covered by tolls.

- ▶ 21.5 km new four-lane highway with a median strip (opens in December 2014).
- ▶ 17.5 km new double track (opens in the autumn of 2015).
- ▶ 18 km new local road and pedestrian/bicycle path (to be completed in the autumn of 2016).
- ▶ Three dual road tunnels. Total length: 3.5 km.
- ▶ Three single railway tunnels. Total length: 4.7 km.
- ▶ 27 structures (bridges and concrete tunnels/underpasses).

Additional construction includes:

- ▶ retaining walls and tunnel portals.
- ▶ three intersections with overpasses.
- ▶ two toll stations.

of the blasts that take place during the day require traffic to stop both on the railway and on the road. Every Wednesday, the contractors must report what they want to do in the following week, so that the blasting can be planned in ways that maintain safety and traffic flow.

The blasting must be adapted to "windows" in the timetable, where there are pauses in train movement. Every so often trains are replaced by buses for a longer period, so that large blasts can be set off and intensive work can be performed near the tracks. On national highway E6, traffic can be stopped for up to 20 minutes outside of rush hours (30 minutes in the evening during the week).

"Umbrella" in the tunnel. The longest tunnel in the project is being built for the double track: the 3.9 kilometre Ulvin tunnel. There will also be railway tunnels at Molykkja and Morstua, with lengths of 580 metres and 160 metres, respectively.

Inside the Ulvin tunnel, a method for water and frost proofing that is new in Norway has been selected. The tunnel is covered in a waterproof membrane that functions as an umbrella and directs water to the invert. The outside of the membrane is completely covered in a concrete shell.

"This is to prevent water leaks and drips that damage track and technical installations. It also increases the life-span of the tunnel, and we will have far fewer periods in which the tunnel must be closed for maintenance", says construction engineering adviser Jan Ausland in Jernbaneverket.

"Though the solution is more expensive initially, it is an investment that will give lower lifetime costs", he emphasises.

"Worst neighbour in Norway?" That the project's neighbours notice it cannot be prevented – and it is very noticeable. But though the construction site is large and the work pace high, the Joint Project places great emphasis on considering its surroundings.

Hilde Marie Braaten is one of two Jernbaneverket employees who work on the Joint Project with communication and contact with neighbours: "By and large I think the neighbours are very patient with us. Without this

patience, we could not have done our job", she says.

"Noise, mud and dust from the site are probably the most noticeable drawbacks. School routes, temporary accesses and disadvantages for local traffic are also major concerns for the neighbours. A separate environmental plan stipulates how the contractors are to safeguard these and other considerations during the construction period", notes Anne Braaten.

"Residents in particularly noisy areas can be offered alternative places to stay, for instance when work is being done during the night and on weekends. When there is blasting during the day, no one can be within defined

"The Joint Project has been called the largest earthmoving along Lake Mjøsa since the Ice Age."

safety zones, and the contractor notifies residents who must evacuate temporarily while the charge is fired. Neighbours are also given advance warning by text message", she says.

To prevent the tremors from causing damage to nearby buildings, there are more than one hundred vibration meters at the site. The size of the charges are set to be well within the margin specified in the vibration requirements. Continuous measurements are also taken of, among other things, the particle dispersion in Lake Mjøsa, the dispersion of dust, and the ground water level in relation to the tunnel operations.

Opens in the autumn of 2015. Construction on the Joint Project started in the spring and summer of 2012, and the most hectic period will continue until the new four-lane national highway E6 opens in December 2014. After that is completed, technical railway systems will be built before the double tracks become operative in the autumn of 2015.

The old railway route will mostly be used as a pedestrian and bicycle path along the entire route. In 2016, construction work will conclude by completing this path (which has been named "Mjøstråkk") and the local road in the area.



Nils A. Røhne
Mayor
Stange Municipality

"The Joint Project is the start of a 'new era' for the interior of Eastern Norway, the Hamar region and

Stange municipality. For the municipality, this means that we are really incorporated into a common region in which people live and work, and that includes the capital and large parts of the interior of Eastern Norway.

The development of road and rail facilitates a societal development with tremendous positive potential. I am convinced that the number crunchers' socio-economic calculations do not capture the growth and development we will experience as a result of the construction."



Christl Kvam
Regional Director
The Confederation of Norwegian Enterprise, Inland Region

"The development is an important element in the infrastructure

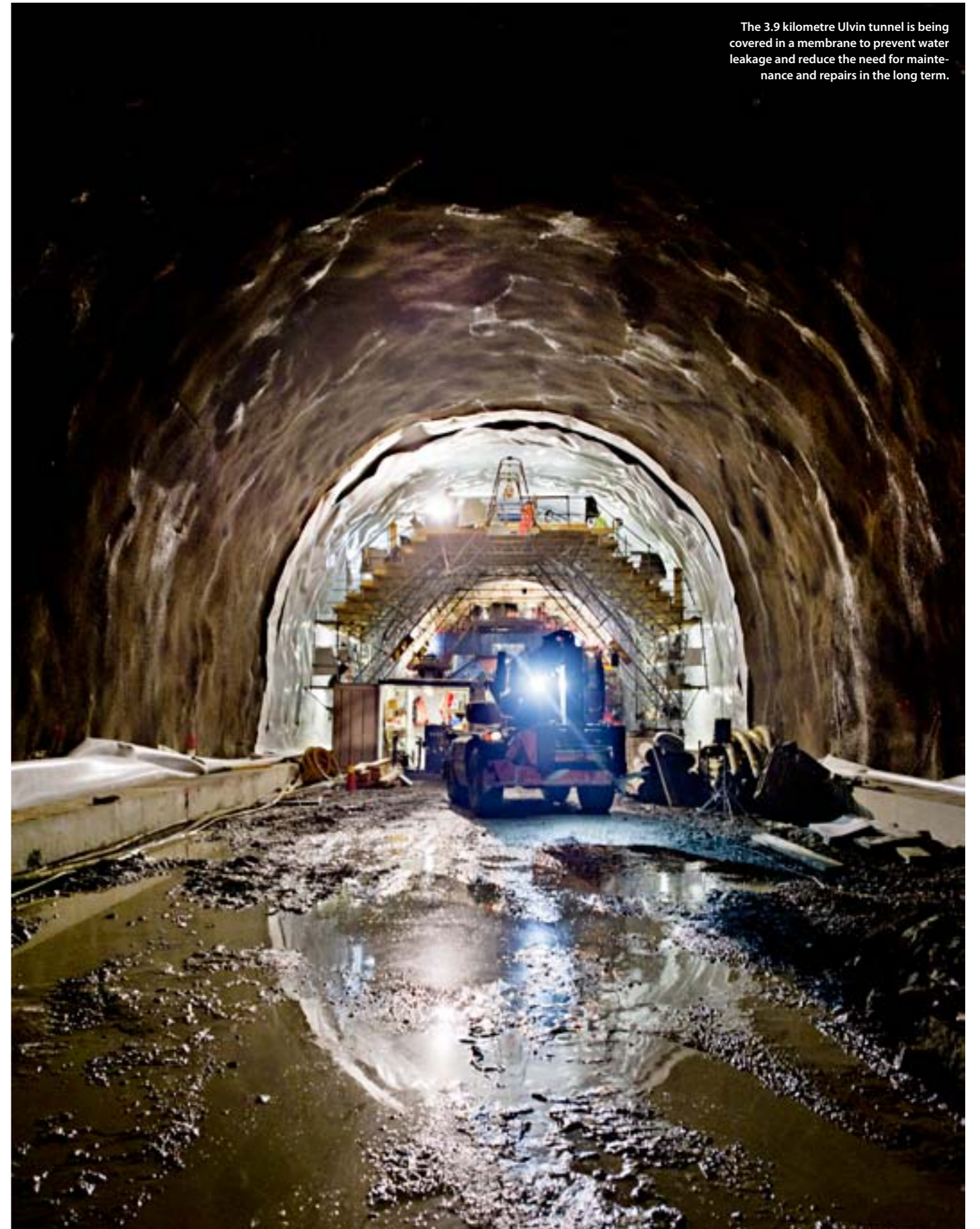
we so desperately need in the interior of Eastern Norway. It strengthens the competitiveness of businesses, with lower transport costs and better access to labour through easier commutes. As the project affects one of Norway's most important transport corridors, it is also important for companies outside the region."



Svein Frydenlund
General Manager
Hamarregionen Utvikling

"The Joint Project will bring us one step closer to being able to see the Hamar

region, and in time the entire Lake Mjøsa region, as part of an integrated labour and residential market in the capital region. Increased population growth will be a natural positive consequence of the new national highway E6 and double track, and that in itself will in time lead to greater diversity and more new business start-ups."



The 3.9 kilometre Ulvin tunnel is being covered in a membrane to prevent water leakage and reduce the need for maintenance and repairs in the long term.

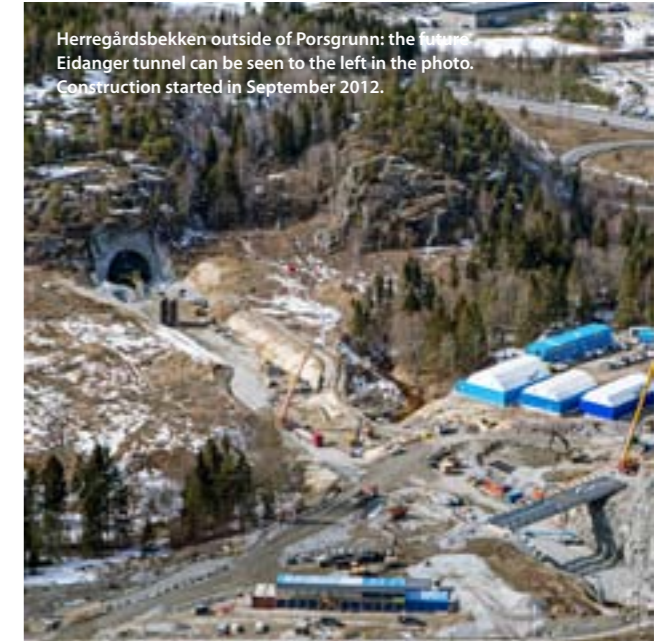
- ▶ **Shortcut to Grenland**
- 20 minutes shorter travel time
- ties cities and regions together
- will be completed in June 2018

Norway's largest cavern

Norway's most spectacular railway station is not visible from the outside. It is located deep inside the mountain at Holmestrand.



The station hall in Holmestrand will be 35 metres long and 16 metres tall. In this photo, only the top level has been removed. The floor will be lowered by another 8 metres.



Herregårdsbekken outside of Porsgrunn: the future Eidanger tunnel can be seen to the left in the photo. Construction started in September 2012.

Shortcut to Grenland

In the southernmost part of Vestfold County, 22.5 km of double track are being built from Farriseidet outside Larvik to Porsgrunn. When the new track is completed in June 2018, the travel time for the stretch will be reduced by more than 20 minutes.

The new double track will help tie the Grenland region and Vestfold County closer together and will entail significantly shorter travel time between the cities, regions and Oslo.

For the most part, the line runs across the valleys, and this means that tunnels and bridges must be built along large parts of the stretch. Seven tunnels with a total length of 15 km and ten bridges with a total length of 1.5 km are being built. Three tunnels and six bridges – with the longest bridge spanning 438 metres – are being built just on the 9.5 km stretch from Farriseidet to the border of Telemark County.

Great emphasis has been put on adapting the contracts to market demand. Eight planned tunnel and basic contracts were reduced to four large contracts. The Vestfold contract is the largest of the four, with a total value of NOK 1.34 billion.

FACTS

- ▶ **Farriseidet–Porsgrunn** work for NOK 244.1 million carried out in 2012.
- ▶ **2013 budget** NOK 1.14 billion.
- ▶ **Prognosis for final cost** NOK 6.37 billion.

Fourteen kilometres of a new double track will be built from Holm in Sande municipality to Nykirke in Re municipality. The track must be able to handle trains moving at up to 250 km/h, and more than 12 kilometres of the track will be in tunnels.

The new line means that Holmestrand can suddenly be reached from Oslo in just 45 minutes. The entire project not only shortens travel time on the Vestfold Line, but is also very

important for urban development in Holmestrand. When the new line is ready, those who live on top of the mountain plateau can take the shortcut – an elevator down to the station.

Magnificent and accessible. The current station area will be rebuilt as a new public transit terminal for buses and taxis, among other things. Additionally, parking capacity will increase compared to the current situation. The station will have three access points: one in the north where the

current station is located, one further south in the centre of Holmestrand and a third by the elevator from the plateau above the town. The station will have four tracks: two for through-traffic designed for 250 km/h and two tracks for the platforms. The platforms will be 250 metres long. The actual station hall will be 35 metres wide and 16 metres high. Universal design and accessibility for everyone have been strongly emphasised in the planning of the interior design.

Construction started in August 2010

FACTS

- ▶ **Holm–Nykirke** work for NOK 753 million completed in 2012.
- ▶ **2013 budget** NOK 1.27 billion.
- ▶ **Prognosis for final cost** NOK 5.7 billion (2012 kroner).

and at the turn of 2012/2013, about half of the tunnel had been blasted. At the beginning of 2013, the project passed one million hours worked, and the LTI rate, which is a measurement of lost-time injuries per million hours worked, was a sound 3.5. According to the plan, the blasting of the tunnel will be completed in the first half of 2014. Finishing work, railway engineering work and the completion of the interior of the station hall will follow before trains can start using the new line in the autumn of 2016.

"The new line means that Holmestrand can suddenly be reached from Oslo in just 45 minutes."



The route out of Oslo Central station and on through Ekebergåsen was chosen after careful consideration and in agreement with the Directorate for Cultural Heritage and the City of Oslo, among others.

The Follo Line prepares for construction start

What do heat pumps in people's homes have to do with trains running at up to 250 km/h? More than you think! The Follo Line is to be built with the least possible damage to its surroundings.

They have gone from door to door, the representatives of Jernbaneverket and the Norwegian Institute for Agricultural and Environmental Research; in streets and roads above Ekebergåsen in Oslo. Deep down in the ground – sometimes a whole hundred metres below the grass – Norway's thus far longest tunnel is to be drilled. The representatives are mapping wells that provide energy for heat pumps and that are located near the planned course of the tunnel. Deep energy wells must be moved if they are too close to the tunnel, or the owner can receive compensation.

On other properties, buildings are being surveyed before the start of the tunnelling. Ten thousand bolts have been inserted into house foundations to secure them. This also allows any changes that may occur to be registered. Ninety wells have been drilled along the course of the tunnel. From these, the important ground water will be monitored electronically.

If the level changes, this can lead to property damage. Jernbaneverket has a zero tolerance attitude to damage. This is a necessary starting point when building Norway's longest railway tunnel while causing the least possible nuisance for the surrounding area in one of the country's most densely populated and high-traffic areas.

New technology. Surveying properties is just one of the many preparations for the Follo Line project in 2012. Important catchwords include technological planning and decisions related to the approach to Oslo Central station, the long tunnel with two separate tunnel bores and the new Ski station. The impact assessment for the new line was approved, and work was done on Jernbaneverket's proposal for zoning plans in the three municipalities that host the Follo Line: Oslo, Ski and Oppegård. For the long tunnel, a decision was made to build it using tunnel boring machines (TBM) in addition to traditional blasting.

TBMs have not previously been used to build railway tunnels in Norway.

Buy some rock material? While good technical solutions were being put in place, the planning of what to use the rock material for started. Who can reuse 10–11 million tonnes of rock material that will be excavated to create a tunnel bore in each direction? The amount does not scare those who have shown interest! The Follo Line Project's new Project Director, Erik Smith, who was hired in 2012, is also attracted to large scale projects after years in charge of several of Norsk Hydro's gigantic construction projects. He is now using his experiences to further develop Jernbaneverket as a professional construction client for the InterCity development. The Follo Line Project is to spearhead new work methods and international cooperation and, not least, take a lead in terms of consideration of neighbours and properties along what will be the first part of the InterCity development southwards from Oslo.

FACTS

Station modifications

Stations and stops that received new or extended platforms in 2012

- Råde, Østfold Line (phase 1 completed, will also get a new parking area and a platform for track 2).
- Lier, Drammen Line.
- Heggedal, Spikkestad Line.
- Bulken, Bergen Line.
- Moelv, Dovre Line.
- Knapstad, Østfold Line, eastern line.
- Marnardal, Sørland Line.
- Nodeland, Sørland Line.
- Frogner, Main Line.
- Dal, Main Line.
- Spikkestad, Spikkestad Line.
- Hauerseier, Main Line (Completed in 2011).
- Skotbu, Østfold Line, eastern line.
- Furumo, Gjøvik Line.
- Hanaborg, Main Line.
- Valnesfjord, Nordland Line.

In 2012, steps were taken to remove small obstacles at 20 stations. These were mainly to mark stair nosings, glass panels and columns. Safety lines have been highlighted at 97 stations.

FACTS

FACTS

The Follo Line project

- 22 kilometres of new double track from Oslo Central station to the Ski public transit hub, with the longest railway tunnel in Norway thus far (19.5 kilometres).
- The construction of the new Ski station, extensive work at Oslo Central station and necessary re-routing of track for the Østfold Line into Oslo Central station and between the tunnel and the new Ski station.
- Comprises a total of 64 kilometres of new track
- The first Norwegian railway tunnel with two separate tunnel bores.
- Will be built using four tunnel boring machines (TBM) as the main tunnelling method and will probably be the first railway tunnel in Norway tunnelled by TBM.
- A third of the tunnelling will be done by conventional blasting (drilling and blasting).
- Designed for speeds up to 250 km/h.
- Enables a halving of the Oslo–Ski travel time and increased capacity to and from Oslo Central station.

Nicer and safer at the stations

In the past year, a number of measures have been undertaken to improve safety, accessibility and, not least, the attractiveness of many of the nation's stations.

The station area is the first and last part of the train journey for passengers, and Jernbaneverket is working to ensure that the public areas contribute to a positive travel experience.

Many of the nation's platforms are too short for the trains that operate on the railway line in question. Jernbaneverket is well underway with building new and longer platforms. During 2012, 16 stations were upgraded.

The new platforms are higher than the old ones, in order to minimise the height difference and distance between the train and the platform so that getting on and off the train will be safer and easier. For the same

"Jernbaneverket is well underway with building new and longer platforms. During 2012, 16 stations were upgraded."

reason, some of the platforms have been moved from a curved stretch to a straight stretch.

The station areas have also had a general upgrade. New monitors and signs that show train departures/arrivals, loudspeakers and audio induction loops will ensure that travellers receive better information. New shelters and benches are in place, and several stations now have more parking spots.

- The Follo Line
 - first part of the InterCity development southwards
 - can replace 5,800 cars a day in 2025
 - will have a lifespan of 100 years



Many measures have also been initiated to make the stations more accessible to all user groups. In some stations, the level crossings are being replaced with bridges or underpasses, and the platform safety zone is being better marked. The public areas in several stations have also received tactile markers, so that the visually impaired can orient themselves better using touch.

In 2012, the upgrade of Moelv station was awarded a prize for good building practices.

Advanced education

Both engine drivers and traffic controllers enjoy their high-tech workday at the Norwegian Railway College. Two simulators prepare them for any imaginable situation.

The Norwegian Railway College provides vocational training for the entire railway sector, and students need both theory and practice. Some need actual training in driving trains, but whether they are engine drivers, traffic controllers or work on the track, they all need to practice in a safe environment.

The simulator centre is a key training arena at the College. The centre is approximately 400 square metres, and students in the various disciplines receive realistic training there. In the simulator, students practice situations that cannot be practised on the actual railway. Regulations are put into practice, students practice handling exceptional situations, and evaluate and reflect on their own performance.

Traffic controller trainee Runar Sørberg emphasises that the highly skilled instructors he meets at the College, as well as the practical training, are very important tools in preparing for operative service in the rail traffic control centres.

"Here, we practice in safe surroundings, and it makes me much more confident when in a live system", he says.

Fewer near-accidents. The train and traffic simulators are unique in the European context because they are integrated. This means that traffic controllers and engine drivers can practice together, as in real life. Several managers and employees in Jernbaneverket and railway enterprises have reported that after students started training in the simulator, the number of near-accidents has declined. In the aftermath of a near-accident, Safety Advisor Øystein Uldal in the Traffic Division, said "In my opinion, this shows that training and practice in recent years, not least the simulator training at the Norwegian Railway College, have made our traffic controllers much better at interpreting and

taking correct action during acute, serious incidents."

Highly regarded. The engine driver training is subject to the Act relating to tertiary vocational education, which among other things requires an approved quality assurance system that ensures compliance with laws and regulations. The College was assessed by the Norwegian Agency for Quality Assurance in Education (NOKUT) in 2012, and though the requirements are stringent, the school's approval was renewed. The vocational college can accept two to six cohorts every year. The number of cohorts varies with demand from the railway enterprises and board decisions. The 2013–2014 admissions correspond to 6 cohorts (120 students). The students continue their training after they have received so-called engine driver certificates and sit the final exam after 1.5 years at the College. After they have been hired by one of the railway enterprises, students take the last part

"The railway sector needs new professionals because of increasing investment in railways and the high average age of its employees."

of the training before the railway enterprises award the final certification.

Great responsibility. The Traffic Department trains dispatchers and traffic controllers who ensure that traffic on the railway network runs in a safe and efficient manner. Previously the traffic controller training took place at various stations, but in 2012 the College assumed responsibility for all basic training as well as for the annual refresher course for all traffic controllers.

The third department at the College is the Department of Railway Engineering, and this is run on commercial terms. However, it is not supposed to profit from courses and training based on Jernbaneverket's sector responsibilities. The Department is responsible for training in railway disciplines within construction, operations and maintenance of Jernbaneverket's infrastructure. The College holds courses and continuing education programmes in various locations in Norway and Scandinavia.

Needs more people. The railway sector needs many more professionals in the years ahead, both because of increasing investment in railways and because of the high average age of current employees. The number of apprentices has increased significantly in recent years. The Department provides vocational training for all apprentices in signalling, rail disciplines and contact line. The length of the training varies from a few months to nearly a year.

The number of skilled workers, engineers and other vocational groups that have participated in courses organised by the College has increased every year. The College has tripled its turnover in the 2010-2012 period.

FACTS

The Norwegian Railway College is located in Jernkroken at Grorud, and consists of three departments

- **Engine driver training**
Public vocational college for engine drivers.
- **Traffic training**
Internal training of dispatchers and traffic controllers.
- **Department of Railway Engineering**
Training of apprentices, skilled workers and others in the railway sector in the form of basic training, continuing education, courses and trainee programmes.



The Traffic Department of the Norwegian Railway College trains traffic controllers who ensure that the traffic on the railway network runs in a safe and efficient manner. Here, Elisabeth Skamsar Øien is in the traffic controller simulator at the Norwegian Railway College.



The InterCity development will tie the cities closer together, and make it easier to commute between them daily.

- ▶ National Transport Plan
 - The level of investment is proposed increased by more than 50 per cent
 - InterCity development in Eastern Norway
 - Electrification of the Trønder Line

FACTS |||||

What is the National Transport Plan?

The National Transport Plan (NTP) is a Report to the Storting (White Paper) and the Government's ten-year plan for transport. The Plan covers operations, maintenance, renewal and investments.

A new NTP is prepared every four years. Extra attention is therefore paid to the projects in the first four years of the plan, and to how much money is planned 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. NPT is not a binding ten-year plan, but does give quite detailed indications of the direction that Norwegian transport policy ought to take.

The National Transport Plan for 2014-2023 was presented on 12 April 2013 and was discussed in the Storting on 18 June that year. This Annual Report was produced before the NTP was discussed in the Storting, so any changes in the Plan are not discussed here.



Faster train travel and more frequent departures

Politicians have staked out a course for the Norwegian railway: For the first time, there is a clear schedule and clear goals for the future InterCity development in Eastern Norway.

It will become easier to commute between the cities in the InterCity triangle in Eastern Norway, and commuting will also be made easier in Trøndelag and in the local traffic to Bergen. The development will result in more frequent departures and shorter travel times.

The National Transport Plan for 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. Nine billion kroner a year is to be spent on building new lines in the coming years. During the first four years, efforts will be concentrated on these projects:

- ▶ **Arna-Bergen** – double track expansion results in more departures for local traffic.
- ▶ **Hell-Værnes** – double track expansion.
- ▶ **Follo Line** – new double track Oslo-Ski leads to faster trains to and from Østfold, but also to more frequent departures along the populous local stretch between Ski and Oslo on the "old" Østfold Line.
- ▶ **Langset-Kleverud** – new double track on the Dovre Line along Lake Mjøsa leads to shorter travel times to Hamar and Lillehammer.
- ▶ **Holm-Holmestrand-Nykirke** – new double track on the Vestfold Line leads to shorter travel times.
- ▶ **Farriseidet-Porsgrunn** – new double track on the Vestfold Line ties Grenland closely to the Vestfold cities and the Oslo area, and results in significantly shorter travel times.

At the same time as these development projects are underway, Jernbaneverket will focus heavily on extensive planning of the new investment projects

that will start after 2017. An important part of this will involve remaining stretches of the InterCity lines and the electrification of the Trønder Line.

InterCity in 2024. The InterCity development is to be completed with a continuous double track to Hamar, Tønsberg, and Seut/Fredrikstad in 2024 (Sarpsborg in 2026). This opens for departures every half hour, with extra departures during rush hour and shorter travel times. The average level of investment in the railway is proposed increased by more than 50 per cent in the ten-year period compared to the 2013 budget: from NOK 6.1 billion to NOK 9.2 billion a year.

The Trønder Line gets electrified. The Hell-Værnes double track project will as expected start in the first four-year period. Additionally, the planning of the electrification of Trondheim-Steinkjer and the Meråker Line will begin in the first four-year period, and be completed in the last period.

Replacement of signalling systems. The Plan proposes an increased level of operations, maintenance and renewal of the railway network in the ten-year period. Among other things, renewal entails replacing older signalling systems with the new, common European system ERTMS.

Multi-year financing. The Government proposes that the InterCity projects, the Follo Line and the electrification of the Trønder Line are candidates for a new scheme for projects that get special priority. The scheme will ensure more predictable funding, in which the Storting at start-up also decides on budget frameworks for the entire project period. This means a set end date and the opportunity to enter

multi-year development contracts.

Freight. The Ofoten Line will receive funds for passing loops to handle increasing amounts of ore traffic. The Alnabru terminal in Oslo will receive funds to modernise. The Plan envisions that railway freight capacity will initially increase by between 20 and 50 per cent. At the same time, a broad analysis is being made of freight by rail, road and sea, before the politicians will return to decisions on further investments in freight traffic.

Studies. The Plan envisions a number of studies of the railway in the year ahead. The studies, such as the freight analysis, will form the basis for future political decisions. In the first instance, this will be the next National Transport Plan, which will be presented in four years:

- ▶ **Oslo:** Future solutions for public transit in metropolitan Oslo, including a new railway tunnel, will be studied in collaboration with Ruter and Norwegian Public Roads Administration.
- ▶ **The Ringerike Line:** Initial new study of a double track and the possibility of higher speeds. Start-up of planning and construction is set to 2018.
- ▶ **The Jæren Line:** A study has been completed of a further expansion of the double track for the Sandnes-Egersund stretch.
- ▶ **Stretches to Gjøvik, Kongsberg and Kongsvinger** will be studied. The Østfold Line's eastern line will also be studied with regards to the Follo Line.
- ▶ **All stretches without electrical operations** (The Nordland, Rauma, Solør, and Røros lines) will have impact assessments done for a possible electrification.

Largest investment in signals in Norway

A renewal of the current signalling system gives Jernbaneverket the opportunity to operate one of the largest IT projects in mainland Norway.

An ageing signalling system is becoming challenging to maintain. Spare parts are becoming rare and faults are on the increase. In 2012, the Government decided to do something about this and Jernbaneverket received a clear message: We are to build a new signalling system, and it is the so-called ERTMS that is to be the signalling system of the future in Norway. This message gave the ERTMS project the feedback it needed, and the lar-

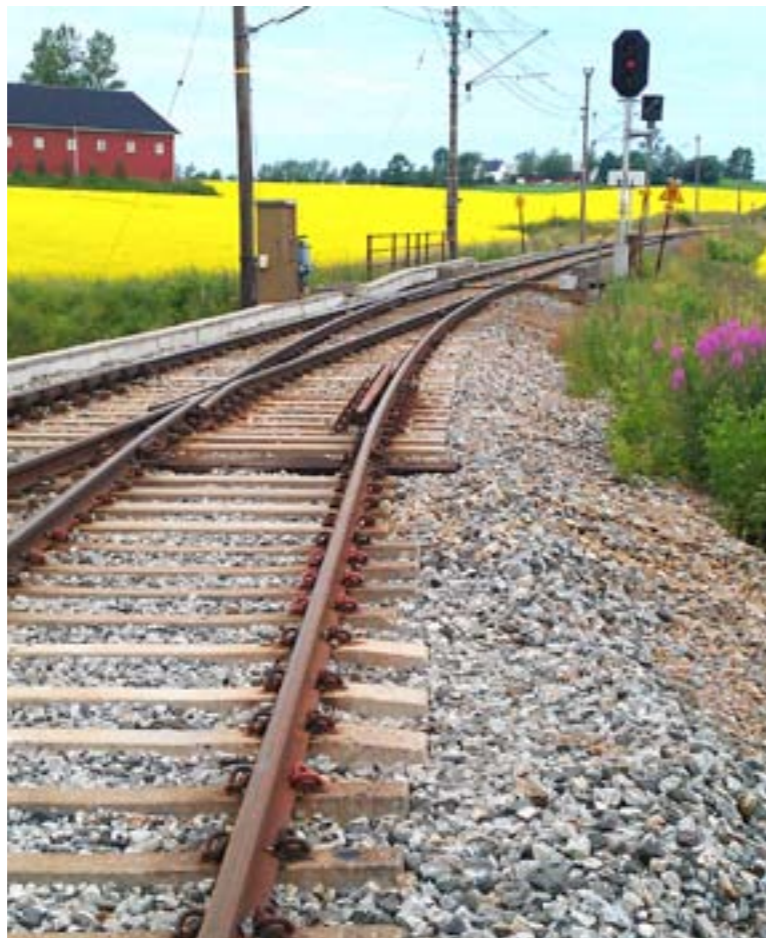
"We are part of an historic journey, the likes of which we have not seen since the electrification of the railway."

gest signal investment in Norwegian history could finally start. ERTMS, or the European Rail Traffic Management System, is a common European set of regulations and a technology platform that the EU has adopted. This means more effective operation of trains throughout Europe.

"We are part of a historic journey, the likes of which we have not seen since the electrification of the railway", says Sverre Kjenne, the Technology Director in Jernbaneverket. It is a very innovative train journey that is now underway.

"We must renew old systems that are no longer in production to prevent ourselves from getting into a situation in which the old system has run out of spare parts and can no longer be operated", he says.

This means that railway stretches will be upgraded with new technology based on standard components.



This will likely have larger ripple effects for the railway than the introduction of automatic traffic control or the electrification of the railway.

ERTMS is a modern, IT-based signalling system in which the signal is not along the tracks but on the engine driver's screen. External signals thus become redundant. This means fewer technical systems in and by the tracks, and thus reduces future operating and maintenance costs for the railway. For engine drivers, it means the end of frequent changes between different forms of operation as well as improved safety, in part through full monitoring

The technology of the future is to be tested on the Østfold Line's eastern line.

of the positions and speeds of trains in Norway. Jernbaneverket has established a project that is to manage the planning and implementation of the ERTMS introduction in Norway, both in terms of the infrastructure and on board the trains. The project is responsible for all activities within railway technology, engineering, financial management and project management.

FACTS

Past and future

The planned extensive work on the signalling system in Norway means that technology must be tested and tried. The work on the test stretch on the Østfold Line's eastern line started in August 2012 from Ise to Rakkestad. In time, there will be many changes to the eastern line. Many of the stations are worthy of preservation and must be treated with care. At Kråkstad, the entire station area is under a preservation order, and the old rail trolley shed must be moved to fit the new technology. Five stations will be rebuilt.

In the summer of 2013, the stretch from Rakkestad to Sarpsborg will be closed to all traffic, and the test stretch between Rakkestad and Sarpsborg will be completed during the autumn of 2013. The entire trial line between Ski and Rakkestad will be made operational on 10 August 2015.

Builds railway competence

7,663 people applied for a total of 459 positions in Jernbaneverket in 2012.

Every month, Jernbaneverket hires employees with many different kinds of education and competence. What most of them have in common is that they do not have a background in railway disciplines. They have a lot of professional competence in their area, but must acquire specialisation within topics related to the railways once they start in Jernbaneverket.

Jernbaneverket has sector responsibility for building competence in railway disciplines in Norway. In 2012, the experience-based master's degree in railways was established at the Norwegian University of Science and Technology in Trondheim. Professionals in Jernbaneverket have helped define competence requirements and create the training programme, and have been in charge of its implementation in collaboration with the Norwegian University of Science and Technology.

Railway doctorate. The programme has three majors: Tracks/traffic, the electric system and signals. In 2012, 15 master's degree students started the programme, and many others choose to take individual courses.

"Several of these students are already wondering what they can do after having completed their master's in order to do a doctorate. This is a very welcome development: we need



strong professional communities who can take responsibility for new generations of railway engineers and who can contribute to research and professional development", says Bente Tangen, who is in charge of recruitment and competence in Jernbaneverket.

Railway fitter apprentices Jeanette Wingeng and Aleksander Dehlimarken build competence as skilled workers while working at the Alnabru freight terminal in the spring of 2012.

"Several of these students are already wondering what they can do after having completed their master's in order to do a doctorate."

Railway professor. At the end of 2012, a professor of railways was hired at the Norwegian University of Science and Technology. Eilas Kassa is to build a scientific and ordinary programme of study in railways. He is to help create an academic community that manages and develops knowledge within the railway field. The professorship is funded by Jernbaneverket for five years.

Other possibilities. With increased activity and investment in the railway, there is a greater likelihood of encountering exciting challenges. Many students apply to Jernbaneverket to write master's thesis on topics related to the railway, and several apply for summer jobs. At the same time, the number of apprentices and trainees in the organisation is on the increase. This promises new generations of skilled workers and engineers.

The photo is from the E6-Dovre Line Joint Project.

On side with the market

The massive development of the Follo Line is coming soon, and there is broad political agreement on a quick development of the InterCity network. This will require high competence and capacity, both in Jernbaneverket as the construction client and in those who build the facilities.



At the moment, Jernbaneverket has projects for more than NOK 50 billion being planned or built. With this portfolio, Jernbaneverket is one of Norway's largest construction clients. The projects vary greatly in size and complexity: from projects for a few million kroner, to the Follo Line, which will cost more than NOK 20 billion.

Smaller contracts. Some years ago, the annual allocation for new railway development projects was at about NOK 1.5 billion a year. As the construction client, Jernbaneverket undertook much of the planning and engineering itself, while the actual construction was divided between many smaller contracts for each individual project. A contract worth NOK 400 million was considered very big. Now, Jernbaneverket has signed contracts for NOK 1.5 billion.

European interest. With the railway investments being made in Norway, the interest from foreign companies wanting assignments has increased significantly. The recession in Europe has strongly contributed to this development. Today, three large foreign contractors are working on two large construction projects. Additionally, many European suppliers of railway technology see opportunities for assignments in Norway, and several companies have delivered facilities to the Norwegian railway. When Jernbaneverket employees travel to discuss future development in Norway, foreign contractors are especially focused on one particular railway system: the massive Follo Line project.

Construction client and orderer. The development requires Jernbaneverket to change its construction activities in several areas. Since 2011, intensive work has been done to develop a professional construction client organisation that is to do project planning for smaller projects and let the market assume responsibility for larger parts of the developments. Project implementation will be more streamlined. In the future, more turnkey contracts will be entered, which give the suppliers a more comprehensive responsibility for planning, design and building, while Jernbaneverket manages and controls the projects.

"Jernbaneverket now has as many tenders for its large projects as Sweden and Denmark have for their railway projects."

Jernbaneverket is to be a professional orderer that defines what is to be delivered and that ensures that it gets the solutions and results ordered.

Collaboration is important. How the work is implemented will be up to the contractor. Previously, Jernbaneverket has taken on a lot of the coordination because the investment volume has been low and it has had good capacity to do so. With the large investment budgets, Jernbaneverket must find new ways of collaborating with the suppliers.

New strategy. The new strategy of not dividing the projects into smaller

contracts has already led to a much more effective competition than previously. Jernbaneverket now has as many tenders for its large projects as Sweden and Denmark have for their railway projects.

Safety first. Jernbaneverket is focused on continuing to build competencies within management and control of the development projects, and will excel in project leadership, design management, project management, safety management and the follow up of suppliers and contractors. Follow-up of salary and work terms, HSE and safety will always be prioritised. Everyone working for Jernbaneverket shall be ensured proper terms and be safe at work.

Competence challenge. Many services can be bought in the market, but the railway technical work can become a challenge in the future. This applies particularly to the planning and construction of new signalling systems. Signal competence takes a long time to build, and it is difficult to obtain competence from abroad within the signalling discipline, because Norway has special rules and, in part, old systems. Coordinating new and old systems can be demanding.

Ambitious Director

In the spring of 2013, the Government ordered Jernbaneverket to make its operations 10–15 per cent more efficient in the 2014–2023 National Transport Plan period. The Director General has greater ambitions and wants to achieve them in a shorter period of time.

Jernbaneverket is a much more dynamic and modern organisation today than when I worked here a few years ago", said Supplier and Market Director Michael Bors, after about a year in Jernbaneverket – for the second time. He thinks that part of the explanation may be that several new managers have been recruited from the private sector in recent years, and that efforts to achieve maximum profits from investments have been intensified. This has also been helped by Director General Elisabeth Enger's clear message to the employees that more money must be spent on the tracks and less on, among other things, administration and support. A large turnaround operation to make Jernbaneverket more modern and efficient started in 2012. It will cover all activities and lead to changes in the organisation.

Administration and support are being made more efficient. In the winter of 2012, the Director General hired the management consultancy firm McKinsey to see if there was potential to make the support functions in Jernbaneverket better and more efficient. The report showed that the organisation had failed to realise the benefits of economies of scale as well as comparable organisations. Seven areas were identified as having potential for greater efficiency, and an efficiency programme ("Efficient support") was established in January 2013. The project is to specify which measures are to be implemented during the year in order to achieve

- more efficient organisation and management
- simplification and elimination of tasks
- improvement of the support systems used in Jernbaneverket.

"We are a growing organisation and we need to scale our support functions correctly and in such a way that we

are better able to realise the benefits of economies of scale. The goal of the measures is to have a much more efficient organisation by 2014; one that gives more railway for the money", says an optimistic Director General Elisabeth Enger.

We are going further. In December 2012, the Director General started an extensive travel programme under the slogan "We are going further" ("Vi skal videre"). In this programme, the Director General travelled by rail to visit employees affiliated with all railway lines in Norway. The purpose was to get ideas for how the organisation can best be organised to face its challenges over

"We are a growing organisation and we need to scale our support functions correctly and in such a way that we are better able to realise the benefits of economies of scale."

the next four years. The opportunity to meet the head of the organisation face to face was very well received among employees, and many had good and constructive suggestions for improvements. All ideas have been documented and systematised and are incorporated into the ongoing work on developing the organisation and making it more efficient.

Traffic management is being modernised. The operative traffic management in Jernbaneverket is also undergoing changes. New ICT tools are being developed in the Operative Traffic Information project (OTI). Before Easter of 2013, new tools for short-term timetabling (TPS) and for ordering track access (BEST) were made operational.

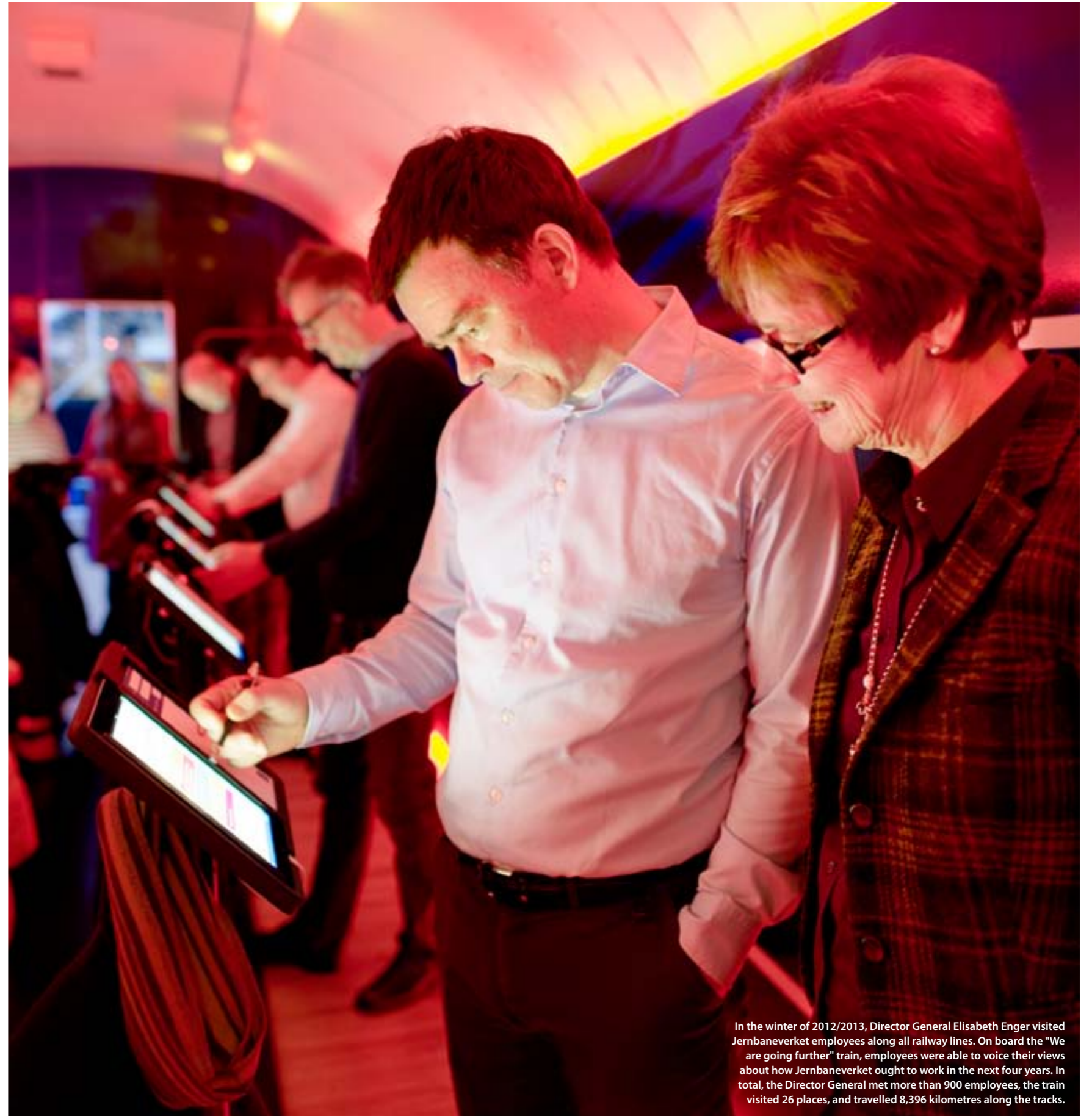
This entails far more effective work processes, both for orderers and for the scheduler in Jernbaneverket. The new systems provide a faster overview of available time slots on the tracks, and cumbersome paper work can also be discontinued. At the same time, everyone who needs access to the track on short notice, whether for a train or for work machinery, can get quicker responses.

"This is like moving from a telegraph to the internet", said Director of Traffic Operations Bjørn Kristiansen when he presented the status of the OTI project to train companies, contractors and internal users in February 2013. He was referring to the fact that the old-fashioned way of distributing train movement orders will soon be history. When the third tool, an electronic distribution system (FIDO), comes live, engine drivers and chief safety officers will receive operative messages electronically instead of in hard copy. The plan is for FIDO to be piloted on the Ofoten Line in December 2013 and be in full operation across Norway in March 2014.

Development of the construction market. Making Jernbaneverket more efficient is also in part about developing the construction market. The development of a competent and competitive construction market happens gradually as the market gains confidence in projects being financed and implemented as planned. Only when a sufficient number of contractors have gained the required competence and experience will it be possible for Jernbaneverket to streamline its role as a construction client to a greater extent than it currently does.

Under the heading "On side with the market", you can read more about the beneficial effects that larger construction contracts have had on the construction market.

- Turnaround operation to make Jernbaneverket more efficient
- Better utilisation of economies of scale
- Increased competence and competitiveness in the construction market



In the winter of 2012/2013, Director General Elisabeth Enger visited Jernbaneverket employees along all railway lines. On board the "We are going further" train, employees were able to voice their views about how Jernbaneverket ought to work in the next four years. In total, the Director General met more than 900 employees, the train visited 26 places, and travelled 8,396 kilometres along the tracks.

- ▶ Trains are one of the safest forms of transport we have
- ▶ Safety and preparedness have top priority in Jernbaneverket
- ▶ Modern trains are environmentally friendly

Safety and the environment are top priorities

Safety and the environment are two disciplinary areas that receive a lot of attention in Jernbaneverket.

No single fault is to lead to rail accidents. The security and signalling system, along with procedures, rules and regulations, are to ensure this. Unforeseen events that require alertness and quick action can nevertheless arise. Jernbaneverket therefore works systematically to continuously improve safety in order to prevent harm to people, the environment or property.

The new traffic control simulator at the Norwegian Railway College has given both engine drivers and those who monitor and control traffic from traffic control centres the opportunity to practice handling all imaginable situations in safe surroundings together.

Though trains are among the safest forms of transport available, the work on securing and closing level crossings is nevertheless an important part of Jernbaneverket's work on safety. This is because level crossings are where accidents occur most frequently.

Trains are also an environmentally friendly form of transport. Modern, electric trains have low energy consumption and no CO₂ emission.

Furthermore, environmental concerns are to be integrated into all Jernbaneverket activities. The goal is to reduce the negative environmental impact of railway activities as far as possible. Construction is an area with great potential for reducing climate gas emissions. Since 2009, the Follo Line has been a pilot project for the development of an environmental accounting method for Jernbaneverket.

In the autumn of 2012, the project was given one of the International Union of Railways' (UIC) Sustainability Awards, because the method documents in detail the railway infrastructure's environmental impact throughout its lifespan. The method is now fully developed and ready for use in all projects Jernbaneverket invests in. In the long term, this will better enable Jernbaneverket to select the most environmentally friendly materials, and to create incentives for the further development of green products.

Modern, electric trains can transport people and freight safely and without emitting CO₂.

Changing attitudes

School visits, media stories, information campaigns, films for youth, brochures and posters are some of the measures Jernbaneverket implemented in 2012 to increase awareness of traffic safety related to the railway.

The purpose of the measures is to get people to understand that they expose themselves and others to great danger by taking shortcuts across the tracks, or by not paying attention when crossing the railway. Far too many take risks with their own lives to save a few minutes during a busy day.

Work on improving attitudes must be done over time, and the message must be repeated constantly in order to achieve results. In the past year, Jernbaneverket has focused especially on developing tools so that working on attitudes becomes a low-threshold activity for its employees. The work consists of developing materials for various age groups and making these materials available. A new safety campaign has been developed, a film for youth was made, and work started on an information programme targeting children.

Jernbaneverket also marked the International Level Crossing Awareness Day for the first time, holding events around Norway in June 2012 to focus on safety at level crossings.

Stop – look – listen! Regardless of their age, Jernbaneverket's message to all road users is: Only cross railway tracks at places meant for crossing. Use the level crossings. Stop, look around and listen for trains!

Some think it is enough to know the timetable to safeguard themselves against being hit by a train, but work trains and freight trains may come that are not in the timetable and are not shown in apps that show train times. Trains can come fast and very quietly, they cannot swerve and they need a lot of time to stop. Work on changing attitudes is therefore an important part of Jernbaneverket's safety measures related to level crossings and movement along the tracks.

Jernbaneverket warns against the use of headphones and mobile phones, because the only way the train has to alert people to danger is to use the train whistle, and the use of headphones reduces the likelihood of hearing the whistle in time.

FACTS

- ▶ "Zero vision": The Norwegian railway has one of Europe's best accident statistics, but we have no one to lose.
- ▶ There are about 3,600 level crossings in Norway. About half of them are normally not in use.
- ▶ Every level crossing constitutes a risk. Jernbaneverket's long-term goal is therefore to remove them all.
- ▶ The level crossings with the highest risk will be closed first.
- ▶ About 200 measures and improvements are implemented annually at level crossings.
- ▶ In the past decade, about NOK 72 million have been spent on such measures every year.
- ▶ Building pedestrian bridges and underpasses is costly and time-consuming, in part due to many old user rights to the level crossings and landowners who must give permission for the use of surrounding areas.



Jernbaneverket Safety Advisor Margarita Lankina received help from her son Dmitrij in handing out materials with traffic safety messages during the level crossing day in the summer of 2012.



Close call

On 21 August 2012, a 13-year old girl cycled towards a level crossing secured by a pedestrian chicane at Evja in Mjøndalen, as she had many times before. She was listening to music on her headphones, and did not hear the train before it was suddenly there.

Because she is a careful teenager who has had instilled that she must be very careful when crossing the railway track, she dismounts and looks quickly to the right, but forgets to look to the left because she gets distracted. The cord to one of her ear-plugs gets tangled in the handlebars and pulled out of her ear. While she is standing on the track sorting this out, she suddenly hears the train approaching and throws herself out of its track just in time. The girl gets a real fright, but otherwise escapes unharmed. The bicycle is not as fortunate.

In the aftermath of the event, the girl's mother often heard and read that "this could never have happened to our children." Apparently, many people believe

"The girl gets a real fright, but otherwise escapes unharmed."

that accidents only happen to youth who are dim or whose parents do not look after them well. The truth is that children, youth and adults all need more knowledge and better attitudes regarding the use of level crossings. Just one moment of inattentiveness is enough. "We were all shocked when we heard about the event, and in our family we will never use the crossing at Evja again", said the mother, and added that despite the near-accident, many people in the neighbourhood still opposed closing the crossing. This was because it would take them a few minutes more to cross the railway tracks on their way to school and work.

Jernbaneverket spent a long time working on closing the level crossing at Evja in Mjøndalen, where the near-accident occurred. In the end, the work was successful. The level crossing was closed on 28 May 2013.



Good drainage is crucial to handling large precipitation volumes. Jernbaneverket also collaborates with the Norwegian Water Resources and Energy Directorate and the Norwegian Public Roads Administration about preparedness and handling crises related to natural hazards.

Mobilising against natural hazards

More frequent occurrences of extreme weather can threaten infrastructure, safety and the environment. Preparedness against avalanches, floods and landslides has therefore been stepped up.

In 2012, Jernbaneverket decided to introduce a new instruction to handle heavy precipitation. The level of preparedness is to be linked to the volume of water expected over a 12-hour period, and the threshold values for each preparedness level are adapted to local conditions. Various steps taken to improve drainage, including new and larger culverts, are also crucial to ensure that the infrastructure is as robust as possible and can handle frequent occurrences of extreme weather.

Fruitful collaboration.

In 2012, we are starting a four-year research project related to natural hazards, infrastructure, flooding and avalanches/landslides (NIFS) together with the Norwegian Public Roads Administration and the Norwegian Water Resources and Energy Directorate.

Here we are joining together to solve shared challenges and coordinate the agencies' work on preparedness and crisis management where it is natural to do so. Specific proposals are being prepared for improvements to plans and routines, and relevant data are collated and made available. The alerting service www.varsom.no is an example of an important dissemination channel that has been developed in a related collaborative project.

Measures against quick clay.

Today, there are several guidelines and standards used when building in areas with quick clay. The project aims to specify and enable the development of current rules and routines. This will provide a basis for a better and more equal practices in areas with quick clay, in regards to mapping and the interpretation of ground surveys or calculations.

The project shall also establish shared acceptance criteria for areas at risk of flooding and avalanches/landslides. Handling floods and water gone off course is very important to reduce injury to persons and infrastructure.

Never entirely certain.

We can never fully protect ourselves against natural hazards, but it is important to establish systems for securing, monitoring and alerting, so that events are prevented and consequences minimised. Among other things, a mobile system that scans slopes with a laser has been developed, and this can quickly create a detailed model of the terrain so that small movements can be studied and avalanches/landslides can be detected at an early stage.

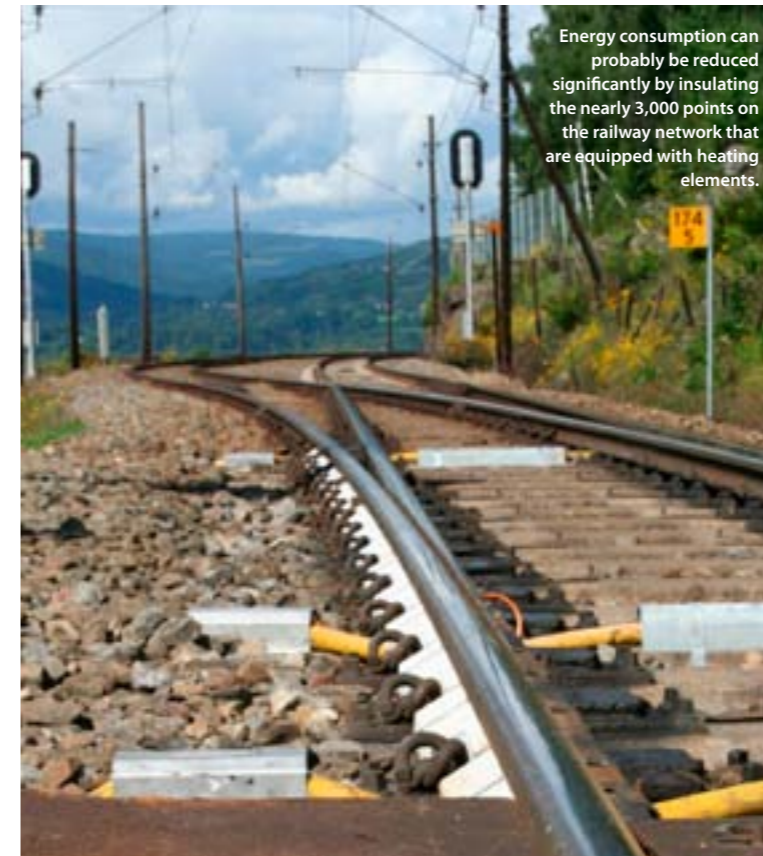
Read more at www.naturfare.no

"We can never fully protect ourselves against natural hazards, but it is important to establish systems for securing, monitoring and alerting."

Energy conservation

Won't waste heat

Jernbaneverket works to reduce its energy consumption and to utilise energy more efficiently.



Energy consumption can probably be reduced significantly by insulating the nearly 3,000 points on the railway network that are equipped with heating elements.

Point heating keeps the tracks free of snow and melts snow and ice in the points, but preferably only where needed and not several metres around the points. An effective energy-saving measure is therefore to insulate the points and better regulate the heat.

In the winter of 2011/2012, Jernbaneverket implemented a pilot project at Bergseng station on the Dovre Line to reduce the electricity consumption of points heaters. By insulating points that have a heating element, heat is kept where it is needed, with the same effect as the insulation of houses. The supplier of the insulation material estimates possible energy savings of up to 60 per cent.

Jernbaneverket has conducted its own energy measurements of the points at Bergseng station: one set of points with insulation and one without. The energy saving from October 2012 to March 2013 was 45 per cent for the insulated points. The points without insulation had snow brushes, so the difference was somewhat less pronounced as an energy-saving measure had already been installed.

In the autumn of 2012, four points at Hamar station were also insulated. Jernbaneverket has nearly 3,000 points with heating elements, so there is great potential for further energy savings.

FACTS

Since 2003, Jernbaneverket has had energy saving projects in collaboration with Enova. Examples of completed projects include:

- ▶ Regulating points heating
- ▶ Installation of heat pumps and phasing out oil heating
- ▶ Replacing old light fixtures with more modern and energy efficient technology (LED)
- ▶ Installing snow brushes
- ▶ Insulation of rails in points
- ▶ Follow-up of measures identified in energy saving analyses of buildings

Testing beaver technique at Minnesund

In the autumn of 2012, expertise was brought from Slovakia to see whether the technique of building artificial beaver dams could be suitable for handling heavy precipitation in Norway as well.

This technique has been used in Slovakia with very good results. By building dams from tree trunks, twigs and stones from the surrounding areas, the water is slowed down so that culverts and pipes with low capacity can nevertheless handle flood peaks before they cause roads and railway tracks to be washed out. Over time, the dams will collect twigs and soil on the surface so that the sides of the valley are strengthened and

there is protection against future erosion at the bottom of the valley. In this way, small investments can lead to good results over several years.

Every drop counts. The "Handling floods and water gone off course" project is one of seven subsidiary projects in the NIFS research project. The technique is being tested in an area near the old Minnesund station, where several small streams run towards the railway line, where the water is drained in culverts through the embankment. Here there are significant challenges related to erosion, unstable slopes and landslides and sediment transport from

the upper areas. "It is great to be able to test advantages and disadvantages to the various techniques in an area where we have these problems", says Project Manager Steinar Myrabø in Jernbaneverket.

Artificial beaver dams are built in small catchment areas, often smaller than one square kilometre. About 90 per cent of Jernbaneverket's culverts are located in such small catchment areas. However, small streams can become "monsters" and lead to significant problems and damage if there is sufficiently heavy precipitation. Drainage and culverts must then work properly. Artificial beaver dams can help in this context.



Jernbaneverket Project Manager, Steinar Myrabø inspects the artificial beaver dam near Minnesund.

2012

January

2 January: Jernbaneverket assumes responsibility for the assistance service at the Oslo Central station, Gardermoen, Bergen and Trondheim stations succeeding NSB and the Airport Express.

February

Jernbaneverket completes several large studies in the first two months of the year. First, the high-speed report was presented, and in February, the study of the concept to be chosen for the InterCity stretches is presented, as is the 2014–2023 National Transport Plan.

March

1 March: Jernbaneverket starts testing commuter parking with payment by text message at the Kolbotn and Lørenskog stations. The purpose is to avoid having people park in the commuter spots when not taking the train.

13 March: A large landslide in Soknedalen on the Dovre Line means that the line must close for eight weeks while the rail embankment is rebuilt from the bottom of the valley, 180 metres below.

April

12 April: Minister of Transport and Communications Magnhild Meltveit Kleppa marks the official start of construction for the E6-Dovre Line Joint Project, and thus the start of a new and modern railway between Eidsvoll and Hamar.

To complete necessary work effectively and to minimise the disadvantages for passengers, it has become common practice to shut down rail traffic a few weekends a year. During the weekend of 13–15 April, several tasks are completed between Hønefoss and Bergen while the Bergen Line was closed. Work also takes place at a number of places on the Kongsvinger Line and Vestfold Line this weekend.

May

2 May: Jernbaneverket and the Norwegian Public Roads Administration sign Norway's largest construction contracts

for more than NOK 1.8 billion with Hæhre Entreprenør AS. The contract is for the E6-Dovre Line Joint Project.

3 The blasting of the Holmestrand station hall is well underway. The hall will be enormous when completed, and the sheer size of it is already visible.

On the night of 26 May, the Spikkestad Line closes for nine weeks for the upgrade of the Heggedal and Spikkestad stations, and for maintenance work on the stretch.

Jernbaneverket sends a proposal for a zoning plan for the Follo Line to the Planning and Building Authority in the Oslo Municipality. The plan is submitted for public consultation in the summer of 2012.

June

7 June: It is 50 years since the Nordland Line was opened all the way to Bodø, and the Norwegian Railway Museum marks the occasion with an anniversary exhibition: "The Nordland Line – a long history."

July

A lightning strike at Alnabru freight terminal causes extensive damage to the electrical and safety systems, and this causes problems for freight traffic.

After successful testing, the system of commuter parking using payment by text message was introduced at the Ski and Asker stations from 1 July.

Oslo Central station is closed for six weeks (from 24 June to 6 August) for extensive renewal and maintenance.

August

The Frida storm hits the Sørland Line and the Randsfjord Line, and causes washouts and landslides in 25 locations that must be repaired before train traffic can get back to normal.

September

During the weekend of 1–2 September, construction and maintenance work is performed at a number of locations along the Main Line and the Dovre Line. The entire stretch from Kløfta to Trondheim (including



the Trondheim central station) is closed. 19 September 2012: Minister of Transport and Communications Magnhild Meltveit Kleppa travels to Porsgrunn to detonate the charge that marks the start of construction for the 23-kilometre stretch from Farriseidet outside Larvik to Porsgrunn. The billion-kroner project is planned completed in the summer of 2018.

During the weekend of 28–30 September, Jernbaneverket performs extensive work on the Trønder Line, Nordland Line, Bergen Line, Main Line, Dovre Line and the Gjøvik Line.

October

4 The 150-year anniversary of the Kongsvinger Line is marked by a large public party for several thousand people.

5 At the end of October, 40 mayors from eight counties participate in a march from Oslo Central station to the Storting to demand full development of InterCity trains in Eastern Norway by 2023.

6 26 October: The Bane Energy unit of Jernbaneverket receives a first prize from the International Union of Railways (IUC) for having developed Erex, which is an IT tool to measure, calculate and invoice electricity costs for trains. The system has caught the attention of European train

companies and infrastructure managers because it shows exactly where energy-saving measures can lead to great savings. The Follo Line project is also honoured for having developed a system that can provide a detailed overview of the environmental impacts of future development projects, a so-called environmental account.

November

Jernbaneverket continues the stepped-up winter preparedness efforts that were introduced two years ago. New equipment, more people and better preparedness is to make the railway more robust when the snow and cold set in.

Intensive work is being done to build an academic community in railway disciplines at the Norwegian University of Science and Technology. An experience-based master's degree is established as a first step on the road to a regular master's degree programme.

December

9 December: A completely new and market-adapted timetable is introduced in Eastern Norway, with more departures and a regular train frequency. The new timetable is the start of the extensive re-

structuring that will be completed in 2014 with even more frequent departures.

The Oslo tunnel is closed to train traffic on Sunday 16 December due to smoke from a smouldering fire in a cable duct. The tunnel is reopened the following Monday afternoon, after damaged cables have been replaced and the system checked.

In 2102, several fire prevention measures are completed in the Oslo tunnel, and on 19 December a contract for a new fire hose is signed. The work is to be completed in 2013. (Value: NOK 96 million)

Customers are more satisfied. The index of customer satisfaction increased from 71 to 73 per cent through the year.

7 The Sørland Line was hit by the worst weather in living memory. For a period, several subsections are closed to traffic while awaiting ploughing and inspection. Jernbaneverket's diesel locomotive with snow removal equipment (MZ) comes to the Sørland Line to plough, and a milling machine is also sent westward.

Jernbaneverket does its "Christmas cleaning" of the Oslo tunnel. Twenty-three night shifts and 555 litres of water a minute are required to clean the tunnel and ensure good operational stability.

158 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 fuel 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.
- 2006** ▶ The railway enjoys **growth in both freight and passenger traffic**, and increases its market shares.
- 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 up during the spring. The introduction of a new **travel guarantee scheme** is approved.
- 2009** ▶ The National Transport Plan for 2010–2019 is presented. According to the plan, **NOK 92 billion** will be invested in the railway in the next decade.
- 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.
- 2011** ▶ After renewal work in 2011, **60 per cent of the railway network in central Oslo is completely new.**
- 2012** ▶ The punctuality of train traffic is better than in years, with **nine of ten trains running on time.**



Rælingsbrua in Lillestrøm

About Jernbaneverket

Jernbaneverket plans, constructs, operates and maintains the Norwegian national 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 headed by Director General Elisabeth Enger and consists of four main departments: Infra-

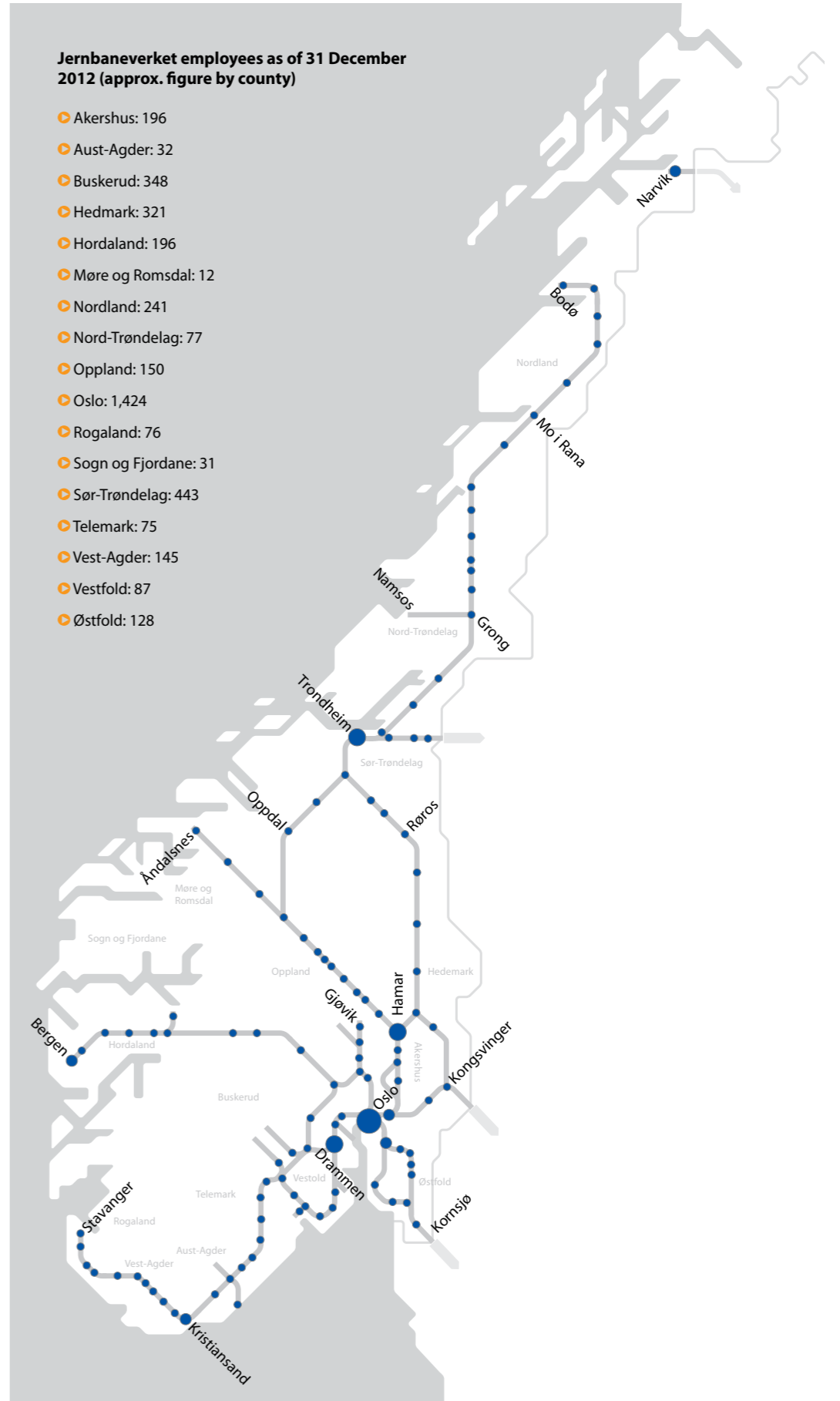
structure Management, Infrastructure Construction, Traffic Operations and Customer Service, and the Director General's staff.

Jernbaneverket employees are spread across much of the country and have a broad range of professional competencies. In Jernbaneverket, you can find dispatchers, traffic controllers, railway fitters, land consolidation graduates, construction managers, architects, geotechnicians, supervisors, environmental advisors, engineers and track coordinators, to mention some of the many occupations represented.

"Jernbaneverket employees are spread across much of the country and have a broad range of professional competencies."

Jernbaneverket employees as of 31 December 2012 (approx. figure by county)

- ▶ Akershus: 196
- ▶ Aust-Agder: 32
- ▶ Buskerud: 348
- ▶ Hedmark: 321
- ▶ Hordaland: 196
- ▶ Møre og Romsdal: 12
- ▶ Nordland: 241
- ▶ Nord-Trøndelag: 77
- ▶ Oppland: 150
- ▶ Oslo: 1,424
- ▶ Rogaland: 76
- ▶ Sogn og Fjordane: 31
- ▶ Sør-Trøndelag: 443
- ▶ Telemark: 75
- ▶ Vest-Agder: 145
- ▶ Vestfold: 87
- ▶ Østfold: 128



The national railway network comprises:

EL	Name of line	Km	Km double track	Bridges	Tunnels	Level crossings	Stations
●	Nordland Line	726	0	284	155	712	42
■	Sørland Line	549	14	512	191	131	45
■	Dovre Line	485	4	327	40	306	28
●	Røros Line	382	0	228	6	474	27
■	Bergen Line	371	0	201	144	180	33
■	Østfold Line, western Line	171	64	133	17	71	23
■	Vestfold Line	138	23	99	17	111	11
■	Gjøvik Line	123	2	74	7	101	22
■	Kongsvinger Line	116	0	61	0	67	13
●	Rauma Line	115	0	106	5	183	4
●	Solør Line	94	0	31	1	199	0
■	Main Line	68	20	65	5	17	21
■	Østfold Line, eastern Line (Ski–Sarpsborg)	78	0	32	2	88	11
●	Meråker Line	70	0	60	1	50	4
■	Gardermoen Line	64	60	25	4	0	3
■	Randsfjord Line (Hokksund–Hønefoss)	54	0	22	1	72	2
■	Bratsberg Line	47	0	43	20	50	3
■	Ofoten Line	43	0	7	24	43	6
■	Drammen Line	42	42	26	12	0	16
■	Arendal Line	36	0	17	3	47	8
■	Roa–Hønefoss Line	32	0	27	3	48	0
■	Flåm Line	20	0	2	21	40	8
■	Asker Line	15	15	8	3	0	0
■	Spikkestad Line	13	0	10	0	8	5
■	Tinnos Line (Hjuksebø–Notodden)	10	0	16	4	17	2
■	Brevik Line	9	0	18	0	5	0
●	Stavne–Leangen Line	6	0	11	2	0	1
■	Freight Line Alnabru–Loenga	7	0	0	0	0	0
■	Alna Line	5	0	6	1	1	0
■	Skøyen–Filipstad	2	1	0	0	1	0
Total lines with regular traffic		3,891	245	2,451	689	3,031	338
Total lines without regular traffic		339	0	121	27	659	0
Total:		4,230	245	2,572	716	3,690	338

- Electrified
- Not electrified

"Stations" in the table indicate locations with stops for passenger trains; in technical railway terms, the number of stations is far higher.

Environment

	2012	2011	2010
Electricity consumption in Jernbaneverket (GWh) ¹	105.1	104.4	112.1
Number of locations with polluted soil	29	43	55
Number of animals hit by a train	1,951	2,050	2,294
Clean tracks (percent)	88	87	85
Clean stations (percent)	92	88	97

¹Total electricity consumption without correction
Source: miljørapport2012.jernbaneverket.no

Financial highlights (NOK million)

Excerpt from cash accounts

	2012	2011	2010
Operation and maintenance	5,538.00	5,586.50	5,315.40
Operation and maintenance Gardermoen line	98.50	89.30	97.70
Investments in the line	5,069.90	4,402.90	3,864.90
Grant-funded expenditure	10,706.40	10,078.70	9,278.00
Track access charges	119.80	100.80	104.00
Sale of electricity for train operations	191.60	296.80	318.40
Other revenue	424.30	331.20	265.80
Revenue to state accounts	735.70	728.80	688.20

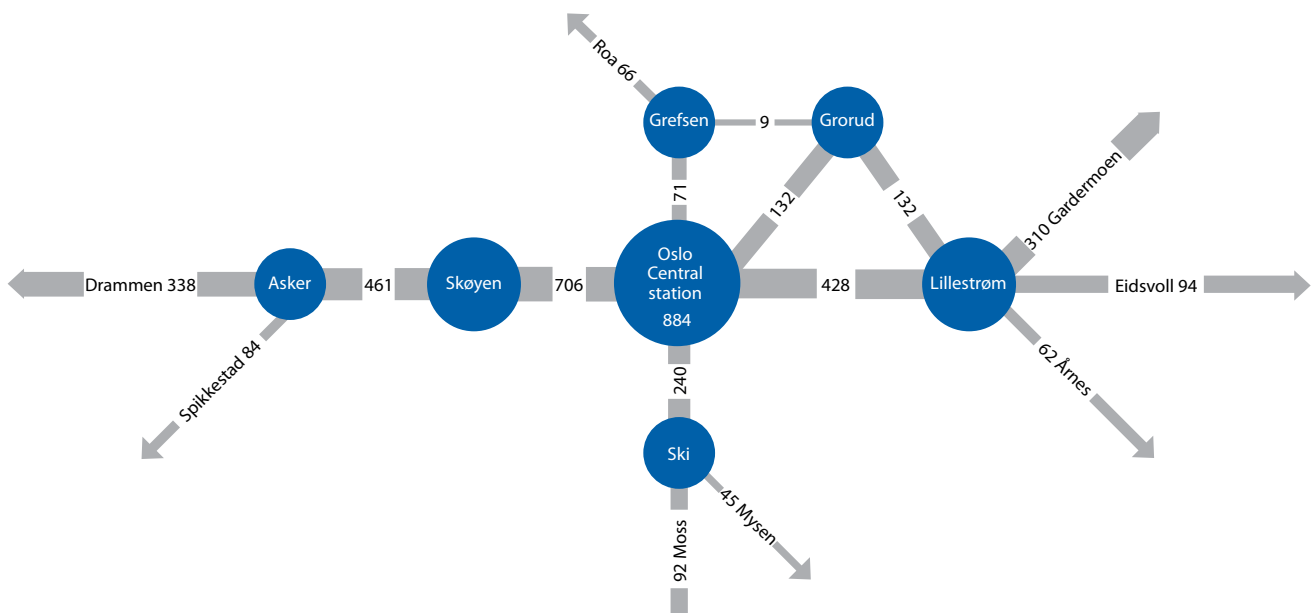
Excerpt from accrued accounts

	2012	2011	2010
Total operating revenue	6,164.00	5,820.43	4,400.60
Total operating expenses	-6,088.00	6,022.90	4,925.10
Total interest and other items	-1.00	-1.37	-1.10
Results for the year	75.00	-203.84	-525.60
Grant coverage (as a percentage)	87.1	87.1	80.8
Payroll (as percentage of operating and investment expenses)	22.7	22.3	21.9
Full-time-equivalent employees	3,829	3,547	3,275

The state accounts are based on cash accounting and follow the classifications in the national budget. The result for the year is in accordance with the accrual principle.

TRAFFIC

Total number of trains per day in the Greater Oslo area



TRAFFIC

Million tonne-kilometres¹

	2007	2008	2009	2010	2011	2012
Domestic train traffic	2,453	2,599	2,464	2,157	2,089	2,531
Of this:						
CargoNet AS	2,430	2,466	2,429	2,113	2,049	2,034
Others	23	133	35	44	40	497
Cross-border traffic²	1,002	956	813	1,065	1,367	958
Of this:						
CargoNet AS	283	234	204	255	182	111
LKAB Malmtrafikk AS	633	558	494	683	696	737
Others	86	164	115	127	489	110
Total:	3,455	3,555	3,277	3,222	3,456	3,489

Source: NSB AS, Cargo Net AS, MTAS (Malmtrafikk AS), Tågakeriet AB, Ofotbanen AS, Green Cargo, Peterson Rail AB, Cargolink AS, Railcare tåg AB, TX Logistikk AB

Data from HectorRail AB is missing for 2009-2010, data from Cargolink is missing for 2009-2010

¹ Tonne-kilometre: term describing the transport of one tonne of freight for one kilometre.

² Tonne-kilometre, calculated on stretches in Norway for cross-border traffic.

Million passenger kilometres¹

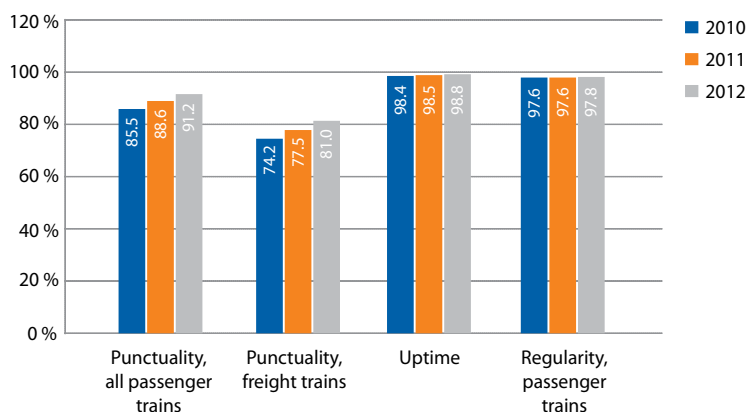
	2007	2008	2009	2010	2011	2012
Domestic train traffic	2,895	3,047	3,012	3,023	3,030	3,140
Of this:						
NSB AS	2,561	2,698	2,670	2,668	2,659	2,759
NSB Gjøvikbanen AS	55	57	59	59	61	63
Flytoget AS	268	282	273	286	298	306
Flåm Utvikling AS	11	10	10	10	12	12
Cross-border traffic²	88	97	69	72	74	62
Of this:						
NSB AS	59	63	68	71	72	62
Others	29	34	1	1	2	0
Total:	2,983	3,114	3,081	3,095	3,104	3,202

Source: NSB AS, NSB Gjøvikbanen AS, Flytoget, Ofotbanen Drift AS, SJ AB

¹ Passenger kilometres: the number of passengers multiplied by distance driven.

² Passenger kilometres, calculated on stretches in Norway for cross-border traffic. Data from NSB for 2012 is inconsistent with NSB's data for the previous year, due to a new calculation model that came into use in 2013.

Punctuality, regularity and uptime



Operating accidents in 2012

- Accidents by type
- Accidents according to UIC Safety Database definitions, with cost per incident where a train was directly involved >150,000 Euro, death, serious injury, or full delay of train traffic for more than six hours. Operational railway.

Type of accident	Number of incidents	Fatalities	Serious injuries
Collisions	11	0	1
- Train operations (train – train)	1	0	0
- Train operations (train – object)	10	0	0
- Shunting	0	0	1
Derailments	5	0	1
- Train operations	5	0	1
- Shunting	0	0	0
Level crossing accidents ⁽¹⁾	1	1	0
- Crossings with barriers, lights and claxons	0	1	0
- Crossings with gates	1	0	0
Other level crossing accidents	1	0	0
Rolling-stock fires	1	0	0
Other accidents ⁽²⁾	0	0	0
Total:	19	1	2

⁽¹⁾ Collisions between road vehicles and railway rolling stock

⁽²⁾ Other accidents resulting in death or serious injury

MAINTENANCE

Price level for maintenance and renewals per metre of main track

Track section	Operation, corrective and preventive maintenance (NOK per metre)	Renewals, incl. the Oslo project (NOK per metre)
Main Line including the Oslo area	1,247	3,168
Drammen Line	478	249
Gardermoen Line	658	118
Kongsvinger Line	307	81
Gjøvik Line	502	97
Østfold Line, western Line	403	461
Vestfold Line	272	94
Sørland Line	361	273
Bergen Line/Randsfjord Line	607	254
Dovre Line	540	398
Røros Line	198	69
Nordland Line	210	81
Ofoten Line	1,288	1,388
Other lines	155	32
Unspecified and Infrastructure Management staff	64	37
2012 average	449	345

The figures apply to the Infrastructure Management Division and are partially based on estimated distribution.

Some of the maintenance work in 2012

Action	Amount	Unit
Ballast cleaning	24	main line km
Preparations for ballast cleaning	25	main line km
Replacing sleepers	58,400	pieces
Replacing track	37	main line km
Replacing points	43	pieces
Contact line renewal	2	main line km
Track adjustment, continuous	963	line km

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