

# **Norwegian National Rail Administration (*Jernbaneverket*)**

## **National Signalling Plan**

Upgrading of, and investment in, railway signalling equipment

Introduction of ERTMS

November 2015

**Norwegian National Rail Administration (*Jernbaneverket*)**

**National Signalling Plan  
2015**

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# 1 National Signalling Plan – context, purpose and ownership

## 1.1 Context

A significant portion of the signalling and safety equipment on the Norwegian rail network is coming to the end of its life expectancy, and some of it has already exceeded its life expectancy. The need to upgrade signalling equipment on the Norwegian rail network is therefore increasing and in a number of places is becoming urgent.

At the same time, there are many ongoing and planned infrastructure projects that will require new signalling equipment if new and improved infrastructure is to be brought into operation.

In conjunction with the work on NTP 2014-2023, an overall plan for new signalling equipment on the Norwegian rail network was devised in 2013. This plan was given the status of National Signalling Plan and is presented here in an updated version (version 2, 2015).

## 1.2 Purpose of the National Signalling Plan

The Plan sets the agenda for all procurement of signalling systems for the Norwegian National Rail Administration and the national rail network. It covers both upgrades of existing equipment and the installation of signalling equipment on new or upgraded infrastructure.

The Plan states by which dates it is planned to have implemented the common European standard for signalling equipment, ERTMS, on the various sections of track. It also states which projects will be carried out using class-B systems and by which dates ERTMS will apply to these projects too.

The Plan addresses and coordinates the need to upgrade existing signalling equipment and the need for new signalling equipment for new infrastructure. The Plan also attends to the need for technical barriers on sections of track not operated remotely and to railway companies' need to convert trains to ERTMS so that the Plan can be implemented.

The Plan describes the reasons for the recommended and agreed plan for upgrading signalling equipment and deploying ERTMS on the Norwegian national rail network. Preconditions, methodology and the arguments in support of the recommendation are described. The earliest and latest dates by which particular locations need to have new signalling equipment and ERTMS are also stated, together with the factors behind the needs in question.

The objectives of the National Signalling Plan are:

- to ensure compliance with the requirements of the Railway Infrastructure Regulations, Sections § 3-7
- to provide for a comprehensive upgrade of existing safety equipment and construction of new safety equipment, of both class A and class B.

The recommendation contained in the Plan states the sequence of actions, together with the deadlines, for upgrading and installing new signalling equipment on sections of track. The Plan states the year in which a line is to be fully converted to ERTMS.

### **1.3 Ownership of the plan and how it relates to projects**

The National Signalling Plan is owned by the Director of the Infrastructure Division. The Plan is administered by the Director of the Signalling and Telecommunications Department.

The ERTMS national implementation project, ERTMS NI, is also administered by the Signalling and Telecommunications Department, with the departmental director as the person responsible for the project and the Director of the Infrastructure Division as project owner. The project managers are responsible for the planning and for introducing ERTMS on the national rail network.

The shared ownership enables the necessary coordination of the work on the National Signalling Plan and on the ERTMS NI project. The National Signalling Plan is based on an assessment of the Norwegian National Rail Administration's overall need for signalling equipment. ERTMS NI gives practical expression to this Plan in terms of each section of track, based on local conditions and the feasibility of implementing the project.

The plans for the project are based on factors governing when a start can be made on inviting bids, when contracts will be in place and how long it will take to develop, test and approve the solutions required for bringing an ERTMS section of line into operation.

In this revision of the Signalling Plan (version 2, 2015), the project is subject to external quality assurance (KS2), and it is uncertain when this will be complete. It is also as yet undecided when the project managers will be able to begin inviting bids.

Up until now the National Signalling Plan has, to a large extent, been regarded as a necessary framework for the ERTMS NI project, and its various development stages have been presented as the long-term timeframe of the ERTMS NI project. It is in the nature of things that the NI project will now, to a greater extent, set the agenda for the National Signalling Plan, especially with regard to when ERTMS is to be deployed on a further line after the Østfoldbanen East line. .

While the National Signalling Plan will continue to set the prioritisation criteria, what it is possible to bring about and when will from now on be determined by the NI project.

This version of the National Signalling Plan will form the basis for the Norwegian National Rail Administration's approach to NTP 2018-29 and to the Administration's other planning work. Financial circumstances, frameworks and budgeting needs are dealt with in terms of the individual projects. This plan provides guidelines for selecting the type of signalling equipment: ERTMS or class B.

A new signalling system also requires access to a transmission system, and ERTMS makes demands on the GSM-R service along the track. This plan is therefore also important in terms of developing telecommunications at the National Rail Administration.

### **1.4 Basis for the 2015 revision of the plan**

The 2013 version of the National Signalling Plan was based on the premise that the first ERTMS section of track would be brought into service in 2018. In addition to beginning to implement the ERTMS NI project nationally, the Norwegian National Rail Administration has since 2013 gained experience from projects that have put new types of signalling systems into operation, both class B and ERTMS systems. This has resulted in an updated progress plan in the run-up to the first ERTMS section of track being brought into operation. This version of the Signalling Plan is based on the

possibility of bringing the first ERTMS stretch of track into operation in 2021. Such a substantial change in circumstances requires the whole plan to be revised, and it is the biggest change to the basic data from 2013. The consequences of a later start to ERTMS are reflected in the 2015 plan.

A section of track for 'early deployment', on which the new signalling components can be tested out, is also proposed, and care will be taken to reduce the risk associated with a first ERTMS section of track subject to a new contract. An section of track using ERTMS – the Østfoldbane East line – has already been brought into commercial operation in Norway and is being used to gain experience in many spheres including not only the development of new traffic regulations for driving trains on ERTMS lines but also procurement strategy, project implementation, infrastructure changes and operational and maintenance concepts. The section of line concerned has ERTMS Level 2, Baseline 2 version.

More detailed plans for expanding Intercity and for other planned projects are available and have been used when revising the Plan. The need for upgrades has not changed since the 2013 plan.

## **2 Basis for prioritisation in the Signalling Plan**

### ***2.1 Description of the objective***

The National Rail Administration's objective is to upgrade the signalling systems and introduce class-A systems throughout the national rail network. The ERTMS Level 2 Baseline 3 version signalling system is earmarked for this plan, and it is envisaged that existing GSM-R networks will be used for communication between trains and infrastructure.

The ERTMS NI project is responsible for replacing signalling equipment and introducing ERTMS, setting up a new traffic management system and establishing contracts so that the rail companies are able to procure the necessary ERTMS on-board systems in time. The upgrading work is based on existing track plans, and necessary measures are planned to ensure that existing capacity on lines is maintained. Any measures to increase capacity will be assessed for each section of track in the detailed plan, where consideration will also be given to introducing new block signals and also new approaches to stations.

This will involve removing and replacing safety facilities, road safety equipment, propulsion machines, train detection apparatus and other items associated with signalling equipment. In addition, necessary measures will be taken in connection with, for example, telecommunications, technical cabins and transportation routes.

A new traffic management system, TMS, is being introduced as a common technical platform for the whole country. This will be set up for ERTMS and will be rolled out before ERTMS is deployed on each individual section of track.

The rail companies will have to have ERTMS on-board equipment in their locomotives in order to be able to travel on sections of track with ERTMS. The project also has a coordinating responsibility so that a large enough quantity of suitable rolling stock acquires ERTMS functionality in time for ERTMS's being brought into operation on the various sections of track.

## **2.2 Migration strategy**

There are in principle two possible strategies for a transition to ERTMS. One involves converting trains so that they can run on track with both ERTMS and class B systems in simultaneous operation (the rolling stock strategy). The other involves building double infrastructure, with both ERTMS and class B systems in operation simultaneously (the infrastructure strategy).

The National Rail Administration has decided that the rolling stock strategy will form the basis for developing ERTMS in Norway.

### **2.2.1 Infrastructure**

Having to switch frequently between different signalling systems (ERTMS/FATC/DATC) may not be ideal for train drivers. In making the transition to an infrastructure with ERTMS, it will therefore be desirable to bring the system into operation in a way that is as coherent as possible. In a transitional phase, switches between signalling systems more frequent than one might ideally like will probably have to be expected.

In devising new ERTMS signalling equipment and bringing it into operation, there must be a migration strategy designed to reduce the impact on rail traffic.

### **2.2.2 Rolling stock**

The rolling stock strategy involves all rolling stock that is to be used on ERTMS track having ERTMS on-board equipment. Rolling stock can also be enabled to run on class B track through the use of an STM module installed in the train.

The dates on which sections of ERTMS track can be brought into operation will therefore be determined in part by the quantity of available rolling stock with ERTMS on-board equipment. It will be important to coordinate driver training and rolling stock conversion with the infrastructure conversion.

## **2.3 Preconditions and main considerations**

The need to upgrade signalling equipment determines the order in which ERTMS will be deployed. The need for signalling equipment for new infrastructure (new projects and major conversions) is part of the plan and affects the sequence of ERTMS deployment. The need to install technical barriers on track that is not controlled remotely also affects the order in which deployment takes place.

The criteria for prioritising sections of track, given in order of importance:

1. Need for upgrades (upgrading critical equipment in terms of its life expectancy); see 'Strategic plan, upgrade of signalling equipment and ERTMS deployment', Case: 201302418-2
2. Need for remote control
3. Signalling equipment for new infrastructure (planned projects)

Most important considerations:

1. In the transition to ERTMS, instalment of class B (ATC) equipment is to be kept to a minimum.
2. ERTMS is to be fully deployed in Norway by 2031.
3. The ERTMS roll-out should be as coherent as possible so as to prevent operational islands.

The aim is to deploy ERTMS country-wide, but in a number of locations (primarily where there is new infrastructure) it will be necessary to proceed via class B equipment.

The greatest uncertainty in implementing the Plan is associated with the start-up date for the first ERTMS section of track. The factors most critical to the start-up are the time at which the contract is entered into and the development of solutions for safety equipment tailored to the needs of Norway. In addition, access to rail vehicles with ERTMS on-board systems will be critical, especially when converting the Drammen, Oslo S - Ski and Oslo S lines.

The sequence of deployment based on the need for upgrades is assessed in relation to planned investments (new infrastructure) described in the Action Programme and on approved principal plans as per June 2015. Other preconditions and considerations are given in Table 1.

**Table 1: Summary of preconditions and considerations.**

**ID      Preconditions/considerations:**

1      The date on which the first ERTMS section of track will be brought into operation is estimated to be no earlier than 2021 [13], based on experience of the ERTMS experimental track project and the 'Thales' project. This in accordance with the results of the uncertainty analysis in relation to progress in bringing the first ERTMS section of track into operation [11].

2      The following benchmarks form the basis for the project implementation:

- maximum of 50 two-track equivalents per section of track per year;
- maximum of 85 two-track equivalents country-wide per year.

This is based on the indication that the Norwegian National Rail Administration may need longer than its Danish equivalent did to construct and introduce ERTMS. The level is set at double the period, and lower in the first period.

Start-up of one section of track first, then two and then three. The project volume will increase over time, and may be adjusted as experience is gained. The assumption is that enough experience will have been gained of the project to enable more than 85 two-track equivalents to be rolled out after 2024. Only once suppliers have been selected and experience obtained will the figure be more certain and planning more accurate.

3      The assumption is made that financing and the contract/procurement strategy for on-board equipment will not affect the sequence of deployment.

4      It is presumed that the supplier market will be able to meet the National Rail Administration's need for supplies.

5      Precisely when and in which sequence ERTMS will be brought into operation will depend partly on the quantity of dedicated rail equipment required by all the rail companies on the section of track concerned. No account will be taken of any additional trains, charter trains, etc. On-board



equipment is expected to be brought into operation no earlier than three years after a contract has been entered into with the supplier.

6 A shared remote-control technical platform is part of the contract/procurement strategy and does not affect prioritisation.

7 In principle new tracks for crossings do not affect ERTMS deployment, but measures implemented under the NTP may affect the sequence of deployment as part of the 'new infrastructure' prioritisation criterion. If such measures are recommended before ERTMS, they must be carried out using NSI-63 or other suitable provisional equipment.

8 No special account has been taken of plans to develop ATC crossing barriers, but the 'crossing barrier' function is taken care of by ERTMS.

9 'Islands' of conventional equipment, namely DATC/FATC/ERTMS, must be avoided as far as possible.

10 Traffic patterns are based on the 2014 timetable.

11 The 'Strategic Plan: Upgrade of Signalling Equipment and ERTMS Deployment' [1] takes no account – in terms either of investment or beneficial effect – of the cost/benefit ratio (with regard, for example, to saved years of man-labour) of measures implemented at railway stations in connection with the instalment of remote control and the advantages this brings.

12 Branch lines and other minor lines will be upgraded at the same time as the adjoining sections of main track and will not be the factor that mainly determines the need for an upgrade.

13 The plan for the transition to ERTMS will apply to the whole of the national rail network.

14 The national implementation of ERTMS has the following technical dimension in addition to the necessary on-board system for rolling stock and the new Traffic Management System

Upgrade of signalling:

- external signalling items such as systems for train detection, points mechanisms, road safety equipment and reading of sensors;
- internal local and central signalling equipment (object controllers/safety equipment/RBC);
- external and internal cabling.

Engineering work:

- establishment of approach roads
- new technical cabins
- adequate power supply
- necessary safety measures at stations that are to be controlled remotely

Telecommunications:

- necessary transmission
- adequate GSM-R cover

Part of the project's mandate is to pull down and remove the old signalling system and attendant cables and to join together rails where there were previously block sections.

15. Contract strategy/procurement strategy is not subject to this planning process.

16. Signalling equipment at goods terminals will be upgraded when the relevant section of track and the station to which the terminal is linked are upgraded. If goods terminals have their own sidings, these will not be the factor that determines an upgrade, but if such sidings are in great need of an upgrade they can feature in the plan as a separate section of track.

17. This report is based on the rolling stock that is currently used by the rail companies. If railway package 4 is adopted, it may be effective from 2019 and lead to increased competition in passenger services. This might have consequences for the type of railway equipment used on the various sections of track.

### **3 Consistency and flexibility in the Plan - process for making changes**

Neither the order in which new signalling equipment is installed on the specific sections of track in the plan, nor the dates by which it will be installed, are set in stone. The National Signalling Plan must be able to balance, at any time, the need for predictability in planning against the need for dynamic change in keeping with changed circumstances and preconditions.

#### **3.1 The prioritisation criteria are fixed.**

The criteria for determining in what order of priority sections of track are to be converted to ERTMS are considered to be fixed. This means that sections in great need of an upgrade (old signalling equipment) will have priority over sections requiring the installation of remote control.

Furthermore, sections of track requiring ERTMS for the instalment of remote control have priority over new infrastructure projects requiring new signalling equipment. New infrastructure projects have a higher priority than remote-controlled sections of track and non-urgent needs for upgrades.

#### **3.2 The order in which equipment is installed on sections of track and the respective dates may be altered as the need arises.**

Although the prioritisation criteria are fixed, the actual prioritising of sections of track is dependent on a number of circumstances. Any delays to infrastructure projects or to the ERTMS NI project will give rise to the need to re-assess both the order of priority given to the various sections of track and the dates on which these sections are to be upgraded.

Any significant delays in the ERTMS NI project would affect the Signalling Plan considerably. ERTMS would then be deployed later than planned, and the installation of ERTMS on a number of lines urgently in need of an upgrade would then most likely be given priority over both new infrastructure and lines requiring remote control to be installed. In these cases, assessments would have to be made of whether class B-type signalling equipment should be used in order to achieve the project objective of bringing new or updated infrastructure into operation.

### **3.3 Process for making changes to the Signalling Plan**

The plan presents the current planned sequence of ERTMS deployment. Changes to preconditions or basic data will give rise to a need to revise the plan so that it reflects reality. Examples of such changes may include:

- Changed need for an upgrade/spare parts situation, etc.
- Change to the National Rail Administration's project portfolio (infrastructure)
- Input from the ERTMS NI project concerning when ERTMS is expected to be ready for the first section of track and the expected capacity of suppliers in terms of rolling out trackside signalling systems and converting trains.
- Budgetary considerations

## **4 Signalling Plan**

The Rail Administration's National Signalling Plan recommends upgrades and the development of signalling equipment based on the following set of arguments..

The recommended order in which ERTMS is to be deployed and the plans for introducing class B equipment are presented in the form of a detailed timeline up to 2030. The diagram shows the anticipated period for line development work. Work on the plan is to begin before this. The end of the diagram shows the latest point at which the new signalling equipment is to be brought into operation on each section of track.

### ***Figure 1: Graphical presentation of recommended sequence of deployment***

*See original document for graphic.*

General observations on the order of priorities: The line between Oslo S and Ski and the Bergensbanen, in addition to Oslo S – Skøyen, are the lines with the greatest need for upgrades of signalling equipment. These sections really should be upgraded first, but the date has been adjusted to take account, among other things, of limited access to converted rolling stock.. Efforts should be made to upgrade them as soon as is feasible but no later than indicated in the Signalling Plan. Oslo S must be upgraded before 2026, and there can be no postponement. By 2026 the spare parts will no longer be available, and the service agreement will have expired.

The strategic plan for upgrading signalling equipment [1] states the optimum deadline, from a cost perspective, for upgrading the various sections of track. This is based on the anticipated increase in maintenance costs as signalling equipment gets older and the evaluated risk of failures that, in the long term, may lead to reduced transport capacity.

If there are changes to the completion dates for projects planned to be carried out using new class B equipment, an assessment will have to be made of whether it might be appropriate to carry out the projects using ERTMS instead. If the implementability of the ERTMS NI project proves to be better than anticipated in the plan, the introduction of ERTMS may be speeded up under the project.\*\*\*

The figure below shows the dates for introducing ERTMS.

**Figure 2: National Signalling Plan – recommended sequence of stages for developing ERTMS**

See original document for map.

Table 2: Summary of the arguments for the recommended signalling plan per section of track

<b>Line</b>	<b>Governing conditions</b>
<i>Ofotbane (2021)</i>	<ul style="list-style-type: none"><li>• The need to upgrade the Ofotbane is not urgent, with the exception of Narvik Station.</li><li>• The increased capacity planned for the line means that the station will need to be extended, with new signalling equipment at Narvik Station.</li><li>• The deadline for introducing ERTMS is not definitively fixed but, because of the increase in capacity, the recommended deadline is being set as early as possible.</li><li>• ERTMS cannot be introduced until the summer of 2021 at the earliest because of the capacity for equipping the line with rolling stock. This in accordance with the agreement between LKAB, the Norwegian Transport Administration and the Norwegian National Rail Administration.</li></ul>
<i>Nordlandsbanen and Meråkerbanen (2022/2023)</i>	<ul style="list-style-type: none"><li>• The Nordlandsbanen is not in urgent need of upgrade.</li><li>• The need for remote control and for the introduction of technical barriers on the northern part of the line (Eiterstraum - Bodø) means that this section of track has priority over other sections.</li><li>• Planned and coordinated electrification (by approximately 2022) is envisaged for the Trondheim - Steinkjer section. It is recommended that new signalling equipment be introduced simultaneously, given the need for enhanced train detection once the line is electrified. ERTMS ought not to be introduced on this section of track prior to electrification, given the rail companies' desire to make the most of existing materials.</li><li>• There is flexibility regarding the Steinkjer - Eiterstraum section in view of the deadline for replacing the signalling systems. The ERTMS NI project opts for upgrade where it is most appropriate.</li><li>• Upgrade of Trondheim station will accompany that of the Dovrebanen.</li></ul>

- Development of the Meråkerbanen is included in that of the Nordlandsbanen, and there will be concurrent planned electrification (by approximately 2023).

Rørosbanen and  
Solørbanen (2024)

- This section of track is in great need of upgrade.
- There is a need for remote control and for the introduction of technical barriers on the Støren - Røros section.
- There should be flexibility initially, but the upgrade should be complete before 2026 because of the spare parts situation.

Dovrebanen and

Raumabanen  
(before 2030)

- The Dovrebanen is not in urgent need of upgrade.
- ERTMS will be introduced on the Dovrebanen once the Oslo S section has been converted. This will enable freight companies on this stretch of line to use locomotives that there is no desire to convert. The development is envisaged to take place in conjunction with the development of Alnabru and Trondheim stations.
- It is recommended that class B equipment be used on the Kleverud - Hamar project in view of the availability of converted rolling stock. In consideration of the use of resources in the ERTMS development, it is proposed that the Dovrebanen as a whole be developed.
- Upgrade/upgrading to ERTMS on the Eidsvoll - Lillehammer section of track is viewed in the context of the new double track for the Hamar - Lillehammer section in conjunction with the Intercity development.
- The Raumabanen is included in the ERTMS development of the Dovrebanen.

*Vestfoldbanen*  
*Brevikbanen*  
*Bratsbergbanen*  
(2024/ 2026/ before  
2030)

- The Vestfoldbanen is not in urgent need of upgrade, except for a number of local stations.
- The development of the Intercity parcels of track will partly determine when ERTMS is introduced on the Vestfoldbanen.
- The Barkåker - Tønsberg section of track will provisionally retain its existing equipment, with an extended lifetime, until such time as the Nykirke - Barkåker project is completed.
- The first Intercity section of track is accepted as being the Nykirke - Barkåker one, with a planned completion date in 2024. As a supplement to the new section of track, ERTMS will be introduced on the section from Drammen to Tønsberg before 2024. It is anticipated that, in Tønsberg, new equipment will be used for the phased conversions that will be part of the Intercity development.
- The Holm - Nykirke section will be completed before ERTMS is available and built using class-B equipment.
- Upgrade of the line from Tønsberg to Larvik will coincide with the initial Intercity development on this section of the line. It is anticipated that new equipment will be used for the phased conversions

- The Farriseidet - Porsgrunn section will be completed before ERTMS is available, and class-B equipment will therefore be used.
- The section of track from Larvik to Nordagutu will be converted to ERTMS after Larvik and coordinated with ERTMS on the Sørlandsbanen.
- Drammen station is on the Oslo S - Drammen – Hokksund section of track.

*Gjøvikbanen (2027)*

- The Gjøvikbanen is not in urgent need of upgrade.
- The need for remote control and for the introduction of technical barriers on the northern part of the line is one reason why it is recommended that the upgrade be completed in the course of 2027.

*Bergensbanen*

*Flåmsbanen*

*Roa-Hønefossbanen*

*Randsfjordbanen*

*(2023)*

- The considerable need for upgrade on the Bergensbanen west of Hønefoss is a crucial factor in the priority given to this work.
- The Arna - Bergen section of line is planned to be completed so soon that ERTMS will not be ready by then to be brought into operation, so it is therefore planned to use class B equipment. It is in terms of the ERTMS NI project that an assessment will be made for the transition to ERTMS of the Arna - Bergen section of line, but the work will be completed before 2030.
- Flåmsbana, Hokksund - Hønefoss and Roa - Hønefoss will be part of the ERTMS development of the Bergensbanen.
- The Roa - Hønefoss section of line will be equipped with ERTMS early and will be an 'Early deployment' section for testing purposes. Existing signalling equipment will be used for normal train services until such time as the remainder of the Bergensbanen is brought into service using ERTMS.
- Work on the Ringeriksbanen will include ERTMS.

*Sørlandsbanen*

*Arendalsbanen*

*Hjuksebø-Notodden*

*(2028)*

- The Sørlandsbanen is not in urgent need of upgrade but a high proportion of its equipment is old.

*Østfoldbanen*

*(2023/2026/before*

*2030)*

- The Oslo - Ski section of the Østfoldbanen is in urgent need of upgrade, and it is recommended that ERTMS be introduced as early as possible. It is acknowledged that this cannot be done before 2023, given the need for rolling stock, and before the Follobanen has been completed as a possible diversion.
- Otherwise, the Østfoldbanen is not in need of urgent upgrade.
- The Follobanen will be upgraded, and Ski Station converted, using class-B equipment, as necessary phased conversion work at Ski Station must be carried out before the first ERTMS equipment is available.
- On the Ski - Fredrikstad line, the two projects (Sandbukta - Såstad and Haug to Seut) will use class-B equipment because, under current plans, they will have to be completed before ERTMS is available.
- The double-track Seut - Sarpsborg section will be upgraded using ERTMS before 2026.
- The Follobanen and Ski - Seut section will be converted to ERTMS once the Seut - Sarpsborg section has been completed.
- The Sarpsborg - Kornsjø upgrade will be coordinated with the Intercity development in Sarpsborg and the introduction of ERTMS on the Swedish side of the border.
- The Østfoldbanen East line will be updated to Baseline 3 by ERTMS NI in course of the project period.

the

*Oslo S-Drammen –  
Hokksund  
Spikkestadbanen  
(2026/ 2024)*

- Oslo S and Skøyen are in great need of upgrade, and it is recommended that they be updated to ERTMS as early as possible. It is acknowledged that this cannot be done before 2025-2026 because of the need for rolling stock.
- Elsewhere on the line the need for upgrade is not urgent.
- The upgrade of Drammen station in conjunction with the Intercity development will require new signalling equipment. It is envisaged that new equipment will be used for the phased conversions. The (Asker) - Hokksund section of line as a whole will be converted to ERTMS.
- The (Skøyen) - Asker section of line will be upgraded once the (Asker) - Hokksund section has been upgraded. Subsequently, the Oslo S - Skøyen section will be upgraded.

*Hovedbanen and  
Gardermobanen  
(2029) •*



- The Hovedbanen and Gardermobanen are not in urgent need of upgrade, with the exception of Alnabru.
- The line will be upgrade once Oslo S has been upgraded.
- The track for entering and exiting Alnabru is part of the ERTMS development of Hovedbanen.
- Alternatives for renovating signalling equipment at Alnabru will form the subject of a separate report.

*Kongsvingerbanen  
(before 2030)*

- The Kongsvingerbanen is not in urgent need of upgrade, with the exception of Kongsvinger.
- No ongoing or planned projects that set the agenda. Coordination with ERTMS plan on Swedish side of the border.

More details are contained in the document ‘National Signalling Plan – Line Information’ (*Nasjonal signalplan – strekningsinformasjon*) [10].

The work schedule was presented to Norwegian State Railways, and comments were received [7]. The response reveals a perception that the plan is feasible, on condition that there are, for example, a sufficient number of brand-new trains with factory-installed ERTMS, promptly available workshop capacity and top-class on-board equipment installed immediately after the contract is entered into. These are risk elements that both Norwegian State Railways and the Norwegian National Rail Administration follow up in their respective projects.

To summarise, it can be said that the plan, as it now stands, attends to the need for upgrade described in the Strategic Plan for Renewal (*Strategisk plan for fornyelse*) [1]. Technical barriers/remote control were installed relatively early on three stretches of track, while the Gjøvikbanen was accorded a priority lower than that of renovating Oslo S and installing a certain amount of ERTMS equipment for the Intercity development. The plan is to bring class-B equipment into operation also, once new ERTMS equipment is available in Norway. This is conditional upon its being possible to bring the maximum number of items of equipment into operation per year per section of line and upon there being access to rolling stock equipped with ERTMS on-board equipment on the specific sections of line. In conjunction with developing the Intercity sections of line, there is an accumulation of projects requiring new signalling equipment in the period 2022-2024, and there is also the need to upgrade equipment on sections of line.

The guidance given, to the effect that the roll-out should be coherent, and operational ‘islands’ prevented, has been very largely put into practice. For a transitional period, and until the whole network has been upgraded, there will be no avoiding having areas with different types of signalling equipment. The area that is the exception in this respect is the stretch of track between Oslo S and Ski on the Østfoldbanen – here, ERTMS will be in place for a longish period before adjoining equipment and sections of line acquire ERTMS equipment. An optimally coherent roll-out of ERTMS on the Intercity sections of line requires especially good coordination between, on the one hand, the

projects under which new work is being done on railway lines and, on the other, ERTMS NI. The latter is upgrading the equipment that is in place between the areas where Intercity work is being done.

## 5 Documentary information

### 5.1 Log of changes

Rev.	Description of change	Date	Carried out by
00E	The changes are described in the previous document. IUP-00-A-04278-00E	21.11.2015	xloas
	a) The document number has been changed to that of an STY-document and becomes part of the management system		
	b) New proposed date for bringing the first ERTMS section into operation		
	c) Change to order of priorities as a result of new timetable for ERTMS NI.		
	d) Information on cost estimate removed		
	e) Updated description of objectives, preconditions and guidelines		

### 5.2 Definitions

Table 3: definitions and acronyms

Definition/ acronym	Description
ATC	Automatic Train Control. Existing automatic speed control system in Norway. <i>See class B.</i>
DATC	Partially equipped ATC. ATC area that does not have full speed control.
ERTMS	European Rail Traffic Management System. Common European standard for signalling equipment. <i>See class A.</i>
ETCS	European Train Control System. Automatic speed control system, class A. Part of the ERTMS system
FATC	Fully equipped ATC. ATC area that has full speed control.
Class A	Automatic speed control systems that comply with the common European standard as described in TSI CCS [15]. <i>See also ETCS.</i>
Class B	National automatic speed monitoring systems, limited to what is described in Annex B of TSI CCS [15]. The current ATC system is class B equipment. <i>See also ATC.</i>
NTP	National transport plan
On-board system	That portion of the signalling equipment that is on board the rolling stock.

STM	Specific Transmission Module. Module additional to the ERTMS on-board system, allowing stretches of track to be travelled on without ERTMS
Two-track equivalent	A batch of signalling equipment corresponding to that used at a two-track station.
Railway company	Any public or private company whose main business is the transport of goods and/or passengers by rail where the company undertakes to provide the tractive force; also, companies that provide only the tractive force.
The national railway network	The railway infrastructure that is intended for passenger and/or goods transport and that is administered by the Norwegian National Rail Administration ( <i>Jernbaneverket</i> ).

### 5.3 References

Reference list:

- [1] Strategic plan, upgrade of signalling equipment and introduction of ERTMS, Ref:201332418-2
- [2] Memorandum, Experiences of ERTMS experimental deployment, 201302418-3
- [3] Summary of ERTMS NI plan, ERP-00-A-00012
- [4] Input from the Strategy and Society units, 201504242-15
- [5] Updated needs regarding signalling equipment for new or conversion projects,
- [6] Signalling equipment for new or conversion projects, February 2013, 201302418-5
- [7] Response from NSB, 201504242-13
- [8] National Signalling Plan – input from Traffic and Market, 201504242-7
- [9] Memorandum, Basic data for preparing the National ERTMS Plan, 201302418-8
- [10] National Signalling Plan, information regarding sections of line, IUP-00-A-00-00648\_01E
- [11] Sensitivity assessment of National Signalling Plan 2015, 201504242-12
- [12] Minutes of meeting, Presentation of ongoing work on the National ERTMS Plan, 201504242-1.3
- [13] Input for updating of the National Signalling Plan, version 1 from ERTMS NI, 201504242-2
- [14] Experience of implementing Thales, 201504242-14
- [15] TSI CCS, Decision 2006/679/EF implemented in Regulation on TSI control, monitoring and signalling - FOR 2007-10-26 No 1194

## **Annex 1: Organisation and process**

The project for updating the National Signalling Plan began in May 2015 and was led by Astrid Arnesen on the instructions of Sverre Kjenne, Signalling and Telecommunications, Infrastructure Division.

A central project group was established to give guidance to the working party tasked with implementing the project. The central project group consisted of Terje Eidsmoen (Strategy and Society), Odd Erik Berg (Infrastructure, Maintenance), Per Arne Fredriksen (Large Projects), Vibeke Aarnes (Infrastructure, Oslo Corridor) and Jon Inge Kjernlie (Traffic and Market). The working party consisted of Kjell Kristian Hageland (ERTMS Project/Infrastructure), Finn Holom (Planning and Technology/Infrastructure), Marianne Hesland (Signalling Services/Infrastructure) and Astrid Arnesen (Signalling and Telecommunications/Infrastructure, Atkins).

The work process for updating the National Signalling Plan is illustrated in Figure 3.

### **Key to Figure 3: Process for updating National Signalling Plan**

*See original document for preferred layout.*

#### **Phase 1 Preparation of basic data**

- \* Need for upgrading of signalling equipment
- \* Survey of projects (construction of new signalling equipment or conversion of existing equipment)
- \* On-board equipment, scope/consequences for machines, passenger trains and goods trains

#### **Phase 2A Assessment per section of track**

- \* Description of basic data and other relevant factors per section of track
- \* Summary of the influence on the section of track of various prioritisation criteria
- \* Recommendation for the section of track, including description of consequences in the event of accelerated or postponed upgrading/development

#### **Phase 2B Alternatives/scenarios**

- \* All the sections of track on the timeline are based on the recommended period for upgrading/development.
- \* Discussion of the influence of various factors
- \* Triple estimate regarding indicative timescales/project implementation

- \* Preparation of alternative bases for proceeding and various scenarios
- \* Advantages and disadvantages of particular scenarios
- \* Recommendation

### **Phase 3 Consolidation of the plan**

- \* Present the work schedule to internal organisational units and to NBS and SJT.
- \* Adjust the plan if necessary.
  - Sensitivity assessment
- \* Presentation to JBV's management

### **Phase 4 Complete report**

Collating of report

- \* Preconditions
- \* Description of the objective
- \* Management of change
- \* Description of process/methodology
- \* Recommended signalling plan

The updating of the National Signalling Plan followed the same process as that used for establishing the Plan, but with the focus on requirements that had changed since the previous plan was drawn up. An assessment was made of how the required changes and conditions affect the Plan.

The organisational units have provided input regarding requirements that have changed since they provided their input in 2013; see list of references.

## **Annex 2: Procurement of signalling equipment for Norwegian National Rail Administration projects**

In the case of new-build projects in need of ERTMS signalling equipment, it is planned to establish a customer-supplier relationship where the ERTMS-NI project is the supplier and the individual investment project is the customer. The main plan will be drawn up by the investment project and will form the basis for agreement between the parties. The ERTMS project has responsibility as the supplier all the way from drawing up the detailed plan to supplying ready-approved equipment within the basic framework set by the agreement.

If there is a need for points mechanisms for maintenance purposes, these will be procured via the contract with ERTMS-NI for such systems. This also applies to other components such as axle counters, external road safety equipment and cables.

Standardisation is the objective, and the project must carry out an assessment of whether all or parts of the various components are to be exchanged. The agreements with the suppliers are established in such a way that they cover procurement both within and outside of the ERTMS project. In addition the project will cover support for such procurement.

## **Annex 3: ERTMS NI project**

ERTMS NI has this plan as the basis for its work and must proceed to:

- Assess how sections of line might most appropriately be divided up for the purposes of bringing them into operation, including the installation of systems for a transitional period, for example in Hell;
- Assess the appropriateness of introducing new safety equipment where there is at present no such equipment but only agreements to operate very little traffic, for example on the Numedalsbanen;
- Coordinate the procurement and planning of signalling for new build and large conversions;
- Coordinate the procurement and equipping of a sufficient number of trains to be able to bring sections of line into operation using ERTMS.

The National Signalling Plan forms the basis of the National ERTMS Plan that is to be notified to ESA. This plan shows the order of priority for converting sections of track to ERTMS and the dates by which such conversion should have taken place. It is the National ERTMS Plan that will form the basis for ESA's overall plan.



## Annex 4: Survey of planned class-B equipment

Important! The need for signalling equipment may arise early in construction projects and is often indicated in the plans that state the sequence of phases. The completion date for the project is therefore not directly connected with the project's need for signalling equipment.

### Times

Station/Project	Relevant section National Signalling Plan	Completion (project)	To ERTMS (by)	Comments
Høvik stasjon	Oslo S-Asker	2015	2026	To be completed before ERTMS becomes available. Part of new Basic Route 2015 ( <i>Grunnrute 2015</i> )
(Eidsvoll)- Kleverud	Dovrebanen	2015	2030	To be completed before ERTMS becomes available.
Sandnes- Stavanger	Sørlandsbanen	2016	2028	Dispensation expires. To be completed before ERTMS becomes available.
Holm-Nykirke	Vestfoldbanen	2016	2024	To be completed before ERTMS becomes available.
Brevikbanen	Vestfoldbanen	2018	2028	Included in the Farriseide-Porsgrunn project. Dispensation expires 31 December 2018. Forms part of new installation (ref. 201201634-46) for Farriseide-Porsgrunn section of line.
Farriseidet- Porsgrunn	Vestfoldbanen	2018	2028	To be completed before ERTMS becomes available.
Hell-Værnes	Nordlandsbanen	2018	2022/2023	To be completed before ERTMS becomes available. To be upgraded to ERTMS in conjunction with ERTMS on southern part of the Nordlandsbanen.
Arna-Bergen	Bergensbanen	2021	2030	Decision on planning for class B at both stations because the roll-out date, which is earlier than the date on which ERTMS will become available, has been maintained.

Kleverud-Hamar	Dovrebanen	2024	2030	Project in early planning phase. Part of Intercity concept document. Class B pursuant to signalling plan. If Hamar station requires new equipment before 2024, this must be class B equipment; if new equipment not required until later, ERTMS is to be used on part of the Brummundal-bound section of track.
Tracks for crossings	Many			Not distributed across the country. The plans contain a great many tracks for crossings. Many of these require new equipment. The strategy may be one of not installing these until such time as the whole line has been upgraded to ERTMS, making changes to the closest existing equipment or deciding to introduce class B equipment with NSI-63 if necessary. Account was taken of this in the 'Last buy'/spare parts order.
Ski st./Follobanen	Østfoldbanen	2021	2030	To be completed before ERTMS becomes available.
Haug-Seut	Østfoldbanen	2023	2030	Because of current phase plans and roll-out in 2021, this section of track must be upgraded using new class-B equipment.
Sandbukta-Såstad	Østfoldbanen	2021	2030	Because of current phase plans and roll-out in 2021, this section of track must be upgraded using class-B equipment.

