Leigh | Fisher
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REPORT

Rail winter performance & preparedness

International benchmark

Ref: NLA1001 Amsterdam Date: 7th June 2012

Content

- **Beantwoording vragen buitenland review**
- **Introduction into the international benchmark**
- **Key characteristics benchmark countries**
- **Findings structured around Infrastructure, Rolling Stock and Operations**
- **Summarized benchmark findings**

LeighFisher has offices in the Netherlands, UK, Italy, USA, Canada and India. We offer a broad range of strategic management consultancy services, with an emphasis on policy, economic regulation, business strategy and planning, economic and financial modelling, and PPP and related transaction support.

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De Minister heeft de Tweede Kamer toegezegd de prestaties van het spoor te vergelijken met die in het buitenland

Vragen Buitenland review

Uit brief van Minister aan Tweede Kamer van 9 februari 2012

1. Hoe verhoudt de kwaliteit en robuustheid van de Nederlandse spoorinfrastructuur en de kosten (met name van de storingsgevoelige onderdelen zoals wissels en bovenleidingen) zich tot die van andere landen waar zich vaker (extreme) winteromstandigheden voordoen?
2. Hoe verhoudt het Nederlandse beheer- en onderhoudsprogramma van de kwetsbare delen van de infrastructuur (zoals wissels en bovenleidingen), zich tot die landen?
3. Hoe verhoudt de snelheid van herstel van verstoringen zich tot andere landen?
4. Hoe zijn in vergelijking tot die landen de kosten voor het beheer en onderhoud van de kwetsbare delen van de infrastructuur (zoals wissels en bovenleidingen), alsmede de totale systeemkosten?
5. Wat zijn de veiligheidsprestaties in vergelijking met die landen?

Antwoord vraag 1

Vraag 1.	Hoe verhoudt de kwaliteit en robuustheid van de Nederlandse spoorinfrastructuur en de kosten (met name van de storingsgevoelige onderdelen zoals wissels en bovenleidingen) zich tot die van andere landen waar zich vaker (extreme) winteromstandigheden voordoen?

- Wissels zijn in alle landen storingsgevoelige elementen. In de winterperiode ligt het aantal storingen aan wissels in de onderzochte landen rond 20-30% hoger in vergelijk met de rest van het jaar. Op dagen met sneeuwval treedt een piek op in storingen maar exacte gegevens hierover ontbreken
- Alle onderzochte landen hebben in de laatste 5 jaar één of meerdere jaren met slechte prestaties gekend waarna de aandacht op de wintervastheid en staat van onderhoud in het algemeen sterk is toegenomen
- Bovenleiding systemen laten bij DB en SBB geen grote toename zien als gevolg van het winterweer. In Zwitserland wordt gedurende sneeuwval en strenge vorst ook ‘s nachts gereden om de bovenleiding (en ook het spoor) sneeuw en ijsvrij te houden. DB heeft als additionele maatregelen sinds afgelopen winter dat de bovenleiding op de hogesnelheidslijn Köln-Frankfurt door spanningsregeling warm gehouden wordt en op trajecten waar snelheden boven de 160 km/uur liggen wordt voor aanvang van de dienst een ‘bezemtrein’ over de baan gestuurd

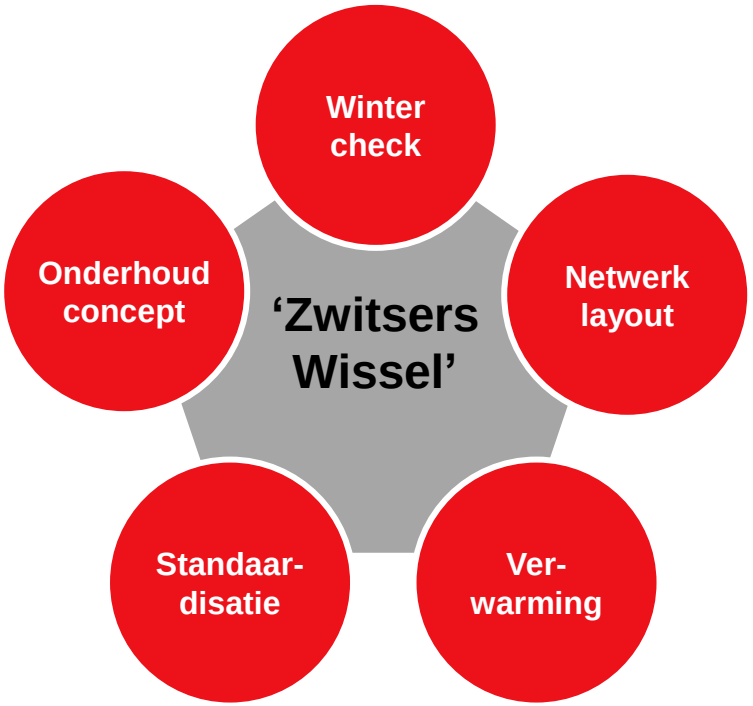
Antwoord vraag 2

Vraag 2. Hoe verhoudt het Nederlandse beheer- en onderhoudsprogramma van de kwetsbare delen van de infrastructuur (zoals wissels en bovenleidingen), zich tot die landen?

- Een belangrijk verschil met ProRail is dat DB, SBB en NR het dagelijks onderhoud aan de infrastructuur niet outsourced hebben. Dit betekent dat ze zelf verantwoordelijk zijn voor storingsherstel en gereed hebben van ploegen. In Zweden is het onderhoud ook outsourced als in Nederland maar hier stelt Trafikverket extra ploegen voor schoonmaak op
- In alle benchmark landen is het toegestaan om enkelsporig storingsherstel uit te voeren; in Zwitserland en UK is het machinisten toegestaan de cabine te verlaten om kleine ingrepen aan de infra te plegen (in SBB locomotieven is altijd een bezem te vinden)
- SBB heeft naar aanleiding van winterproblemen zo'n 5 jaar geleden een zgn. 'Weichen Kompetenz Zentrum' ingericht om de aanwezige kennis op het gebied van wisselverwarming vast te leggen en zo gericht mogelijk toe te kunnen passen
- DB en SBB hebben een uitvoerig inspectie en testprogramma voor wissels dat in de herfst wordt uitgevoerd
  - SBB voert dit programma uit op 100% van het wisselbestand
  - DB heeft een gedifferentieerd inspectieprogramma waarbij de 16.000 (van totaal 72.000) meest gebruikte wissels volledig getest worden

Antwoord op vraag 2 - vervolg

- Het beeld dat er een Zwitsers wissel zou bestaan dat (vrijwel) nooit stoort en als product van de plank gekocht kan worden is onjuist. Het Zwitsers wissel kan gekarakteriseerd worden als een holistische aanpak gericht op het maximaliseren van de beschikbaarheid



Kenmerken van het 'Zwitsers wissel'

- Netwerk layout: de configuratie van wissels bij uittakkingen geeft een hogere beschikbaarheid van de uittakking als geheel
- Verwarming: kennis in huis en speciale aandacht middels speciaal kenniscentrum
- Standaardisatie: van zowel wissel als verwarming zorgt voor sneller storingsherstel
- Onderhoudsconcept: mogelijkheid voor enkelspoorwerken voor snel storingsherstel; aandacht voor schoonmaak van wissels
- Wintercheck: inspectie en test van gehele wissel bestand in de herfst

Antwoord vraag 3

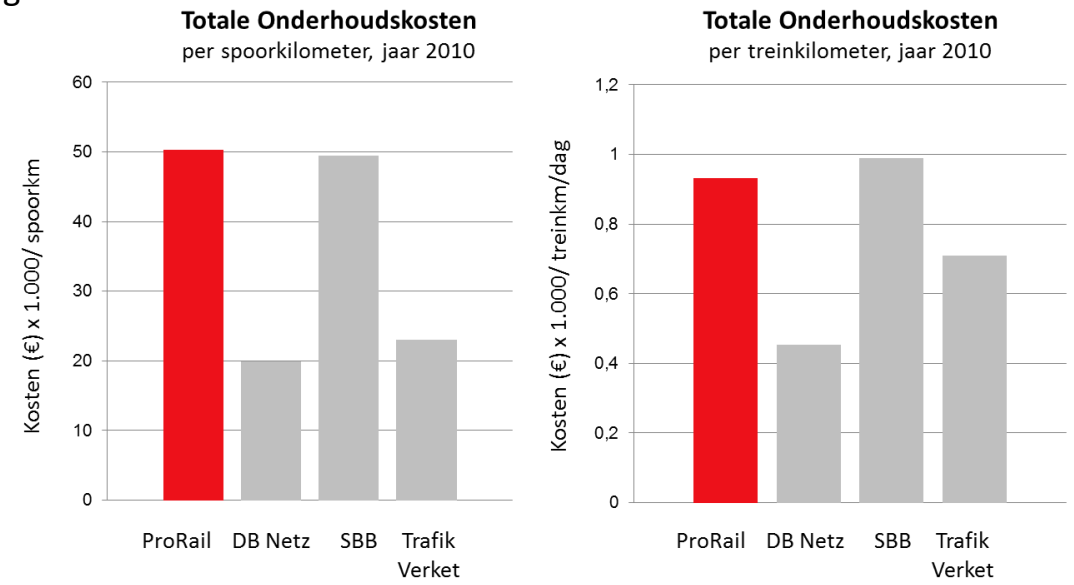
Vraag 3. Hoe verhoudt de snelheid van herstel van verstoringen zich tot andere landen?

- De algemene tendens is dat de storingshersteltijden overal toenemen en dat dit met name veroorzaakt wordt door de aanrijdtijd. De aanrijdtijd wordt bepaald door de bereikbaarheid van de locatie en de hoeveelheid storingen die een ploeg moet oplossen
- In Zwitserland en Duitsland is er een sterke focus om de aanrijdtijden te verlagen en daarmee de storingshersteltijden te reduceren. Bij verwachte slechte weersomstandigheden worden hier het aantal schoonmaak en herstelploegen uitgebreid en strategisch over het land verdeeld. DB heeft de eis voor aanrijdtijd voor het eerste wissel binnen het verantwoordelijkheids gebied van een ploeg (rond de 20 wissels) gereduceerd tot 15 minuten. Bij DB is de gemiddelde storingshersteltijd over de winterperiode niet meer dan 10% hoger ligt vergeleken met het gemiddelde over de rest van het jaar

Antwoord vraag 4

Vraag 4. Hoe zijn in vergelijking tot die landen de kosten voor het beheer en onderhoud van de kwetsbare delen van de infrastructuur (zoals wissels en bovenleidingen), alsmede de totale systeemkosten?

- Het vergelijk van onderhoudskosten (exclusief vernieuwing) op basis van spoorkilometers laat een tweedeling zien: ProRail en SBB geven in vergelijk met DB en TrafikVerket 2x zoveel uit; op basis van treinkilometers liggen ProRail ,SBB en Trafikverket dicht bij elkaar en ligt DB op een lager niveau
- Er zijn diverse kanttekeningen te plaatsen bij deze kostenoverzichten:
  - SBB en TrafikVerket hebben sinds 2010 aanzienlijke verhoging van het onderhouds-budget doorgevoerd (beide rond EUR 3.000 per spoorkm)
  - DB heeft een groot deel van het netwerk dat lichter belast wordt
  - Een aanzienlijk deel van het onderhoudspersoneel van SBB valt gedurende de winterperiode onder de afdeling operaties: de feitelijke onderhoudskosten zijn dus hoger
  - De mate van onderhoud is afhankelijk van de conditie en leeftijd van het het totale netwerk; deze is niet inzichtelijk

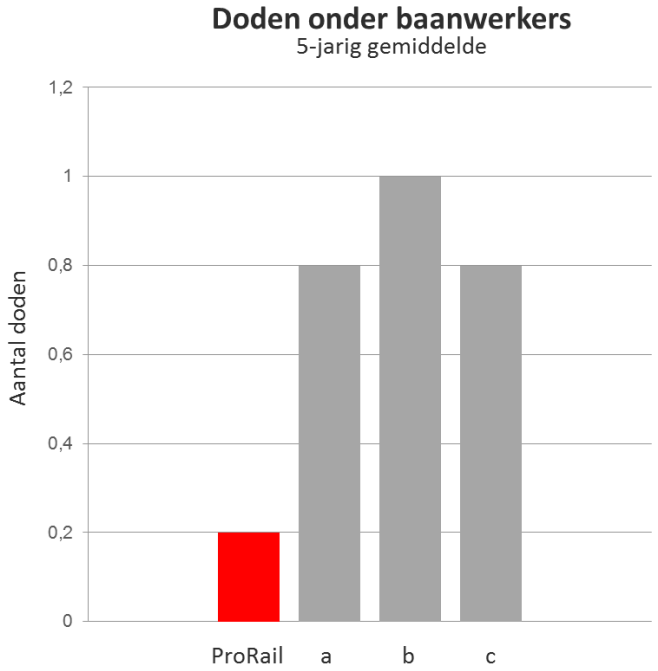


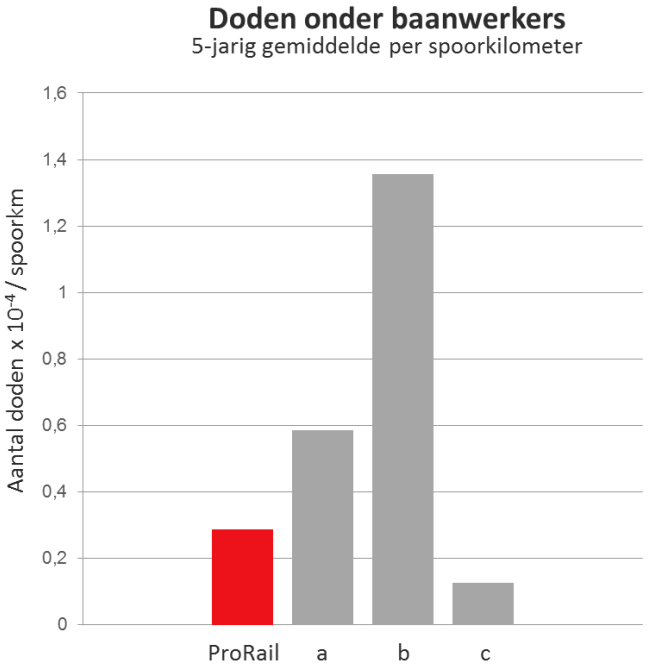
- Op basis van de algemene onderhoudskosten kosten, inclusief kanttekeningen, kan geconcludeerd worden dat SBB een hoger onderhoudsbudget heeft dan ProRail relatief ten opzichte van het aantal spoor en treinkm terwijl DB en TrafikVerket minder besteden
- Met uitzondering van TrafikVerket worden kosten voor wissels door de inframanagers niet separaat inzichtelijk gemaakt (Trafikverket besteedt rond 35% van het onderhoud aan wissels)

Antwoord vraag 5

Vraag 5. Wat zijn de veiligheidsprestaties in vergelijking met die landen?

- ProRail heeft in absolute zin het kleinste aantal fatale ongevallen onder baanwerkers. In geval het aantal doden wordt betrokken op de netwerklengte scoort ProRail als tweede van de onderzochte landen
- Statistisch is niet aan te geven in welk land de veiligheid van de baanwerkers het grootst is en dus ook niet of het toestaan van enkelspoor werken lijdt tot grotere onveiligheid





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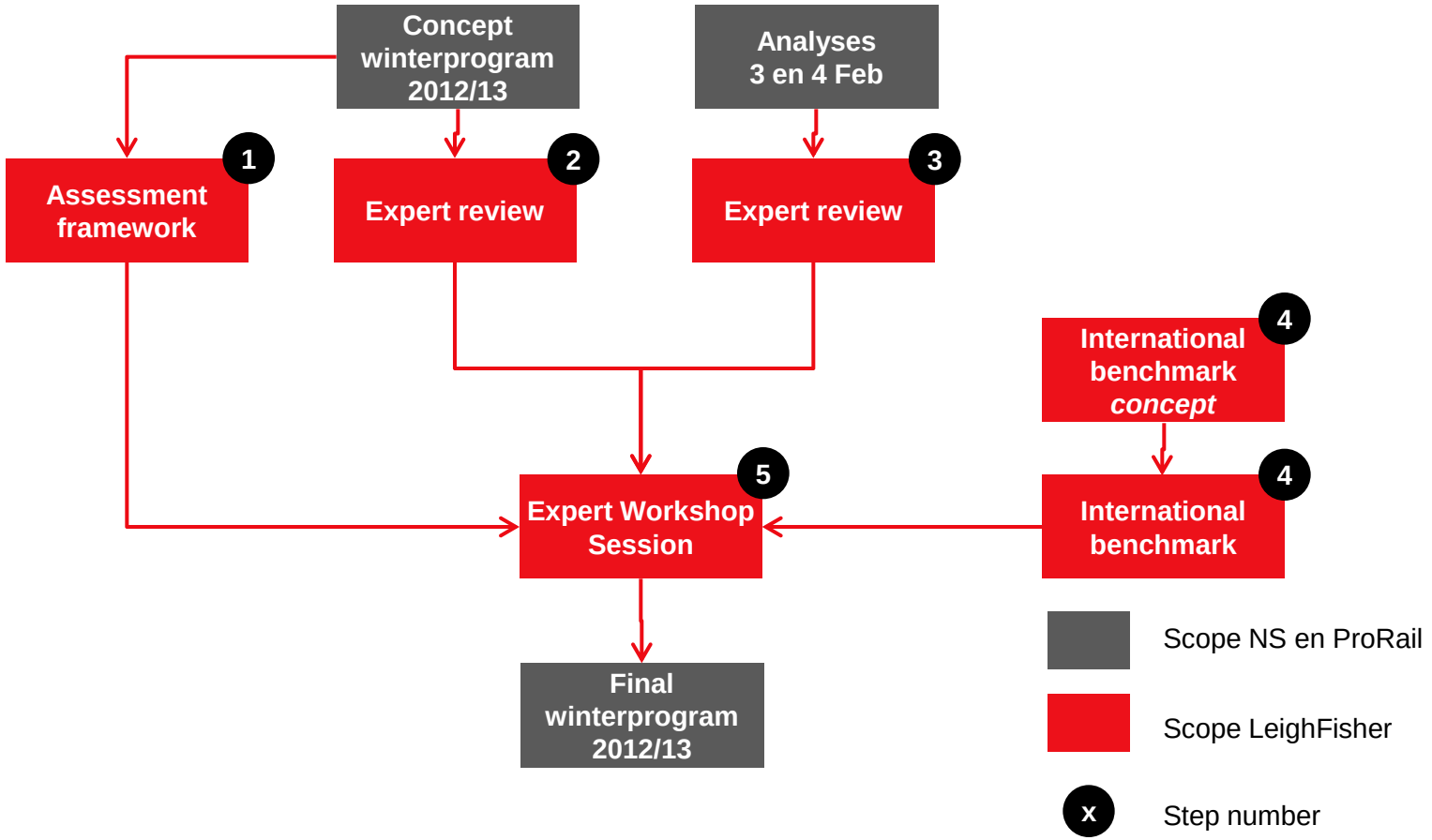
Glossary

S&C	switches and crossings	wissels
IM	infrastructure manager	infrastructuurmanager
TOC	train operating company	vervoerder (personen vervoer)
FOC	freight operating company	vrachtvervoerder
MTTR	mean time to repair	storingsherstelltijd
DB	Deutsche Bahn	Duitse spoorwegen
SBB	Schweizerische Bundesbahnen	Zwitserse spoorwegen
NR	Network Rail	UK infrastructuurmanager
SJ		Zweedse vervoerder
DfT	Department for Transport	Ministerie van verkeer (UK)

NS and ProRail are preparing for improved winter performance, this benchmark should provide best practices

Overview of steps of LeighFisher's assignment

And the positioning of this international benchmark in the process



Purpose of this benchmark is to put the Dutch performance in an international perspective and draw on lessons learned

Purpose of the benchmark

The purpose of this benchmark is:

- To put the performance of the Dutch Railways in an international perspective
- To learn from and share best practices and lessons learned
- To provide NS and ProRail with input for their winter program

The purpose of this benchmark is NOT:

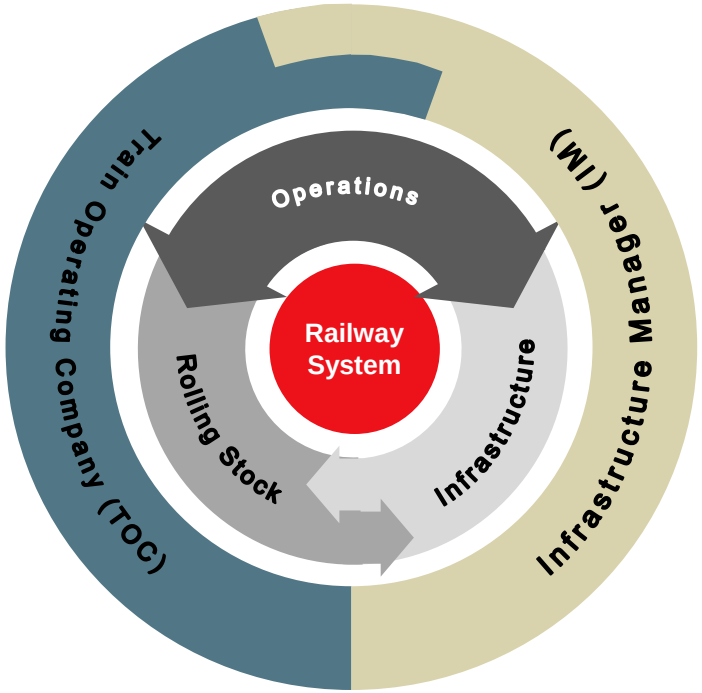
- To assess if ProRail and NS are doing a good job
- To compare costs and performance at a component level

Elements of performance

For railway infrastructure

The benchmark questions are focussed for the Dutch issues and are structured around the railway's core processes

Core processes and responsible parties involved



Benchmark process

The process followed for this benchmark is:

- Preparation of benchmarking questions using the queries as included in the request for proposal as starting point
- Benchmark questions were send to international experts
- A combination of visits and telephone calls was used to realise the first draft
- The first draft was the basis for the winter workshop with the experts and NS, ProRail and ministry IenM
- Other publicly available sources are used to complement the insights
- The discussions of the workshop are captured in the final concept version
- International experts have reviewed the final draft before the final report is made

The expert team for the international benchmark and expert workshop is carefully chosen to maximise the learning

International expert team

Country	Org	Position
		Manager infrastructure asset and maintenance strategy
		National Season Delivery Specialist
		Vice President, director rolling stock
		Infrastructure maintenance expert
		Asset manager infrastructure

Overview of additional sources used

Sources used
• Deutsche Bahn 2010 Annual Report • Deutsche Bahn 2011 Annual Report • Deutsche Bahn Dates&Facts 2010 • DB Netz Geschäftsbericht 2010 • Winter technologies for high speed rail, Maxime Bettez, June 16th 2011 • High-speed train operation in winter climate, Lennart Kloow & Mattias Jenstav, July 2006 • SJ 2010 annual report • Trafikverket 2010 annual report • SSB 2010 annual report • SSB Financial report 2010 • Die SBB in Zahlen und Fakten 2011 • ProRail Jaarverslag 2010 • Network Rail Limited Annual Report and Accounts 2011 • Realising the Potential of GB Rail, Final Independent Report of the 'Rail Value for Money Study', Department for Transport, May 2011 • The Resilience of England's Transport Systems in Winter, Department for Transport, October 2010, • Passenger focus, national passenger survey spring 2010

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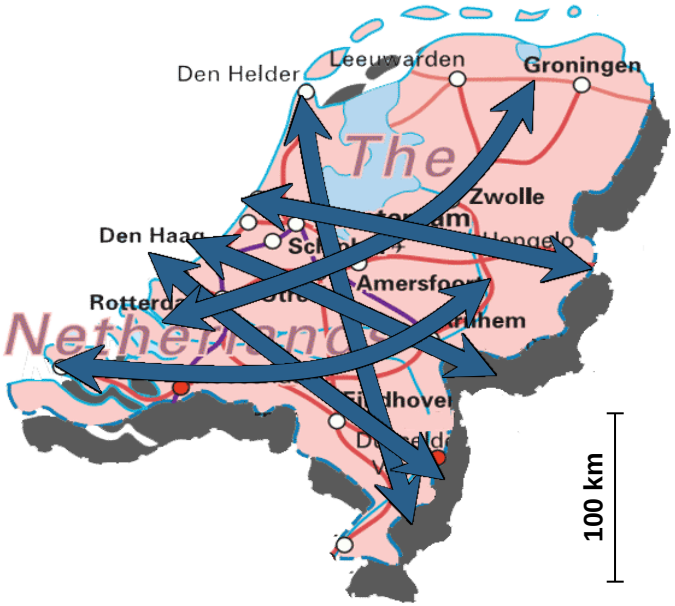
Key characteristics The Netherlands

Network Characteristics	
Network length:	3,035 km
Track length:	7,000 km
Number of S&C:	7300
Type of network:	Grid
Network utilisation (trainkm/trackkm/day):	54
Passenger density (pax/trackkm/day):	171

Institutional model	
Institutional relation TOC / IM	Complete separation
Infrastructure manager	ProRail
Main Train Operating Company	NS

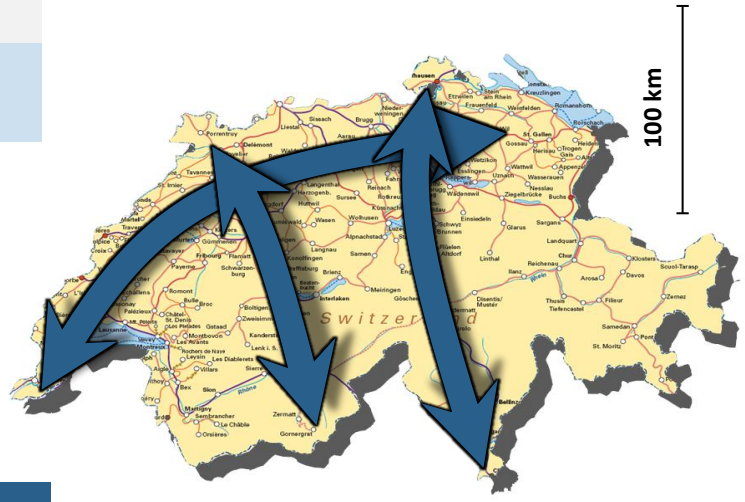


Country specifics	
Does IM has own maintenance staff	All maintenance outsourced to third party
Single track working allowed:	No
Centralised ultimate decision making:	Yes
Shared responsibility for pax info IM/TOC:	No, NS is responsible

Key characteristics Switzerland

Network Characteristics[1)]	
Network length:	3,069 km
Track length:	7,381 km
Number of S&C:	14,254
Type of network:	Lines
Network utilisation (trainkm/trackkm/day):	50
Passenger density (pax/trackkm/day):	130

Institutional model	
Institutional relation TOC / IM	Integrated in single holding
Infrastructure manager	SBB
Main Train Operating Company	SBB



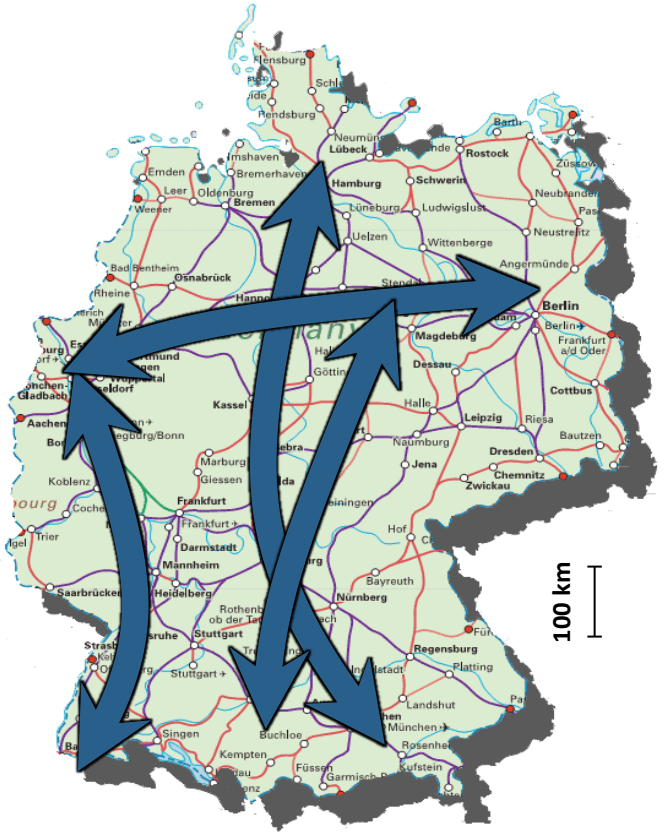
Country specifics	
Does IM has own maintenance staff	Yes
Single track working allowed:	Yes
Centralised ultimate decision making:	No

1): SBB network

Key characteristics Germany

Network Characteristics	
Network length:	33,525 km
Track length:	63,663 km
Number of S&C:	66,000
Type of network:	Lines (long distance) Grid (regional around major cities)
Network utilisation (trainkm/trackkm/day):	44
Passenger density (pax/trackkm/day):	85

Institutional model	
Institutional relation TOC / IM	Integrated in single holding
Infrastructure manager	DB Netz
Main Train Operating Company	DB



Country specifics	
Does IM has own maintenance staff	Yes
Single track working allowed:	Yes
Centralised ultimate decision making:	Yes

Key characteristics Sweden

Network Characteristics	
Network length:	10,000 km
Track length:	13,642 km
Number of S&C:	
Type of network:	Lines (long distance) Grid (regional around major cities)
Network utilisation (trainkm/trackkm/day):	28
Passenger density (pax/trackkm/day):	13

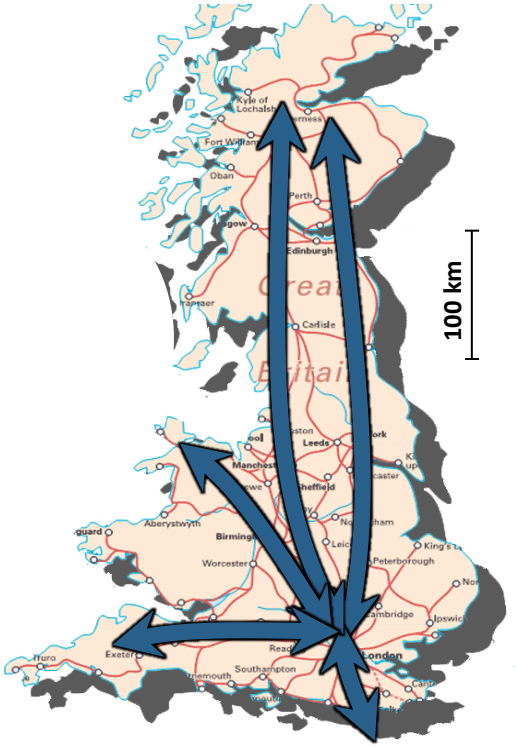
Institutional model	
Institutional relation TOC / IM	Complete separation
Infrastructure manager	Trafikverket
Main Train Operating Company	SJ

Country specifics	
Does IM has own maintenance staff	All maintenance outsourced to third party
Single track working allowed:	Yes
Centralised ultimate decision making:	No (but under construction)
Shared responsibility for pax info IM/TOC:	Yes

Key characteristics United Kingdom

Network Characteristics	
Network length:	19,000 km
Track length:	33,800 km
Number of S&C:	69,000
Type of network:	Radial

Institutional model	
Institutional relation TOC / IM	Complete separation
Infrastructure manager	Network Rail
Main Train Operating Company	Various



Country specifics	
Does IM has own maintenance staff	Yes
Single track working allowed:	Yes
Centralised ultimate decision making:	Yes
Shared responsibility for pax info IM/TOC:	No, TOC is responsible

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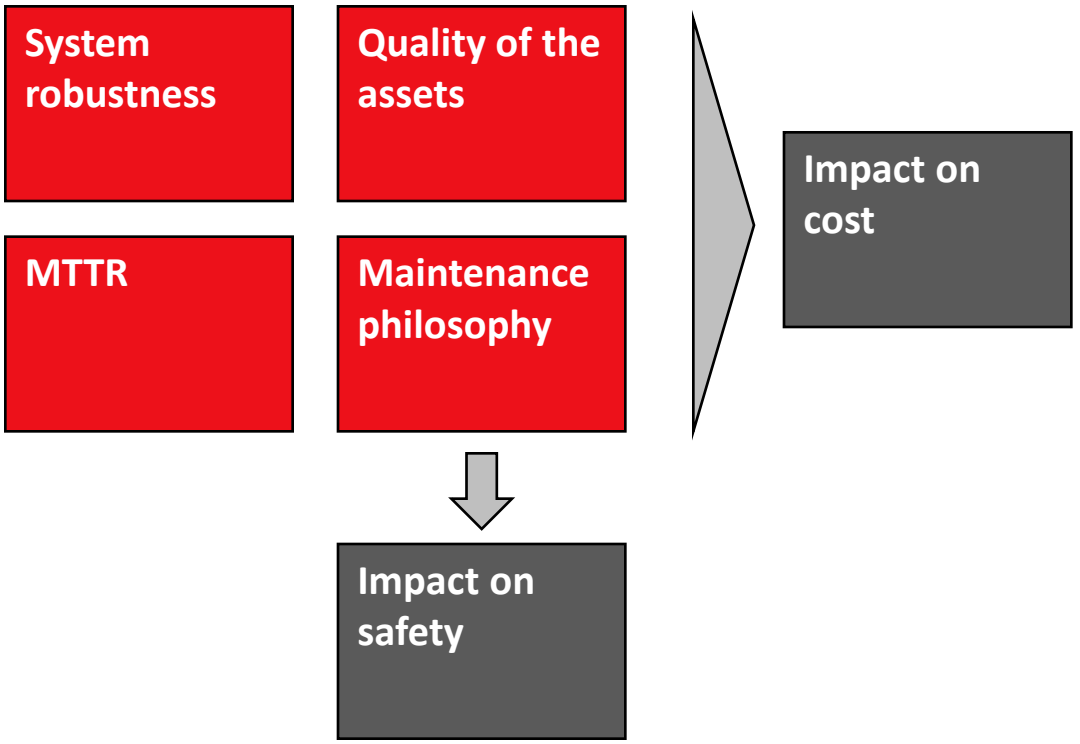
For infrastructure we focus on S&C and catenary as these appear most vulnerable for winter conditions

Reliability of S&C and catenary during winter conditions

Availability of S&C and catenary during winter conditions



S&C: switches and crossings
MTTR: Mean Time To Repair

These translate in five benchmark questions

1. **What is the level of availability and reliability of S&C and catenary during winter compared to the annual average (or: what is the number of defects to S&C and catenary during winter compared to the annual average)**
2. **What are characteristics of the maintenance program, including aspects as:**
   a) **Is single track working (whilst other track is in service) allowed**
   b) **On yards and stations: is it allowed to work in between train services or do you need to take a piece of infrastructure out of service before you can enter the tracks**
   c) **Who has ultimate control over track access by repair teams**
   d) **How do repair teams reach the site (via road or rail) and what about the locations of maintenance teams**
   e) **Are train drivers allowed to exit their cabins in an attempt to clear faults**
3. **Are additional repair teams available at site (or more sites than the standard maintenance locations) or on call during winter conditions (expected adverse conditions)**
4. **How does the MTTR during winter conditions compare to the annual average**
5. **What is the safety record for track workers the last couple of years**
6. **What is the impact on cost**

Switches & Crossings (S&C) are sensitive to winter conditions in all countries

1a. Reliability and availability of S&C

Germany	Sweden	United Kingdom	Switzerland
• During the winter there is an increase of approximately 20-30% in the number S&C failures • There is no difference between switches for low speed and high-speed • Performance is better in areas with more frequent winter conditions • An extra special check on the functioning of switches is performed on the 16,000 most important ones (out of 72.000)	• The increase in failures for catenary and S&C during the winter amounts to approximately 20% • S&C suffer from ice falling off trains; de-icing is considered to be an effective measure to reduce the number of S&C failures • A variety of technology solutions aimed at preventing snow build up in S&C, ranging from brushes to mini ramps, are being tested[1)] but no clear insight into effectiveness is yet available	• Winter months show an increase of approx. 20-30% in failures • The impact of S&C defects in terms of train delays per incident has increased from around 70 minutes in '99-'00 to around 120 minutes in '11-'12. During this time there has been a significant increase in the number of trains ran.	• Availability & reliability strongly depends on weather and local conditions. Last year many trains were affected due to the harsh winter • After problems with switch heating some 5 years ago, a 'knowledge center' for switch heating was set up with specialists that develop specifications and perform maintenance in shops during summer and repairs on site in winter • All switches on the network are checked in autumn • Sweeping trains are ran at night during snow fall to prevent ice and snow accumulation

1): Source 'Winter technologies for high speed rail', Maxime Bettez, june 16th 2011

Reliability of catenary systems during winter is less of a concern

1b. Reliability and availability of catenary

Germany	Sweden	United Kingdom	Switzerland
• There are no specific issue's with the reliability of the catenary system but measures are taken: —On the Köln-Frankfurt high-speed line, the wire is heated by 'sending through' more energy —Sweeping trains on some main lines with passenger trains with speed in excess of 160 km/h with freezing temperatures; this only in case a passenger train is first to run on the specific route and when there was a shutdown of traffic during the night	• The increase in failures for catenary and S&C during the winter amounts to approximately 20%	• Electrification failures are on average 100 incidents per period (approx. 30% less than '99-'00), resulting train delays per incident have dropped from around 800 minutes in '99-'00 to around 450 in '11-'12	• Availability & reliability strongly depends on weather and local conditions. Last year many trains were affected due to the harsh winter. • No particular problems with catenary as it is of a lighter construction (AC system compared to Dutch DC[1)] system) and thus less sensitive to snowfall, rain or icing • Sweeping trains are ran at night during snow fall

1): AC: Alternating current; DC: Direct current; The Dutch catenary system is equipped with two wires instead of a single one required for AC systems; the double wire is more likely to collect snow

Single track working is common practice and train drivers are allowed to exit their cabin in some countries

2. Characteristics of maintenance approach

Germany	Sweden	United Kingdom	Switzerland
• Single track working is allowed; Conditions apply dependent on line speed and type of work • On busy yards and lines with multiple operators it is more likely that tracks need to be taken out of service • Track access for maintenance crews is granted in close cooperation with the traffic control. Traffic control is staying in contact with maintenance crews informing them on actual traffic situation • Train drivers are not allowed to leave their cabin • Work sites are normally accessed by road	• Single track working is allowed on route sections as well as yards • Train drivers are not allowed to leave their cabins for simple obstructions in switches	• Single track working is allowed • Route Control and the discipline leaders have ultimate control over track access by repair teams • Repair teams reach the site usually by road (4x4), but it can be achieved by train where necessary • Train drivers are allowed to leave their cabins for simple obstructions in switches • FOC (freight operator company) ground staff receive training in elementary aspects of track maintenance including the clearance of points and walkways of snow and ice	• Single track working is allowed • It is allowed to work in between train services • On busy yards it is more likely that tracks need to be taken out of service • The infrastructure department has ultimate control over track access by repair teams • Repair teams normally travel by car, during winter conditions they are stationed at the main stations and main lines. • Train drivers are allowed to leave their cabins to clear snow and ice; locomotive cabins are equipped with brooms

Most countries have maintenance personnel in house

3. Organisation of maintenance crews

Germany	Sweden	United Kingdom	Switzerland
• DB Netz has maintenance personnel in house • Also contractors are used to provide additional resources • When weather conditions so dictate, cleaning teams are dispatched to strategic locations country wide ➢ Teams typically consists of three people ➢ One team is responsible for app 15-20 switches ➢ First switch in the area must be reached within 15 min. • Regional office staff is trained to assist in cleaning teams • This allowed doubling the number of people in winter service for cleaning and self guarding in total up to approximately 18.000	• All maintenance is fully outsourced to contractors • The contracts specify the response time to reach the site; the specified response time depends on the importance of the route in terms of train frequency • Infrastructure manager TrafikVerket buys additional capacity from contractors if weather conditions such requires	• The Infrastructure manager Network Rail has maintenance personnel in house; Railtrack (the emerged infrastructure manager after brake up of British rail) had outsourced all maintenance to third parties; after Railtrack was taken over by Network Rail, the latter took over the maintenance personnel from the third party contractors • In case of winter weather, additional teams are pre-arranged in line with weather forecasts. On call staff are prepared	• The Infrastructure manager has maintenance personnel in house • A large part of the maintenance crew transfers from the maintenance division to the Operational division during the winter months • 72 hour prior to winterconditions (according tot the weather forecast), measures are taken. Repair and support teams are placed along main arteries and at major nodes in the network • A priority list exists for cleaning switches

Key to preventing a strong increase in failure repair time is the strategic location of maintenance crews

4. MTTR levels in winter

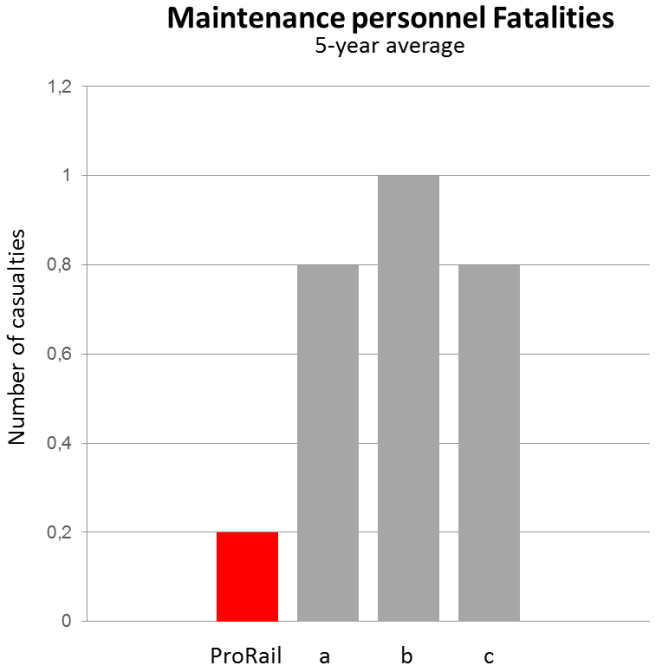
Germany	Sweden	United Kingdom	Switzerland
• The average repair time for switches in the winter period is app. 10% higher compared to an annual average • Strategic positioning of teams make that the time to reach the site is reduced to 15 minutes • In and around cities the repair time is lower compared to more remote locations due to the closer proximity of maintenance crews • Since this winter the number of cleaning teams are increased resulting in a shorter time to reach the site	• Specific data on the MTTR during winter conditions is not registered, although on average, the MTTR increases during winter conditions	• Specific data on MTTR during winter conditions is not available	• Specific data on the MTTR during winter conditions is not registered • In case of adverse weather conditions, maintenance crews are located in more strategic locations to reduce the time to reach the site

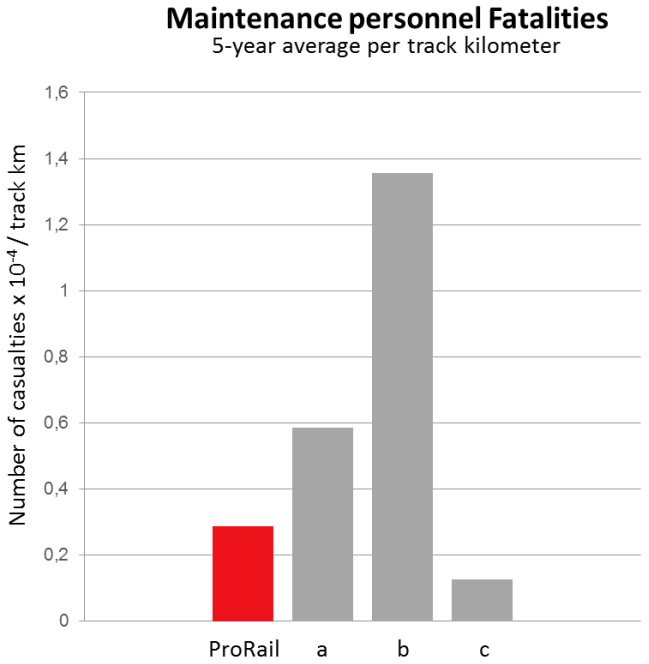
MTTR: Mean Time To Repair

There is no statistical ‘safer’ railway for maintenance personnel

5. Safety of maintenance personnel

- Maintenance personnel fatalities expressed as 5-year average between 2006 and 2010 are shown in figures below



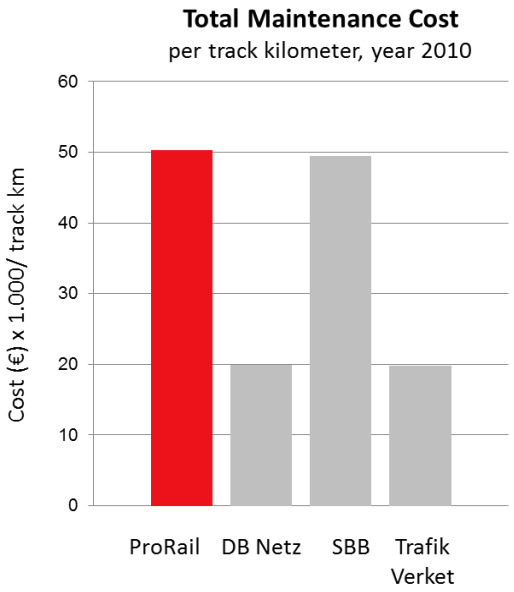


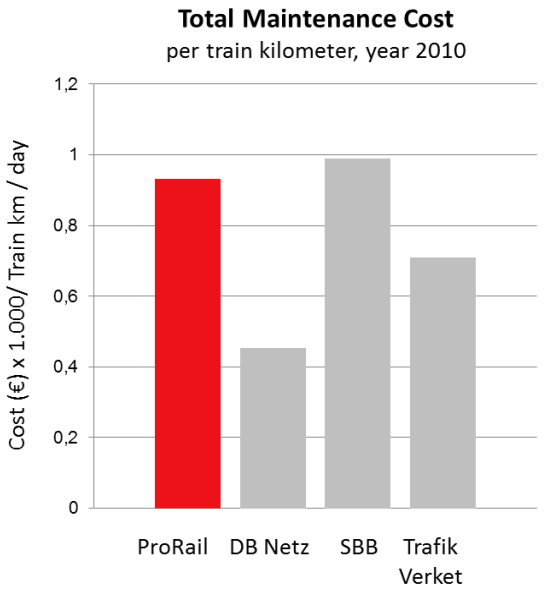
Cost of maintenance comparison suggest a relation to network utilisation

6. Cost of maintenance

- Total maintenance cost are shown in figures below
- None of the benchmark countries, except TrafikVerket (infrastructure meneger in Sweden) has cost information specified at the level of detail of switches; TrafikVerket allocates 35% of its maintenance budget to switches

- Remarks to the cost information:
  - SBB and TrafikVerket saw an increase of available maintenance budget from 2010 of some EUR 3.000 per track kilometre
  - Compared to NL and SBB, DB has relatively a lot of lines with low use
  - The cost of a major part of SBB maintenance personnel in the winter period is allocated to operations
  - The required maintenance level is subject to age and condition of the network





For rolling stock we want to focus on aspects that have a direct relation to infrastructure defects and line availability

Prevention of causing defects to infrastructure	**Prevent ice falling from trains**
Minimising negative impact on line availability	**Towing away defective trains**

These translate in three benchmark questions

1. **What measures are /will be taken to prevent large pieces of ice falling from rolling stock and damaging rail infrastructure (switches)**
2. **What is the experience with de-icing of trains**
3. **What arrangements are in place to remove defective trains from the route to sidings**

Rolling stock engineering measures are effective to prevent snow accumulation and specific inspection is essential

1. Prevention of ice falling from trains

Germany	Sweden	United Kingdom	Switzerland
• Speed reductions down to 160 km/h are enforced to prevent snow build up and subsequent damage to trains (specific track related reduction)	• Elements of trains such as bogies are designed to minimise ice build up • SJ aims to de-ice trains on a regular basis; although this is not specifically done for effective measure • In case of heavy snow, train speeds are reduced to reduce snow collection and build up • Train drivers can report the amount of accumulated snow as part of standard maintenance reports	• Ballast height reductions is used as a measures to prevent impact from ice falling of trains • Speed reduction for high speed trains down to 100 miles per hour are enforced to prevent snow build up and subsequent damage to trains • Operating companies are testing new technical solutions to improve resilience like: introducing ice-breaker trains, modifying the electric brake to use the resistors to melt ice in the roof area's and test a silicon-based coating to prevent ice sticking to under frames [1)]	• On tracks with a high risk of snow and ice falling of trains, train speed is reduced for all trains on that track • During stationing, trains are quickly checked. When large pieces of accumilated snow or ice are present, train speed is reduced, only for that particular train. • There are no specific measures taken for S&C (apart from switch heating) • Modern trains have flat bottoms to prevent snow and ice accumulation

1): Source 'The resilience of England's Transport Systems in winter', Department for Transport UK, October 2011

De-icing of trains is gaining importance and multiple methods are is use

2. De-icing of trains

Germany	Sweden	United Kingdom	Switzerland
• De-icing is currently not a standard practice • De-icing is set-up since this year but because of mild winter (in terms of snow) no real experience yet • The de-icing facilities use a combination of hot air and hot water	• SJ has longer experience with de-icing of trains and has tried multiple methods • Earlier methods could take up to 8 hours to de-ice a trains • Best practice de-icing method is with hot air; SJ has best experience with hot air 25 ^{0}C, blown at a speed of 50 m/s • New de-icing method has reduced de-icing time significantly; de-icing of an 8-car EMU takes 2hours • SJ is increasing de-icing capacity; the 'old' method to circulate rolling stock through the whole country as the south generally did not suffer from strong winters but this proved to be unreliable for the last couple of years	• Not much is done for de-icing trains, primarily carried out at major station • During winter 2011/12, Scotrail deployed under-train power shower systems based on Finnish practice. • Scotrail have also piloted the use of temporary 75m "polytunnels" to melt the ice from trains in a warm controlled environment. A three car unit takes approximately 2 hours to defrost	• No specific de-icing techniques are in use or on trial • Trains that have accumulated a lot of snow are put in a shed to de-ice

Most countries do not have additional measures in place during winter to remove stranded vehicles

3. Removing stranded vehicles

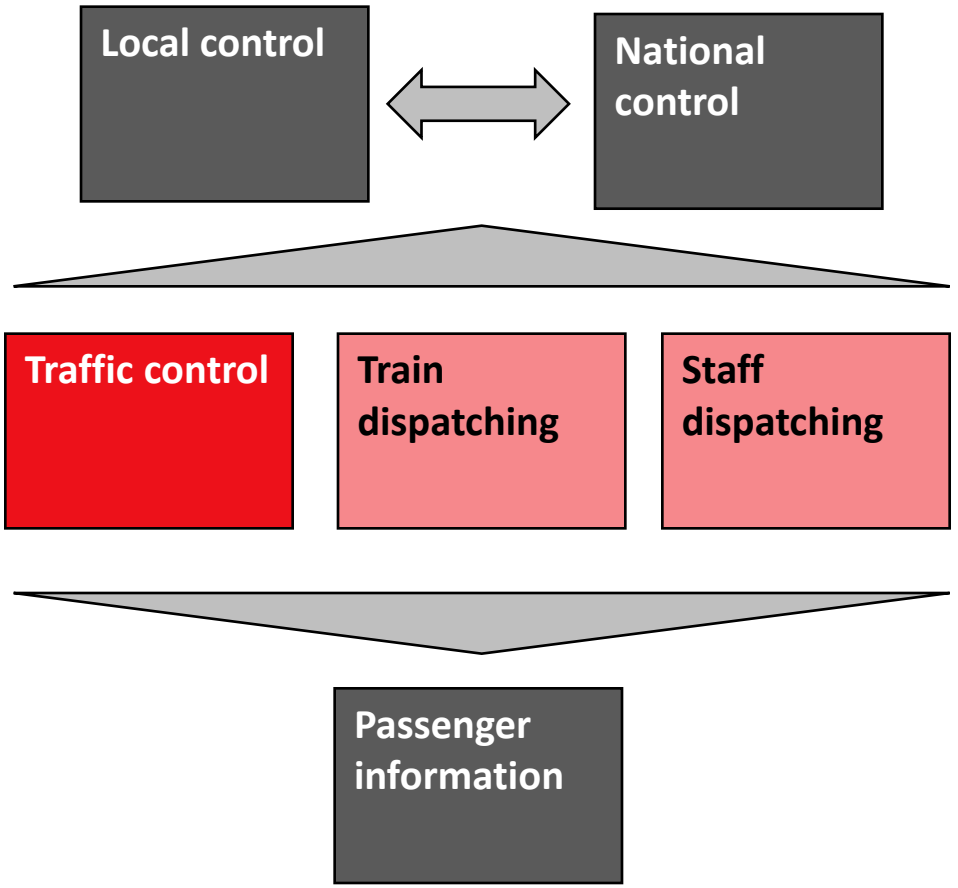
Germany	Sweden	United Kingdom	Switzerland
• No additional measures are taken during the winter	• No additional measures are taken during the winter	• Routine processes are present to remove defective trains from the route to sidings; running at reduced speed • Some traction units are fitted with bogie-mounted Miniature Snow Ploughs (MSP's) allowing trains to run in snow depths of up to 45cm. Regular patrols of high risk routes by MSP fitted locos/units reduces the risk of other trains becoming stranded by sudden, heavy accumulations of snow in remote locations. They can also act as "rescue" locomotives should the situation demand it	• No additional measures are taken in winter • Depending on the situation, either a train behind it is ordered to couple with the defective train and pull or push it out of the way to a siding or the emergency train is ordered and send to the defective train to pull it to a siding • Defective trains can be replaced by replacement trains available at some major stations. These replacement trains are "warm" and permanently staffed at least with a driver. The trains used for rush-hour extra services can be used for replacement services

For operations we want to focus on processes for the operational control of the railway system

Typically, operational control has different geographical levels

Elements of operational control are divided between Infrastructure manager and Train operator

Passenger information is an important product of operational control



These translate in five benchmark questions

1. **How is the traffic control (IM and TOC functions) organised**
2. **Working arrangements between local and national levels of the traffic control systems and the train & staff dispatching functions, including aspects as:**
   a) **What is the autonomy of the local centres**
   b) **Is it known on local level how their decisions interfere with nation wide system integrity**
   c) **Is there a clear allocation of responsibilities for (temporarily) closing parts of the railways**
3. **Do you work with standardised reduced time tables**
4. **What is the experience with the additional workload that specific winter measures may have for the traffic controllers and train & staff dispatchers, the adverse impact on the operations routine and the result on the effectiveness of a measure as a result**
5. **What are the arrangements for provision of passenger information**

Organisation of traffic control varies for the different countries and appear to be linked to the institutional arrangements

1. Organisation of traffic control

Germany	Sweden	United Kingdom	Switzerland
• Traffic control is organised in 7 regional centres • IM and TOC (DB) are sitting together in these traffic control centres; other operators can join these locations as well • A central control centre in Frankfurt provides oversight over total network integrity • The IM has staff for train control and for maintenance in the control centres	• Traffic control functions of TOC and IM are independent from each other • The IM has 8 local traffic control centres controlling all traffic in a specified geographic area • The IM has a national traffic control centre is responsible for co-ordination and national operative decisions • SJ (TOC) has a single operating centre in Stockholm with a full back up in Gothenburg	• Ten routes with 12 Control rooms (Route Control), • One National Operations Control (NOC) and one Engineering Train Control (AMCC) • Route Controls manage the geographical area, liaising with adjacent routes • AMCC and NOC have influential impact on cross route resource management • Some TOC controls are co-located with NR's Route Controls • Use of Automatic Route Setting reduces the understanding of signalling staff what are real critical switches	• Traffic control functions from IM and TOC are working from the same room • Control is currently being centralized in 4 Betriebszentralen (BZ), which cover the whole SBB network, and 1 BZ for the BLS network. Before, it was dispersed over more areas • The BZ can take over each others function i.e. BZ West in Lausanne can take over (part of) the work of the BZ East based at Zürich Airport • A national control centre provides oversight for the 48 and 72 hour planning, for example in case of line closures due to landslides

The national control centres overlook network integrity and ultimate control

2. Interaction of local and national control

Germany	Sweden	United Kingdom	Switzerland
• The local control centres have a high level of autonomy • The central control in Frankfurt provides oversight over total network integrity and has the power to overrule decisions of the local control centres; in practice this very rarely happens	• Local control centres communicate regarding national traffic, but possibilities for improvement regarding the national co-ordination are identified • Local traffic controls have mandate to close down traffic in own geography if conditions such require • For situations spanning multiple geographies, the national traffic control takes the decision after communication with the local control centres • Clear decisions to the customers, closing down the traffic before failures appears, which makes a fast recovering possible (big storms)	• The interaction between the various routes is fairly limited due to the axial network layout • National Operations Control (NOC) and Engineering Train Control (AMCC) play a large part in communicating cross route impact.	• The national control centre is not used to overlook traffic control at the day but has a function in planning 48 and 72 hours in advance

Reduced timetables are being introduced as measure to provide a reliable service also during severe weather

3. Reduced timetables

Germany	Sweden	United Kingdom	Switzerland
• For long distance traffic, actually reduced timetables are not regular used • Reduced timetables are being introduced for the high volume local services; these require agreements with local governments as they fund this traffic • Experiences in Bavaria demonstrate the benefits of reduced timetables to service reliability • Reduced speeds for high-speed lines to prevent damage to the trains; these changes are advertised to the passengers but timetables are not updated	• SJ has defined reduced timetables, five categories are used: **0**: This is the standard level; the number of trains in this situation is 5% below the summer timetable **-1**: ~-7% less trains **-2**: ~-10% less trains **-3**: ~-15% less trains **-4**: ~-30%less trains As the number of trains is reduced, the length of trains is increased to compensate capacity • Decision to introduce reduced timetables need to be made two weeks in advance which has mainly to do with the passenger reservation systems	• For implementation of a reduced timetable TOC's must get dispensation from DfT and agree changes with NR[1)] • In Scotland, Scotrail (the TOC) and Network Rail (NR) have agreed an "emergency timetable" • FOC's produce contingency plans on a flow by flow basis which are designed to reduce the risk of "frozen loads in transit". These plans focus on the movement of coal and aggregates • NR uses timetables with reduced speeds; in case these are used, all systems are automatically updated	• SBB has standard some 6-10% additional time in the timetable. In summer this can be used for engineering works and in winter this allows for running with reduced speeds if weather situations such dictate

1): Source 'The resilience of England's Transport Systems in winter', Department for Transport UK, October 2011

All countries endeavour to reduce the work load for traffic controllers

4. Work load for traffic controllers

Germany	Sweden	United Kingdom	Switzerland
• No specific measures are defined that would increase the workload for traffic controllers • Number of staff in control centres is increased during predicted adverse winter conditions	• At critical weather conditions there is more personnel alerted for maintenance, traffic control and operators • All parts of the traffic control organization are under high pressure and with long and extra ordinary winter conditions this can be a challenge	• As most of the UK works on manual signalling (with little automatic route setting) the majority of signalling locations work 'as normal' • Major terminal stations and signalling junctions experience a much larger volume of phone calls for service alterations during adverse weather conditions • FOC's & TOC's will strengthen control structures at times of serious service disruption, including extreme weather events. In addition, a very senior manager is often brought in to provide strategic leadership on a shift basis leaving the normal control to manage the disruption itself	• The workload of traffic control is OK, since during winter conditions, there are in general no track works going on, which normally are the reason for extra work loads • For train & staff dispatching it is known that winter conditions causes them more work, however, a lot of rules exist on how to react in defined situations, minimizing additional work • Due to the "rules", no real irregular situations will occur, since they are accounted for. This reduces the workload of operators and train & staff dispatching drastically

Providing proper passenger information has the attention of all railways

5. Passenger information

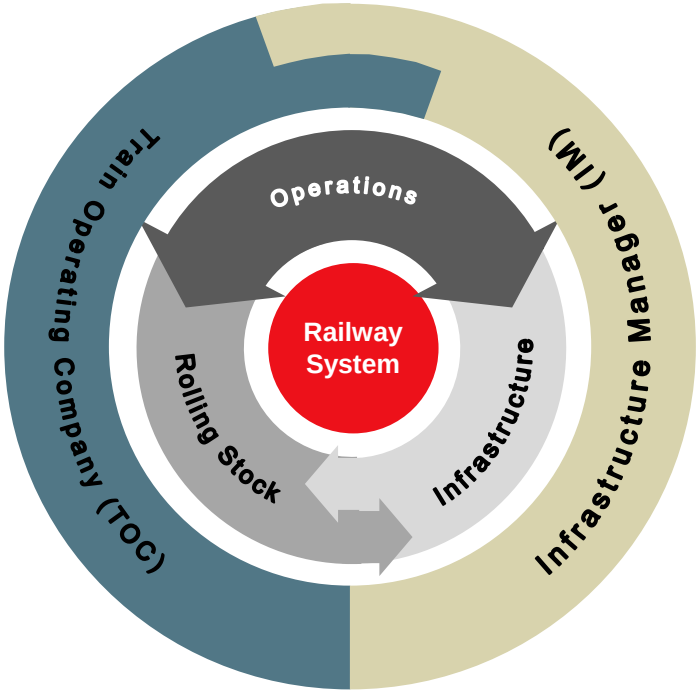
Germany	Sweden	United Kingdom	Switzerland
• Customer satisfaction on the area of passenger information has shown an a favourable development , in particular in cases of service disruptions • Especially the additional installation of dynamic visual displays in stations has led to a significantly improved assessment by passengers	• A customer management group from SJ is working with traffic control. They are responsible for provision of information to passengers • In case of severe disruptions SJ works with floor walkers to directly inform passengers and provide drinks • SJ monitored an increase in customer satisfaction (from 73 to 76 on the customer satisfaction index which corresponds to very good) on passenger information • Although in 2010 passengers were not as satisfied when disruptions occurred and distinct information on the situation and connections was desired.	• TOC contractually obliged for providing passenger info • Advertising root cause of any disruption is very effective for passenger understanding • Informing passengers starts 4-5 days in advance of adverse weather to manage expectations • A major initiative (Passenger Information During Disruption (PIDD)) launched 2008 by the NTF is being rolled to make radical improvements, in train service information both on stations and by personal access on websites, texts etc; including creating a single source of information • Passenger satisfaction has slightly increased from '05 – '10	• Predictability is key to good passenger information; SBB has defined standard scenarios for almost every situation • Some 90% of announcements are automated based on scenarios • A single person in the traffic control centre is responsible for passenger information • The traffic controllers can make in-train traffic announcements • Satisfaction level for passenger information improved in 2010 to 79.9 points out of a possible 100 (2006: 78.8). Where information during disruptions was scored at 70.7 as apposed to 69.8 in 2009

Content

- Beantwoording vragen buitenland review
- Introduction into the international benchmark
- Key characteristics benchmark countries
- Findings structured around Infrastructure, Rolling Stock and Operations
- **Summarized benchmark findings**

In summary, Dutch Railway's performance is in line with peers and all parties can learn from each other for further optimisation

Core processes and responsible parties involved



Infrastructure

- Realised availability for ProRail is in line with other railways
- MTTR levels can be reduced by strategic positioning of cleaning and repair teams and the possibility to perform work with a single track possession, with some countries allowing train drivers to leave their cabin for 'quick fix'
- There is no statistical evidence to identify a significant difference in safety levels for maintenance personnel
- Maintenance expenditure of ProRail is within range of benchmarked countries

Rolling Stock

- De-icing of trains is gaining importance and is effective to prevent damage to trains and infrastructure
- Speed reductions down to 160 km/h are used at high-speed lines to reduce damage to trains from falling ice
- Compared with benchmarked countries ,ProRail and NS are ahead with anti-icing
- No foreign countries have specific winter measures for towing away defective trains

Operations

- Increased integration of processes for traffic control functions for IM and TOC facilitates decision making during disruptions
- Other European countries are starting with introduction of reduced timetables, clearly seeing the benefits and necessity in situations of adverse weather at lines with (very) high train frequencies
- Standardisation of traffic control procedures for disruption events reduce workload for traffic controllers