

Richard Swain

ORR Best Practice Study

Visit to The Netherlands - 24 September to 26 September 2007



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Executive Summary

The visit to the Netherlands was arranged as a two and a half day programme. The first day consisted of meetings and interviews with ProRail at their head office in Utrecht. The second day was spent at a regional ProRail office in Swolle, and included a site visit. The morning of the third day was spent with the main Dutch railway contractor, Strukton, at their head office in Utrecht. The visit took place between September 24th and 26th 2007.

The Dutch rail network was privatised in 1995, when train operations and maintenance activities within Nederlandse Spoorwegen (NS, Dutch Railways) were separated. Train operations remained the responsibility of NS whilst the maintenance activities were split and sold to three private contractors. ProRail was created to manage the contractors.

ProRail has, to date, had strict control over their contractors by using prescriptive contracts with tight financial controls. However, they are soon to pilot a less prescriptive contract type, which has had a mixed reception so far.

Recent changes in law, which limit the amount of night and live track work, have drastically reduced the time available for maintenance work on the Dutch railway. This has led to innovation in the areas of remote monitoring of track equipment, and the use of inspection and geometry measuring trains.

The Dutch tend to use long blockades for maintenance work. They are finding that there are many benefits to this, and they are not purely financial. They claim that more work can be done during a single long blockade than in more numerous, but shorter possessions. ProRail has found that the overall cost and disruption to the network is reduced when longer blockades are used.

The Dutch are keen for their network to develop and mature, at a rate that they can cope with. They are keen to avoid the pitfalls of privatisation that others have fallen into by rushing into things when they do not fully understand the consequences of their actions.

1 Purpose

The purpose of the visit was to gather examples of best practice in terms of railway engineering in The Netherlands. The Netherlands was selected because the rail network is privatized and therefore similar to the UK. This may enable some direct comparisons between the UK and the Netherlands to be made. The privatised nature of the Dutch system is different from that of its European neighbours which are mostly state owned.

In The Netherlands, there is significant use of specialised contractors to undertake maintenance work, and therefore the contracting strategy warranted investigation.

Possession policy in the Netherlands is determined with government and recent changes in legislation have eliminated night time working. This restricts the time available for inspection and maintenance work and warranted further investigation.

ORR has had significant contact with ProRail, (the Dutch infrastructure manager) in the recent past and it was thought that they would be open to discussion regarding asset management best practice.

Meetings on key asset areas were held so that ORR could get a feel for the condition of the Dutch network and gain an understanding of how the Dutch railway asset base is managed.

The knowledge gained from understanding the Dutch network will be used to inform ORR's assessment of the October 2007 submission from Network Rail.

2 Introduction

The main body of this report comprises notes on each meeting in the order they occurred between 24th and 26th September 2007 inclusive.

The meetings on the first day were discussion based, with few formal presentations. The second day was more presentation based and included a site visit, and the third day was a mixture of formal presentations and discussion.

The ORR core team comprised Ian Maxwell (Signalling Adviser), Richard Swain (Structures Adviser) and Frank Zschoche (consultant from BSL, a subsidiary of Lloyd's Register Rail Limited). The core team was joined on the first day by Richard Goldson, ORR Non-Executive Director, and Paul Wiseman NR Head of Investment Efficiency.

3 Background

The Dutch railway system is one of the busiest railways in Europe.

The main public railway company is Nederlandse Spoorwegen (NS, 'Dutch Railways'). There are also four smaller operating companies. The tracks and network infrastructure are provided by Pro-Rail, which until privatisation in 1995, was part of NS.

At privatization, maintenance activities were separated from the train operator activities. Train operations remained the responsibility of Nederlandse Spoorwegen (NS).

Future maintenance activities were to be managed by ProRail, but the maintenance departments themselves were split into three parts and sold to private companies. These were Strukton, who bought 50%, VolkerRail who bought 30% and BAM who bought 20%.

The Dutch network is divided into four main geographical regions and the maintenance for them is split between the specialist contractors. Currently there are 39 contract areas.

The majority of the Dutch network is electrified at 1,500V DC and runs on standard gauge track. The network consists of approximately 2,800km of track. See the network diagram overleaf, Figure 1.

The Dutch government heavily subsidizes ProRail, which receives approximately €1bn each year. It also receives approximately €0.3bn each year from train operating companies (TOCs) in track access charges.

Early on in the visit we were told about the agreement between the Dutch government and ProRail. We were told that the agreement contains a clear explanation of what the government expects from ProRail as an asset manager.

The Dutch government's expectations are apparently summarized into a few short and concise paragraphs. One of ProRail's staff explained that ProRail was pleased with this because it showed that the government had taken the time and effort to understand what it is that they expected, and were able to express it clearly and concisely. This has helped ProRail to understand what the government expects of them and clarifies what they have to do.

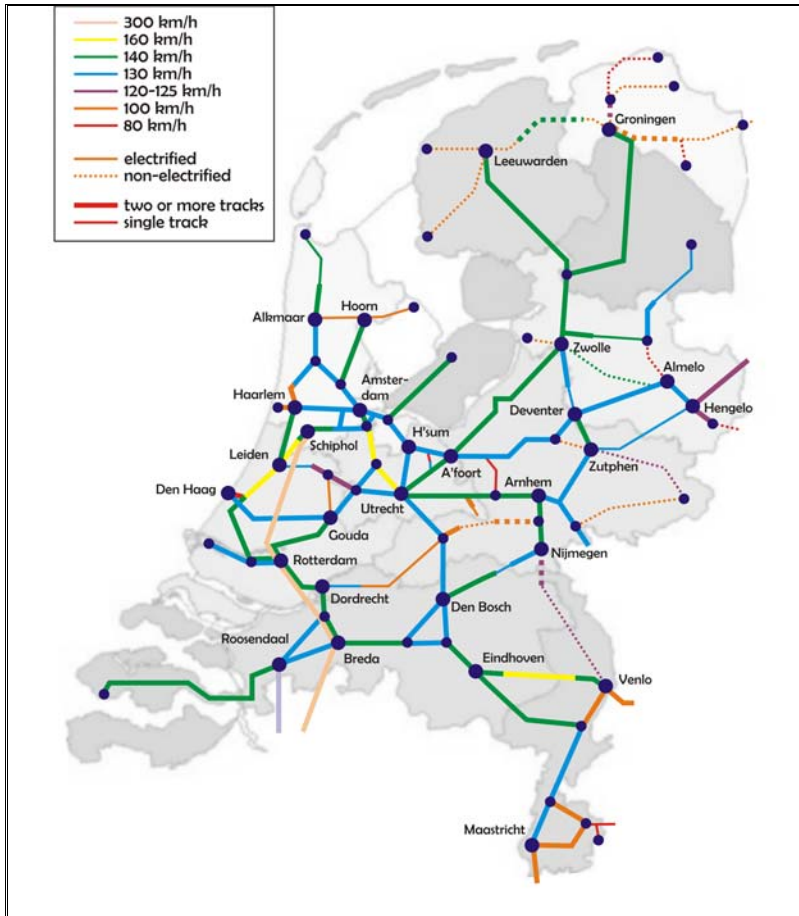


Figure 1: A map of the rail network in The Netherlands, showing line speeds.

ProRail has several key output measures that are the result of good network management. They are as follows:

- **R**eliability
- **A**vailability
- **M**aintainability
- **S**afety

It is apparent that ProRail has a good understanding of how asset condition, costs, performance and maintenance activities are interrelated and contribute to achieving the RAMS principles. ProRail has developed models that attempt to predict how asset condition and performance of the network are affected by variations in expenditure.

The RAMS principles and the understanding of the interaction between the different drivers enable ProRail to draw clear lines of responsibility between the Government, ProRail and their contractors. This is achieved in practice by

cascading important key items down into their management practices using a hierarchy of Integrated Quality Indicators (KPIs), Maintenance Specifications and Maintenance Activities. Sustainability is also introduced by ProRail into maintenance contracts.

The management hierarchy, showing how RAMS is cascaded downwards into ProRail and its contractors was explained diagrammatically, and is shown in Figure 2 below.

Although the UK Government does not produce principals in the same way as the Dutch Government, the diagram was used to give a crude comparison of the level of involvement of the Government in the respective rail industries. The coloured lines indicate the different levels at which the responsibilities between industry and Governments are split in the respective countries.

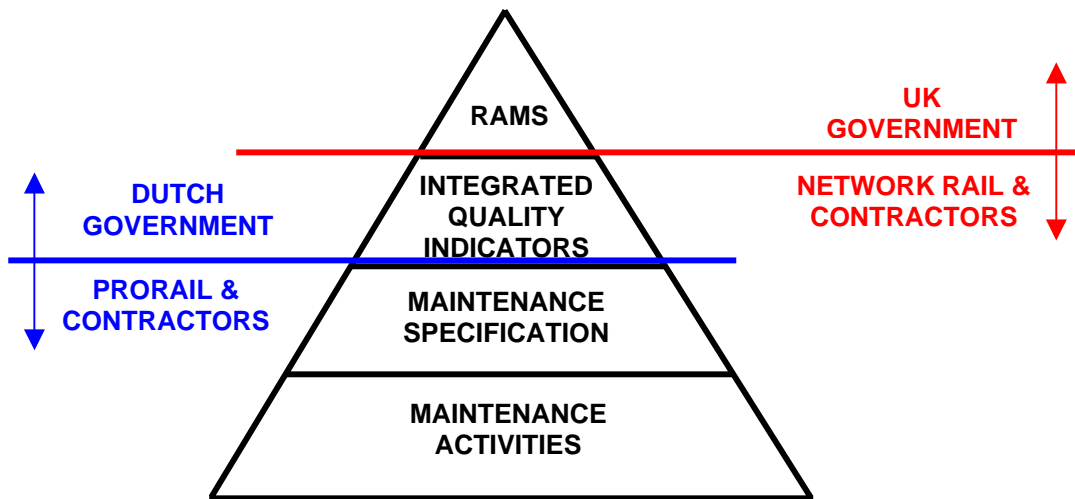


Figure 2: The hierarchy of RAMS and comparison between the UK and Dutch Government involvement.

Following privatisation the ProRail organisation had a traditional, regional structure. It needed to become more efficient and so it was restructured into a matrix arrangement and maintenance work was outsourced.

The new structure and outsourcing enabled processes to flow more freely. There has been a major change for the regional managers who have been required to pull back from managing the assets in their region and to manage policies, introduce better planning processes, provide support and information systems and coordinate operations.

Renewals planning is done on a three and five year basis. ProRail has a modelling system which aids the prediction of costs for different alternative renewals scenarios. It was introduced 6 or 7 years ago, and uses discounted

cash flow methods to predict life cycle costs. It has been used to explain the flow of expenditure between maintenance and renewals. Renewals work is prioritised each year, using a corporate matrix to select the most suitable renewal activities. Renewals are tendered as discrete projects, and are not undertaken within maintenance contacts.

ProRail has found that most efficiency improvements in renewals have come from bundling different activities together and implementing them at the same time. To enable this, line closures are required for many weeks at a time during which work on many different asset areas is undertaken within the geographical limits of the blockade. Large efficiencies have also been gained by undertaking more partial renewals, which represent a saving over full renewals.

We understand that ProRail is very proactive in monitoring the work of their maintenance contractors and appear to be very strict with them. There are three maintenance contractors, spread across four geographical regions.

Maintenance appears to be determined fairly prescriptively as ProRail inform their contractors of what needs to be done, or how often work needs to be undertaken to the different assets. A detailed inspection process is in place following the completion of maintenance work during which ProRail inspectors review a selected sample of the contractors work. If any of the work is not to the required standard then ProRail do not pay them, and the onus is placed upon the contractor to undertake further work and to prove to ProRail that he has done what he should have.

ProRail explained that they are soon to pilot a new type of maintenance contract arrangement in the regions. The new format is less prescriptive than the current form and it makes the contractor responsible for determining when maintenance is required and what is actually done. There are some concerns in ProRail that this will result in the contractor doing less maintenance, with the condition of the network declining as a result. ProRail may also find it difficult to pull back from their current strict arrangements as they will be required to become more of a contract manager than an infrastructure owner/maintainer. However, in contrast, contractors view it as an opportunity to become more innovative and efficient, as they will have more overall discretion.

A crucial factor in the Netherlands maintenance strategy is the limited time available for maintenance works. The Dutch government has recently introduced laws that state that a minimum of 55% of a persons working time must be during daylight hours. They have also changed the laws regarding work on live rails, which is now not permitted. Night time rail work is not undertaken on the Dutch Network.

The lack of time available for maintenance works has been a key driver in the development of innovative remote inspection and monitoring techniques. The Dutch have successfully implemented several different systems in this field.

Video and geometry trains are used to record and measure track quality and geometry and produce data that can be reviewed in the office and stored electronically for future use. One Dutch contractor, Strukton, has been key in working with NR to implement this technology in the UK via the Southern Measurement Train.

Open floored trains are also in operation that allow inspections to be done from the track, and can be used during the day within existing timetables.

Some parts of the Dutch network have had equipment installed at the trackside that is capable of measuring technical data continuously and relaying the information, live, to a computer server. The information can be accessed by any computer or PDA that is connected to the internet and enables maintenance teams to access the system while they are out in the field. They therefore have access to the data that will help them to investigate a problem, or to confirm whether their work has been effective, while they are still out in the field.

These systems are capable of monitoring a variety of properties such as switch motor current, rail temperature, and track circuit detection amongst others. They enable remote monitoring to be undertaken and the data they measure can be used to predict the time at which a component is likely to fail. This enables ProRail's contractors to be pro-active and to identify and plan the replacement of items that are about to fail, before they actually do so.

4 Meetings and Site Visits

4.1 Day 1 Meeting 1

Location: ProRail, The Inkpot, Utrecht, The Netherlands

Hosts: Arjen Zoeteman & Jan Swier (Both ProRail)

Date and Time: 9.00 Monday 24th September 2007

Subject: Development of ProRail

- Jan Swier described the relationship between the Government, ProRail and the Train Operators. The Government pays approximately €1bn per year to ProRail and ProRail receive approximately €0.3bn per year from the TOCs in access charges.
- The Dutch go government 100% stakeholder in ProRail. Both ProRail and TOCs are given concessions by the government.

- ProRail's contract with the Government to manage the network is reviewed every year between the two parties.
- ProRail's output, resulting from good network management is:
 - **Reliability**
 - **Availability**
 - **Maintainability**
 - **Safety**
- Research was undertaken in the last few years in the UK into different types of contracts and specifications for the railway.
- Jan Swier explained how the RAMS principles are filtered down into IQIs (Integrated Quality Indicators), Maintenance Specifications, and Maintenance Activities. He demonstrated this diagrammatically using flip charts, indicating that the RAMS principles were at the highest tip of a triangle, and how they filtered down and outwards, into the different layers of documentation and maintenance activities beneath them.
- IQIs appear to be equivalent to NR's KPIs. They are monitored each month to give the pulse and health rating of the network.
- Maintenance Specifications give allowable tolerances, and quality parameters for the different assets on the network, and state how they are to be maintained.
- Risk Analyses of Maintenance Concepts are used to determine the level of risk that is to be shared between the Government and ProRail.
- ProRail's contract with the government revolves around the cost of the railway and the performance that is obtained for that level of funding.
- The planning horizon is a 5 yearly rolling cycle, although projections are also made on 10 and 15 year look ahead.
- The Government clearly indicate within Pro Rail's management agreement what it is that they expect of an effective asset manager. This is done in a few short paragraphs of text and provides useful and concise guidance on the criteria that ProRail's performance will be judged.

4.2 Day 1 Meeting 2

Location: ProRail, The Inkpot, Utrecht, The Netherlands

Hosts: Arjen Zoeteman & Jan Swier (Both ProRail)

Date and Time: 10.00 Monday 24th September 2007

Subject: Development of ProRail (continued)

- Jan Swier explained the logic of the relationship between network condition, costs, performance and activities.
- ProRail has a 10 year contract with the government, within the contract the planning horizon is 5 years rolling from year to year.
- Efficiency targets are expressed in costs. The average costs for renewals have been reduced since they were contracted out.
- To undertake maintenance work, ProRail tend to close down lines for two weeks and offer alternative bus transport. These long possessions help to get work done right in one go, thereby avoiding the need to undertake renewals within the next 20 years.
- Other cost levers are the bundling of renewal activities and sending the larger projects out for tender. Framework contracts are used as well.
- ProRail has used benchmarks “to irritate the regions and the contractors”. Initially the intention behind them was to demonstrate to the regions that their contractors were the most expensive railway providers across Europe, and force them to react to it and reduce their costs.
- The number of train kilometres is not an appropriate measure to use. ProRail has applied normalized costs per track kilometre. There is no activity based benchmarking as everything is outsourced. Besides, it would require some considerable effort to measure activities.
- Section M31 of the contract is a calculation of overall contract costs, which include:
 - the maintenance activity units
 - the execution time (day/night)
 - the frequency
 - the costs
- ProRail aims for a risk based maintenance concept for switches, tracks, etc. including maintainability, availability and sustainability. FMECA has been introduced to develop a risk based maintenance programme.

- The risk based approach was implemented four years ago. Some people within ProRail understand the concept and are conscious of its potential benefits, but it is not yet an established practice within the organisation. There is a growing awareness that it will be a fundamental instrument in the future.
- Within the maintenance contracts ProRail has defined:
 - RAMS specifications on a higher, output oriented level. This gives the contractors a certain degree of freedom.
 - Safety is specified in detail.
 - Health standards are assured by assessing the compliance with rules and regulation.
 - Sustainability: a typical maintenance contract duration is five years, but asset lifetime is much longer. Sustainability has been introduced as an additional contract element as it would not normally be triggered by the RAMS specifications. An example could be: weather or maintenance of a drainage system.
- The risk of cost increases in labour, materials, and staff etc, are agreed with the government. The government bears the macroeconomic risk. Regional risks have not occurred so far.
- There are limited penalties paid by ProRail to the train operators. However, this is not a significant order of magnitude.
- Four “qualitative” targets have been included in ProRail’s management contract:
 - 1) Increase the transparency in the relationship of costs, performance, condition and activities,
 - 2) Know the interaction between performance of TOC and infrastructure,
 - 3) Know the long term effects of maintenance (LCC management),
 - 4) Structures and management systems to support 1 to 3,
- These targets have been translated into 20 to 30 measures (KPIs); their development is constantly monitored.
- At the start of the infrastructure and outsourcing operation, the organisation had a traditional, regional structure. What was needed at that time were new planning systems and a better relationship with the train operating companies.
- The major change for the regional managers was to pull back from managing their region and to manage policies, introduce better planning processes, provide support and information systems and coordinate operations. For this reason ProRail was restructured into a matrix

organisation. This made processes flow better in the regions, turning them into very autonomous “kingdoms”.

4.3 Day 1 Meeting 3

Location: ProRail, The Inkpot, Utrecht, The Netherlands

Hosts: Ted Slump, Arjen Berends, both Planning Coordinators within ProRail

Date and Time: 11.00 Monday 24th September 2007

Subject: Production Plan, Long Term Plan

- Ted is responsible for short term planning (2 and 5 years), Arjen is responsible for the long term planning, which can be up to 20 years.
- About 50% of the budget is dedicated to renewals, which is the focus of long term planning.
- Long term planning is a three step process which is very much top down and SAP based (SAP is a widely used German financial planning system):
 - 1) Each object has a theoretical renewal time which is recorded in the SAP asset register (first level of planning).
 - 2) After $\frac{3}{4}$ of the theoretical lifetime the assets are inspected to determine the expected residual lifetime (second level of planning).
 - 3) When it becomes time for renewing the assets, the actual network needs, and other opportunities (such as bundling) are examined (third level of planning).
- The five year plan is done from the bottom up:
 - Activities for the coming five years are consolidated in a production plan. This is done using a stand alone database developed by ProRail, and is done by the regional managers.
 - For expensive renewal operations, several different alternative solutions are made; LCM is a modelling system used to calculate the alternatives considering life cycle cost aspects (discounted cash flow method, comparing net present values).

- The LCM was introduced 6 to 7 years ago. It has helped to explain budget shifts between maintenance and renewals.
- Most efficiency improvements came from bundling activities asset group wise and carrying out more partial renewals.
- To prioritise activities, ProRail use a matrix (called the “prio matrix”) to rank and select the most suitable renewal activities.
- Prioritisation of renewals is discussed once a year between the planners and senior management, though feeding the database is a continuous process.
- Due to a lack of renewal budgets in the past, maintenance was increased. The LCM model has since proved that this was the right strategy and earlier renewal would have been cost inefficient.
- LCM is not used in the early part of the lifecycle since maintenance is left to the contractors. This is thought to be slightly inadequate as the maintenance contracts do not contain KPIs to assure that the right level of small scale maintenance is maintained.
- The scope of a renewals project is determined by the region, who then prioritise the jobs that they have. The project division (at HQ) then tenders the job and implements it. The planning horizon for prioritised projects is two years.

Contracting:

- A defined work volume is guaranteed to the maintenance contractor for a five year period, specific renewals projects are handed over for two years.
- In signalling, projects are longer e.g. MISTRAL covers 80% of the signalling installations over a period of 30 to 35 years.
- Stations: passenger access into stations is ProRail’s responsibility, commercial activities are responsibilities of NS Stations.
- Track access (possessions) is determined each April for the next year (i.e. not the immediate coming year). This is less than ideal for planning maintenance activities. A new KPI on possession availability is being planned. Before tendering a contract, ProRail goes through a process to ensure that the contracts are tendered fairly.
- The contractors deliver all services (logistics, labour etc.)
- ProRail has previously attempted to put the work volume normally undertaken within five years into a single three month blockade period.

However, it found that the risks were too high and the prices were driven up.

- Usually renewals are carried out over a weekend, using a blockade from Friday to Monday and sometimes at night during the week. ProRail takes advantage of German contractors by using them during periods of vacation in the Netherlands.
- Current problems are :
 - A lack of control on the contractor's work; ProRail does not get to see all of the work that has been done by the contractor.
 - Asset policies only indicate the typical, or 'average' activities that are needed.
 - From the planners point of view, more input steering is needed from their management.
- The ProRail 'Yardstick' is a "picture book" that has been introduced to ensure a more objective assessment of the condition of the assets. The book contains photographic and descriptive examples of asset defects and enables the inspectors to assess asset condition out in the field. It is based on UIC principles. The track asset yardstick is in use and one for catenaries is currently being developed.
- The consequences of wear and tear are weighted by the criticality of the assets, determined on the basis of track utilization.
- In some cases the initial budget determination for a renewals project has required supplementing with additional funding. Such a situation arises when the budget has been decided too early, before the full scope of the works becomes apparent.
- Signalling work is being limited due to limited signalling resources. To ease this problem, the signalling work in MISTRAL was given to three different contractors. This helps to spread the risks.

Section Summary

Issue	Question for NR
1	What attempts are made within NR to bundle different types of work together so that they can all done at the same time, rather than undertaking different types of work in possessions or blockades?
2	In order to maintain continuity of work, are NR able to take advantage of foreign labour during periods where UK labour is not available, i.e. during peak holiday seasons?
3	How does NR ensure that the quality of the work done by a contractor during a possession or blockade is acceptable?
4	Do NR have an equivalent to the 'Yardstick' which aims to ensure a consistent assessment of an assets condition?
5	What life cycle costing do NR do for track?

4.4 Day 1 Meeting 4

Location: ProRail, The Inkpot, Utrecht, The Netherlands

Hosts: Martijn Blokker, Team Leader Rail System Projects.

Date and Time: 12.00 Monday 24th September 2007

Subject: Inspection Technology, IRISsys

- The frequency of visual inspections for switches depends on the classification of the switch. ProRail applies three switch categories and therefore three inspection intervals: once a week for heavily used switches (Cat A); every two weeks (Cat B), once a month (Cat C).
- Switches are inspected on the basis of video train recordings at 40 km/h; the measurement this train is used on 20 to 30 of the busiest layouts.
- The maintenance contractor measures switches manually once or twice a year.
- EurailScout owns the measuring trains and measures track twice a year (geometry). The requirement for further measurement is being analysed.
- RCF and ultrasonic measurements are also carried out by measuring trains, which run 1 to 4 times a year, depending on the utilization of the track in question.

- The videos have to be analysed manually. Video recording has been in operation since 2004.
- Video recordings are used by the contractors and replace manual visual inspections.
- One of the contractors also hires the measuring train so that he can obtain additional condition data to supplement existing data.
- Walkover track inspections are used only for auditing the Inspection by walking the track has an auditing function only.
- The inspection train produces measurement data that can be consolidated and analysed in a database called IRISsys.
- IRISsys is being developed to be more predictive. Different runs are compared manually.
- Stationary wireless cameras have been installed at some switches. One camera can monitor several switches. They have the facility to zoom and pan. ProRail dictate what elements of the switch need to be observed and the contractor positions the cameras accordingly.
- The POSS system measures the resistance of a switch motor; the contractor analyses the information to predict failures. Approximately 1000 switches are currently monitored (this is approximately 1/6 of the total number of switches). (POSS has been developed by contractor Strukton).
- Measurement of track geometry is increasingly used to control the quality of the contractor's work.
- Other automatic measurement is in place for the overhead lines (measurements of diameter, and video footage) on the same train. This information is primarily used for renewal decisions.
- The train also checks the ATW signals.
- The track circuit relays are measured every 6 years to determine renewals; the track circuit signal is measured more often to determine maintenance requirements.
- Control centres monitor the availability of the assets.
- Concrete civil structures are visually inspected by the same contractor every 3 years; steel bridges are inspected once a year, moving bridges are inspected 2 times a year.
- Larger "quality inspections" are carried out by another company approximately every 10 years in order to determine large scale renewals.
- Sea defences are a common form of protection for the railway.
- CCTV is used in tunnels to prevent vandalism; currently infrared devices are used to detect obstacles at level crossings.

- It is planned to link inspection results with the grinding programme.
- A new trolley is used for inspections and small repairs without having to take the track out of use (Robel produced the prototype). The second generation is a ProRail/VolkerRail development.

Section Summary

Issue	Question for NR
6	Do NR consider the inspection of switches remotely, by video train and cameras, a real possibility for preventative maintenance in the UK?
7	Have NR considered using remote monitoring (such as POSS) on any of the track / signalling assets?
8	Have NR considered the use of an open floored wagon for track / point / switch inspection. This could enable inspections to be done during the day without disrupting traffic movements.

4.5 Day 1 Meeting 5

Location: ProRail, The Inkpot, Utrecht, The Netherlands

Hosts: Arjen Zoeteman, Team Leader Policy & (System) Architecture.

Date and Time: 13.00 Monday 24th September 2007

Subject: Specifying, Measuring and Monitoring Quality

- The policy & architecture division determines the technological standards and certifies contractors (i.e. decides which products are used and which contractors are capable of delivering these products).
- System managers and specialists have a new role as they are responsible for the price and the performance of the product; they create design and maintenance specifications and supervise the contractor's performance.
- After outsourcing maintenance, the number of failures has been increasing significantly.
- Switch failure analyses have resulted in better management of the contractor's recovery teams.
- RCF has heavily increased but it is multi-causal, e.g. due to higher speeds, more load, more double-decker trains, different brakes and more

- slipping; there are also better measuring procedures that detect more failures than in the past.
- A few years ago grinding on the network was introduced and it has now reached a certain base level; the heaviest RCF has been reduced since grinding started.
 - The maintenance and design standards catalogue is placed on the internet and is regularly updated. It is therefore easily available to the contractors.
 - An independent assessment of the asset condition is undertaken on the basis of the “Yardstick”. This takes into account utilization of the lines and is done by the territories.
 - Next year all catenary poles will be measured to determine whether they are nearing the end of their life.

Section Summary

Issue	ORR Issues for PR08
9	Do NR undertake independent assessment of track quality in order to gain a view of the effectiveness of the contractors work?

4.6 Day 1 Meeting 6

Location: ProRail, The Inkpot, Utrecht, The Netherlands

Hosts: Paul Vos, Product Manager Civil Structures, and Piet Verkerk, System Manager Stations,

Date and Time: 14.15 Monday 24th September 2007

Subject: Civil Works

- Paul is responsible for bridges, especially the steel moveable ones.
- Piet is responsible for general management.
- ProRail tries to stick to the Dutch or Eurocode design standards rather than creating their own guides.
- Corrosion protection on steel bridges: This used to be a process of painting every 12 years. New bridges do not require maintenance before

50 years. The focus is on reducing the maintenance efforts, especially since possessions are very limited.

- In the UK there is a problem with embankment settlement due to poor soil quality. Holland has a high water table and poor ground conditions. ProRail use geotextiles and drainage as a standard specification and so this isn't a problem.
- ProRail do not undertake any walkover inspections of their embankments.
- [We later learnt that in ProRail, civil engineering has a very narrow definition and concerns only the items that support the track and that are made out of steel, or concrete, such as bridges. Other civil engineering assets are limited to concrete retaining walls, such as those in place in the Arnheim cutting. An earth embankment, or any other 'soft' formation beneath the track is considered to be the responsibility of the track department.]
- The measuring system can be used to predict failures.
- Bridges are inspected in two ways:
 - Maintenance contractors carry out frequency based inspections looking at safety aspects
 - Main inspections (every 10 years on concrete bridges and every 5 years on movable bridges) are very detailed
- Standards have been introduced for maintenance of under and overbridges (overbridges are not owned by ProRail).
- There is no common philosophy to repair defects immediately; each structure is handled according to its own defects.
- Generally, the differentiation in the Dutch bridge stock is between concrete and movable steel bridges.
- Cracks have to be repaired immediately; and the painting process has been adapted to allow for the cracks.
- Embedded rail is used on some locations; it was developed by Edilor & ProRail.
- Reinforced plastic for bridge components is not used.
- There are no wooden footbridges.
- There are no policies in place to classify structures in the same way that NR have. The Dutch network is fairly evenly trafficked throughout and therefore all routes carry much the same load. They therefore have no need to categorise their structures in accordance with route utilisation.
- The only 'special cases' regarding the management of the Dutch bridge stock is for the steel moveable bridges, each of which is treated on its own merit. These have numerous metallic components and mechanisms that

need to be looked after regularly. (i.e. no equivalent of NR's major structures).

- There is a classification system in place for stations. They are ranked green, yellow or red, according to their importance and condition.
- There are seven tunnels on the Dutch network, a total of 6km in length. The tunnels were built in the 1950s. They are concrete lined and generally in good condition.
- There is a whole life approach to structures. The standard lifetime is 100 years, movable bridges have a shorter lifetime of approximately 50 years. Approximately ten years before the end of a bridges predicted life, the requirement for renewal is assessed.
- Few bridge renewals are undertaken as the stock is relatively new and in good condition.
- Most bridge renewals are due to track requirements and not because of expiring lifetimes. Most bridge works are the result of increased traffic, or is work undertaken to increase the bridges capacity, such as widening to add new tracks.
- There are set of standard unit costs which are used for LCC calculations; These are based on actual costs and are regularly updated; they have been in place for approximately the last ten years.
- Safety related costs have risen in the last few years.

Section Summary

Issue	ORR Issues for PR08
10	How will the switch to Eurocodes affect NR and the work they procure from design consultants? Will the quality and cost change?
11	How would NR's structures policies be affected if NR were to adopt a philosophy where by they repaired all small defects before they became larger defects? How would maintenance / renewal costs be affected?
12	What would be the effect on overall renewal expenditure if interventions were to be more time based, for example, based upon design life rather than condition based? Would it be more expensive or cheaper, would the overall condition of the asset stock improve?

4.7 Day 1 Meeting 7

Location: ProRail, The Inkpot, Utrecht, The Netherlands

Hosts: Coen Valkenburg, System Manager Track and Arthur Kappers, System Manager Switches, Crossing and Ballast

Date and Time: 15.00 Monday 24th September 2007

Subject: Track Works

- Geogrids are used for track sub-formation. They help to spread the loads across a wider area and keep the sand formation layer separate from the ballast.
- The layer of ballast between the subsoil and concrete sleepers is a maximum of 35 centimetres thick. It is typically 20 to 25 cm thick. It is kept as a thin layer to minimise the volume of ballast required as it has to be imported and is therefore expensive.
- Ground radar mounted on trains is used to investigate the condition of the subsoil and the quality of the ballast.
- There is no special monitoring used to monitor embankment movements. Defects, or movements within an embankment would only be picked up following passage of a track measuring train.
- Video monitoring is the future of inspection and it delivers very sharp, high speed pictures. It is in the early stage of testing.
- Switch failures mostly occur on high speed points that have 5 to 7 point machines. It has resulted in the development of a new switch type (“AB switch”).
- Rollers are used on 80% of the switches (various products are used by companies such as BWG, Schwihag etc.).
- The key initiatives in the Netherlands to reduce the costs of track and switches are:
 - Increase the number of fastening systems suppliers
 - Reduce the costs of rails

- Reduce the costs of sleepers
- In some locations, ballast costs can be reduced by using ballast gluing techniques. This reduces the dynamic forces in the area of insulation joints.
- At Gare du Nord the surface layer of ballast was glued which has facilitated the vacuum cleaning process.
- Switches and crossings: the behaviour of concrete sleepers is currently being studied; The first phase to analyse the elasticity has been finished; The second phase is now in progress and investigates the use of different, highly elastic sleeper pads.
- A programme for introducing a new generation of switches and crossings has been postponed. These intended to use a lower tongue profile.
- Improvement of the quality of insulation joints (most track circuit failures are caused by pollution, metal splinters and poor joints built into the track); after 2003, prefabricated joints were introduced which brought down failures to a third of previous levels.
- Chorus dampers (glued to the rail) reduce noise emissions by 3 db(A). A clamped version is currently being tested but doesn't seem to be as good.
- Gas point heating is more common than electric heating since there are natural gas resources readily available from Groningen. The breakdown of points heating is: 70% gas, 20% CB, 10% electrical.
- Three suppliers from England and Sweden are providing solutions to test the investment costs, maintenance and operational aspects of points heaters.
- Gas heating: burner pipes last for 18 years. Inspection is every 6 years. There have been some reliability problems with igniters.
- Lubrication machines are installed in most of the yards.

Section Summary

Issue	ORR Issues for PR08
13	Do NR in general, make use of geogrids to separate track formation layers?
14	Do NR use GPR to investigate the condition of the formation layers?

- 15 Have NR investigated the use of ballast gluing to reduce dynamic forces in track components?
- 16 Have NR considered the use of chorus dampers to reduce noise and vibration?

4.8 Day 2 Meeting 1

Location: ProRail, Swolle Regional Office

Hosts: Patrick Spanjaard, Line Manager North East
Martin Peeters, International Affairs

Date and Time: 9.00 Tuesday 25th September 2007

Subject: Managing the Maintenance of the Rail Infrastructure

Powerdocs Reference: 286236

Organisation

- ProRail's core business consists of 6 activities. Managing and maintaining the network is a large part of this, and was the focus of the meeting.
- InfraManagement is one of the six divisions in ProRail.
- There are several organisations in operation: NS Passengers, NS Real Estate, NS Stations and NS Rolling Stock, and NS Infra Services (incl. Maintenance, Warehouses, Factories and Machines).
- Engineering has been outsourced to Movares; Strukton and Elektrorail have been separate business units and transformed into private contracting companies.
- Today, Rained (Capacity Management), NS Traffic Control, NS Railinfrabeheer (= Infra Management) and Railinfra are divisions within the ProRail Holding Company.
- At the start of the process to outsource maintenance works (1995), the work force was split up into three large contractors: Strukton, VolkerRail and BAM. These three companies cover the four geographical regions of the Dutch Railway, working within a total of 39 regional maintenance

contracts. (BAM are known in the UK as they own civil engineering contractor Nuttall).

- More recently, two additional contractors have become involved in Dutch rail maintenance. One is a Dutch company and the second is German (Spitzke).
- Contractors create a monthly report which enables ProRail to assess and control the contractor's work activities.
- In the North East Region, there are two contractors (Strukton and VolkerRail) that are used for small scale maintenance work. Different types of maintenance works are usually bundled together into the same contract. These are currently worth €25M and €35M. There are some extra, smaller works contracts, which account for the additional €10M.
- The contracts cover all assets and the contractors act as a single point of contact; the contractors subcontract some elements of work. Subcontracting is allowed, but must be within ProRail rules. For example, there are restrictions for subcontracting track work, but not on vegetation control.
- ProRail has a total of 10 inspection teams that cover stations and track. The teams read the contractor's reports and undertake inspections to check performance.
- The contractors are managed using the following means: contracts, monthly reports, a test plan (inspection/audit of the works) and regular progress meetings.

Maintenance Contract

- The contract contains the regulations, relevant legislation and the description of works to be done. It covers all asset types.
- The objective of a maintenance contract is to keep assets in their actual condition (no enhancement).
- The maintenance contractors are not guaranteed any renewal work. If they want renewal works, they are free to tender for it, but are given no special favours over other contractors.
- When the renewal work is complete, ProRail inspectors go out into the field to ensure that the works have been done according to the contractual requirements.
- Before renewal work starts, a renewal project initiation document is created. This is done by ProRail system engineers, renewal planners, and

the maintenance inspection teams. By involving all of the different parties early on in a contract, ProRail ensure that all requirements are laid down in the initial stages of planning and tendering.

- The contracts are based on activities, not on outputs. However, this is in the process of changing. The first output oriented contract (a pilot) has been awarded and will start on January 1st 2008. Similar contracts will follow. ProRail is expecting further cost reductions and improved performance as a result.
- Output contracts are based on route availability which is weighted for different line categories.
- Payment to the contractor will be changed from activity based payments, which have an open budget, to a lump sum.
- Once the new contracts are in place, ProRail's role will change from that of a maintenance manager to more of a contracting manager.
- Contracting periods will be extended from 5 to 6 years.
- There are still some potentially large savings to be made in the maintenance contracts. For example, power supplies, savings have already been made by reducing the volume in the contract by 25%. Such principles could be extended into other asset areas.
- ProRail's maintenance engineers are responsible for all asset types and consider maintenance requirements from several different angles. For example, they review the quality of track and signalling maintenance works on a switch.
- There are four types of point classification. Points classified as A, B and C are inspected weekly. Points classified as D are inspected quarterly.
- The standard 'core' of a contract is determined centrally, and supplemented with details that are added by the regions.

Reports

- There is a maintenance execution plan (Excel table "M31") indicating the activities per line section on a timescale. In the table the contractor indicates what he has actually done. The contractor is required to explain any deviations from the plan and to point out the risks and consequences for ProRail.
- In addition, the contractors occasionally provide inspection reports, for example on ultrasonic measurement; other reports can be provided to ProRail on demand.

Test Plan

- Testing is carried out by ProRail to check the efficiency of the contractor.
- The tests can cover inspections, process audits, document checks (e.g. inspection reports) and financial checks.
- A systematic process has been implemented to determine ProRail's inspection quality, file reports and discuss results with the contractors.
- Every region has an auditor conducting a dozen audits per line manager per year.
- Financial checks (e.g. on invoices and work reports) are thoroughly done on two asset types every six months.

Regular Progress Meetings

- Regular meetings take place to discuss faults (daily), contractual affairs with the contractor (every fortnight), works over the past month (monthly) and adjustments to the contract (yearly).
- There is a constant improvement loop in learning to optimise the contracts from year to year.

Section Summary

Issue	ORR Issues for PR08
17	Do NR project plans include requirements for maintainability?
18	Is NR work based on outputs or activities?
19	Are NR's maintenance activities broken down activity by activity so that maintenance teams have a clear understanding of what they need to do?
20	What testing do NR do to check the quality of the finished work? How independent are the checks that are done?

4.9 Day 2 Site Visit

Location: ProRail, Swolle Regional Office

Hosts: Patrick Spanjaard, Line Manager North East
Martin Peeters, International Affairs
Arjan Van Erven, Inspector of Signalling

Date and Time: 13.00 Tuesday 25th September 2007
Subject: Site Visit
Powerdocs Reference: 286645

Before we could walk on the tracks in the Netherlands we were required hold a valid safety certificate for the Dutch network. In order to obtain a certificate we were required to pass a safety examination to prove our competence and gain an understanding of how safety is managed on the Dutch railway.

We were able to take the safety examination online prior to our visit, whilst still in the UK. The examination consisted of an interactive briefing using text and diagrams that indicated the safety systems that were in operation on the Dutch network, such as the flashing warning light systems and safe distances from moving trains. After the briefing was complete, a short test was taken to ensure that we had understood the knowledge learnt in the briefing. After the test was completed successfully, we were able to print off our own pass certificates, which we then signed and forwarded to ProRail.

The afternoon of Tuesday 25th September 2007 was spent undertaking a site visit. The office at Swolle is located at the railway station.

The visit was lead by one of ProRail's signalling inspectors who described what he would look for and how he would inspect the various assets that we were going to see. Unfortunately, poor weather conditions prevented the team from undertaking a full track walk and so the team was limited in what it was able to see.

We were informed by the inspector that ProRail inspect work only after they have received notification from the maintenance contractor that the work has been completed. Inspections are used as a check to see if the contractor has done things correctly. The independence of the inspector from the workforce helps to keep the inspections objective. Checklists, in the form of standard pro-formas are used and ensure that a consistent approach to the inspections is taken by all ProRail inspectors.

It was explained to us that if the contractor was required to undertake repairs or further maintenance following an inspection, the work was undertaken on a priority basis. ProRail was able to rank the urgency of the work required and in the worst case, where work was required in order to maintain safety, the corrective work would need to be done within 24hours of it being reported to the contractor.

Swolle Station platform:

From the station platform we were able to see several different types of points motors and track crossover arrangements.



Photo1: Track arrangement at Swolle Station.

Relay Room:

In a relay room we were able to view several racks of relays, working drawings and the battery room.



Photo 2: The relay room at Swolle Station.



Photo 3: A close up of a bank of relays.

Level Crossing:

We were able to see a level crossing in operation, its emergency battery supply and the relay cabinet that controls it. We gained an understanding of the items, (such as the angle of the barrier arm and the time taken for the barriers to lower), that the inspector checks during his inspection.



Photo 4: Level Crossing barriers.



Photo 5: The mechanism inside the barrier unit.



Photo 6: The relay cabinet that controls the level crossing.

4.10 Day 3 Meeting 1

Location: Strukton Railinfra, Utrecht, The Netherlands

Hosts: Nick Oversier, Head of Innovation Department.

Date and Time: 9.15 Wednesday 26th September 2007

Subject: An Overview of Strukton Railinfra

- The discussion was aimed at giving us an overview of the development of the Strukton business.
- Nick Oversier had played a key role in the development and introduction of the Southern Measurement Train (SMT) in the UK, working with Network Rail. He had obtained NR approval for it and has had contact with ORR staff in the past (Brian Counter). The SMT is more accurately called the UM 160.
- Video and remote asset monitoring system are being developed more and more following recent changes in Dutch Law. These changes have dictated that work on live tracks between train movements is no longer allowed and have placed limitations on the amount of night working possible. Therefore there is less time available for men to go out onto the tracks to undertake inspections, and so video and remote monitoring methods have become more and more attractive.
- In the UK, several years ago, video based inspection techniques were ditched due to issues that arose following the Hatfield accident. The accident was a big event in the UK and the politics that followed it complicated the introduction of video monitoring techniques.
- Strukton have found it difficult to enter the UK market. This has mainly been because of difficulties with Network Rail's approval processes, which they claim are too strict.
- Strukton Railinfra are soon to change their name to Strukton Rail. They hope that this will make them a little more attractive and recognizable in the UK, amongst other places.
- Strukton Railinfra are the market leader in the Dutch Rail Contracting Market. They currently maintain 55% of the countries network.
- Strukton have numerous offices throughout Europe. These have been gained mostly through acquisitions, by buying other companies. This has

been beneficial to Strukton as they obtain local knowledge and expertise and an existing foothold in the domestic market.

- Strukton have several areas of specialisation:
 - POSS – This is a web based system for live monitoring of critical components such as point motors.
 - UFM 160 – This is a measurement train that measures track geometry, rail and OLE data.
 - IRISsys – This is a data management system.
 - Virtual Inspection – Use of remote, statically mounted video cameras.

Section Summary

Issue	ORR Issues for PR08
21	Are NR aware of the difficulties that their approval system poses to entry into the UK rail market? If it could be eased, it may introduce innovative companies into the market, bringing benefits in the long run.
22	Video based and remote asset monitoring are becoming increasingly important as the time available for maintenance work decreases. What remote techniques have NR investigated and for what assets?

4.11 Day 3 Meeting 2

Location: Strukton Railinfra, Utrecht, The Netherlands

Hosts: Nick Oversier, Head of Innovation Department,
Neils Lange, Maintenance Engineer.
Erland Tegelberg, Managing Director.

Date and Time: 10.30 Wednesday 26th September 2007

Subject: Maintenance Engineering & Viewing Video Footage

- There was general discussion regarding the existing contractual arrangements between ProRail and Strukton and the new one that is soon to be piloted. The new form of contract will be less prescriptive and Strukton consider that this gives them more scope to be innovative and efficient.
- Strukton have undertaken benchmarking against Austrian railways regarding their maintenance procedures.
- They have also reviewed UIC benchmarking data and consider that sometimes the figures that are provided by member countries are used to hide things, especially regarding funding.
- Strukton have considered the big picture question of how railway maintenance work is done, whilst driving down costs and increasing efficiency. These issues can drive the maintenance strategy. Availability and Reliability of the network are key indicators for the network as a whole and it is important to identify the 'killers' to these.
- Strukton maintain 55% of the track in the Netherlands. The Netherlands is split into 4 regions. The intention is to introduce standardised systems for maintenance that are developed with, and used by, the regions.
- POSS – Stands for 'Preventative Maintenance System Strukton'. It currently covers approximately 35% of the switches on the network, which is about 1500 in number. Although initially installed at Strukton's cost, ProRail has seen the benefits of it and have now bought it from Strukton. The system is used by some other rail contractors, where it has been installed and where Strukton no longer have a presence, but some contractors deliberately ignore it.
- POSS is a preventative system, and the knowledge learnt on monitored elements can be transferred to those that are not monitored.

- The video surveillance train is especially effective in station areas where possessions are limited, and where access to the tracks by personnel is restricted and dangerous. In stations it travels at approx. 30kmph.
- Static, permanent cameras are used to look at hard to reach points. Several cameras can be trained on 1 set of points so that different angles of view can be obtained.
- Video of the track can be recorded as the measurement trains pass along the tracks. Video is recorded onto computer hard drives that are removed from the train once the run is complete, and taken into the office for viewing. This process has raised issues regarding electronic data storage – there is a considerable amount of data that needs to be stored, and Strukton have not resolved the issues of how long the data should be kept for, or who should have access to it. These issues have legal implications.
- Strukton's team of inspectors review the inspection videos in the office on a bank of television screens. The videos are watched in short bursts, and team members share responsibilities so that they do not become overwhelmed or lose concentration by studying video footage for long lengths of time. The teams consist of people who are ex-track inspectors, and they have had some difficulties adjusting from track to office work.
- Strukton have a recording system on their trains that records track geometry as the train runs on it. When the collected data is combined with records of recent tamping and track history, targeted, and therefore efficient, maintenance plans can be developed. They said that in some locations targeted maintenance has lead to a 20 - 40% overall reduction in tamping and an improvement in the overall track quality.
- In Strukton's opinion, NR overuse the Southern Measurement Train. Strukton consider that it only needs to be used 4 to 5 times a year on any one piece of track, but NR use it every 2 weeks.
- The data that supports the IRISsys system is hosted on a server in Germany and accessed over the internet. It can be demanding in terms of bandwidth and can sometimes be slow to stream video footage, which can be made up of large files.
- IRISsys system can predict the motion / effects of a moving train travelling at different speeds. This can enable dynamic effects upon the track to be better understood and maintenance targeted accordingly. However, there are some questions regarding the type of train that is being modelled, and how the calculations are actually performed. It is assumed that the software is based on the worst case scenario, but issues such as the type of train that this is, and whether the worse cases for different effects are caused by different trains, are not fully understood by Strukton as the software was developed by a specialist company.
- POSS can be accessed line side by using a handheld PDA. This is particularly useful for maintenance staff who can use it to see the before

and after conditions and therefore see instantly whether their maintenance work has been effective.

- POSS is capable of measuring the following, and live details can be viewed over the internet:
 - Point Motors,
 - Track Circuit Detection,
 - Axle Counters,
 - Level Crossings,
 - Rail Temperature,
 - Train Passage,
 - Surveillance cameras.

Section Summary

Issue	ORR Issues for PR08
23	Have NR consider and researched preventative systems for asset management?
24	In Strukton's opinion, NR overuse the Southern Measurement train as they consider that it should only be used 4 or 5 times a year on any one section of track.

5 Conclusions

It is clear that ProRail has a good understanding of what the Dutch Government expects from it as an asset manager. This is due to Government's requirements being clear and concise and it enables ProRail to incorporate them into its management system, and to cascade them down into contracts with suppliers. Clear lines of responsibility are therefore drawn between the Government, ProRail and the contractors, which enable the outputs to be delivered efficiently.

It would appear that ProRail has a clear understanding of how issues such as condition, cost, outputs and performance of the railway are all interrelated. They appear to be organised and efficient in their operations.

ProRail has, to date, had strict control over their contractors by using prescriptive contracts with tight financial controls. However, they are soon to pilot a less prescriptive contract type which allows their contractors to determine the level of maintenance required in their particular contract region. It is hoped that this will lead to innovation and efficiencies from the contractors, although there are some concerns that ProRail's control of the network will be diminished. It appears, that contractors see the new contract type as an opportunity to optimise the

inspection and maintenance process, and to gain efficiency over existing time based inspection and maintenance procedures.

It remains to be seen how the new contract type will develop and whether ProRail and their contractors will take to it favourably. It may be worthwhile for ORR to maintain contact with ProRail on this issue, to see how this situation develops and whether this practice can be used to good effect within the UK.

The recent changes to Dutch law which limit the amount of night time working, and prevent work on the tracks being done between live train movements, have severely limited the time available on the Dutch network for maintenance work. This has led to innovation in the areas of remote monitoring of track equipment, and the use of inspection and geometry measuring trains, and a reduction in the number of possessions required. ProRail's largest contractor, Strukton, appears to be particularly strong in this area. Strukton have had some involvement in the UK rail industry, although they commented that entry to the UK market was difficult due to NR approval procedures.

During the visit to Strukton we were given a copy of a paper that had been written by Erland Tegelberg on 'Maintenance philosophy in a privatised market'. A scanned version of this document can be found on PowerDOCS#287277. This is a very interesting paper and applies not only to the Netherlands, but to any privatised network. It discusses what the infrastructure manager should be looking for in privatised system, and the choices that are available to him. It briefly describes the Dutch experience of privatisation and confirms that it has led to reduced maintenance costs.

One of the key areas identified in the paper for development is the move away from time based maintenance towards condition and use based maintenance. It is argued that time based maintenance is too generic, and inefficient, and therefore too expensive. The move towards condition based maintenance has led to the development of IT based asset registers and monitoring systems that can be used to optimise maintenance techniques and even anticipate asset failure.

ProRail takes advantage of longer possessions in which a variety of different work activities can be done. Long blockades are becoming more frequent and during them, several different types of asset work are carried out concurrently. In this way more numerous, shorter possessions can be avoided, more work can be done and there is less disruption to the travelling public, with overall possession costs reducing.

It is apparent from our visit that the Dutch railway system is still in the early days of privatisation. The Dutch are keen for their network to develop and mature, and are keen to innovate to improve efficiency. Regarding privatisation, they are

keen not to repeat the mistakes that other privatised networks have made by rushing the process.

Appendix 1 Associated Documents held in PowerDOCS

PowerDOCS	Owner	Subject
<i>Visit Schedule</i>		
285681	ProRail	Meeting Schedule and Contact Details for ProRail staff
<i>Pre Meeting Questions</i>		
285657	ORR	Bridge and Tunnels Questions
274625	ORR	General Infrastructure Questions
285658	ORR	Earthworks Questions
285665	ORR	The Netherlands - Overview
285716	ORR	Background on Strukton
<i>ORR Draft Notes</i>		
286276	ORR	Inspection of Signalling Equipment
286645	ORR	Inspection of Signalling Equipment - photographs
286275	ORR	Maintenance Management
286274	ORR	Track & Switches
286273	ORR	Civil Works
286272	ORR	Product Management
286271	ORR	Inspection Technology
286270	ORR	Planning
286766	ORR	Development of ProRail Pt 1
286268	ORR	Development of ProRail Pt 2
<i>Received Presentations / Papers</i>		
286236	Strukton	Maintenance Engineering at Strukton Railinfra
287099	ProRail	Managing the maintenance of the rail infrastructure
287277	Strukton	Maintenance Philosophy in a Privatised Market

Appendix 2 Comparison of Dutch and UK railway assets

Asset	Number of assets - The Netherlands	Number of assets - UK	Units	Ratio: The Netherlands / UK	Number per track km - The Netherlands	Number per track km - UK	Ratio: The Netherlands / UK per track km
Track	6,500	32,000	km	1 / 4.92	1.00	1.00	1 / 1
Switches	8,200	20,400	No	1 / 2.48	1.26	0.64	1 / 0.5
Signals	9,800	40,000	No	1 / 4.08	1.51	1.25	1 / 0.82
Bridges	4,500	44,000	No	1 / 9.77	0.69	1.38	1 / 1.98
Stations	375	2500	No	1 / 6.66	0.06	0.08	1 / 1.35
Trains daily	5,400	17,400	No	1 / 3.22	0.83	0.54	1 / 0.65
Passengers daily	1,200,000	3,100,000	Per day	1 / 2.58	184.62	96.88	1 / 0.52
Tons of cargo daily	100,000	297,000	Per day	1 / 2.97	15.38	9.28	1 / 0.6

Appendix 3 ORR Issues for PR08

This appendix collects together all the issues raised within each of the sections 4.1 to 4.11.

Issue	Question for NR
1	What attempts are made within NR to bundle different types of work together so that they can be done at the same time, rather than undertaking different types of work in possessions or blockades?
2	In order to maintain continuity of work, are NR able to take advantage of foreign labour during slack periods where UK labour would be on holiday?
3	How does NR ensure that the quality of the work done by a contractor during a possession or blockade is acceptable?
4	Does NR have an equivalent to the 'Yardstick' which aims to ensure a consistent assessment of an asset's condition?
5	What life cycle costing do NR do for track?
6	Does NR consider the inspection of switches remotely, by video train, a real possibility for preventative maintenance?
7	Have NR considered using remote monitoring (such as POSS) on any of the track / signalling assets?
8	Have NR considered the use of an open floored wagon for track / point / switch inspection. This could enable inspections to be done during the day without disrupting traffic movements.
9	Does NR undertake independent assessment of track quality in order to gain a view of the effectiveness of the contractor's work?
10	How will the switch to Eurocodes affect NR and the work they procure from design consultants? Will the quality and cost change?
11	How would NR's structures policies be affected if NR were to adopt a philosophy where they repaired all small defects before they became larger defects? How would maintenance / renewal costs be affected?
12	What would be the effect on overall renewal expenditure if interventions were to be more time based, for example, based upon design life rather than condition based? Would it be more expensive or cheaper, would the overall condition of the asset stock improve?

13	Does NR make use of georgics to separate track formation layers?
14	Does NR use GPR to investigate the condition of the formation layers?
15	Have NR investigated the use of ballast gluing to reduce dynamic forces in track components?
16	Have NR considered the use of chorus dampers to reduce noise and vibration?
17	Do NR project plans include requirements for maintainability?
18	Is NR work based on outputs or activities?
19	Are NR's maintenance activities broken down activity by activity so that maintenance tams have a clear understanding of what he is to do?
20	What testing does NR do to check the quality of the finished work? How independent are the checks that are done?
21	Is NR aware of the difficulties that their approval system poses to entry into the UK rail market? If it could be eased, it may introduce innovative companies into the market, bringing benefits in the long run.
22	Video based and remote asset monitoring techniques are becoming increasingly important as the time available for maintenance work decreases. What remote techniques have NR investigated and for what assets?
23	Have NR consider and researched preventative systems for asset management?
24	In Strukton's opinion, NR overuse the Southern Measurement train as they consider that it should only be used 4 or 5 times a year on any one section of track.

Appendix 4

10 Important Points learnt from the visit:

Number	Comment
1	There are clear expectations from Government of what it requires from ProRail as the rail infrastructure manager. Requirements are clear, concise and easy to understand.
2	ProRail cascade government requirements into their own management systems and into their works contracts.
3	ProRail has sufficient in house expertise to know what they want from their maintenance contractors and the ability to communicate their requirements in contract documents.
4	ProRail has strict processes for monitoring their maintenance contractors and inspecting their work.
5	ProRail use a 'yardstick' to ensure a consistent approach to inspections.
6	Requirements for maintenance works and inspection processes are broken down item by item so that they are clearly understood by contractors and inspectors.
7	Small defects in assets are fixed before they become big ones.
8	Limited possession times have lead to innovations and developments in the areas of remote monitoring, remote inspection and use of measurement trains.
9	UK market is difficult to break into for foreign companies, due to NR's approval procedures.
10	There is an opinion that NR overuse the Southern Measurement Train.