THE HISTORY OF OUTSOURCING RAIL INFRASTRUCTURE MAINTENANCE IN THE NETHERLANDS

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The Dutch rail infrastructure provider has outsourced all minor maintenance on the national network since 1998. Not only is this an unusual situation in the world of rail, it is also risky, as British experience with maintenance outsourcing has demonstrated. However, spinning off parts of a provider's operations, leaving the remaining units to concentrate on core activities, appears to be becoming more common. This trend is highlighting the management-intensive nature of maintenance, and the directness of its influence on operational performance. Maintenance outsourcing is therefore attracting considerable attention.

This article gives a chronological account of the history of maintenance outsourcing. The subjects discussed include the contract, the contracting process and the style of management. The article concludes with an assessment of the current situation. The objective is to establish and transfer knowledge and experience, not only to other organizations about to embark on outsourcing, but also to rail sector managers and staff who are interested in strengthening the control and management of maintenance.

This article gives as complete a picture as possible of what has happened, why, and how. Besides describing the development process, this article also discusses details of the contract structure, the specification tree, cost and performance trends and the demand specification created for the first performance contract to be put out to tender. This is a considerable amount of information, of a very diverse nature. It is a goldmine for interested parties.

The beginning of the beginning

It became clear in the late 1980s that the Dutch national rail operator, NV Nederlandse Spoorwegen, or NS, was ripe for restructuring. There were three reasons for doing so: (1) the growth in traffic and the resulting expansion of the rail network, (2) the liberalization of the European rail transport market, and (3) a need to increase efficiency and effectiveness.

The first step, in 1990, was to spin off the engineering consultancy activities and to merge all upkeep activities into a separate infrastructure organization. Four years later, the internal engineering consultancy NS Ingenieursbureau marked its new independence by changing its name to Holland Railconsult BV (now Movares). Some experts from the old organization transferred to the company Articon BV, which is now part of Arcadis BV. Also in 1994, the upkeep organization was divided up into a management organization, NS Railinfrabeheer, with 700 staff, and an operational unit, NS Infra Services, with 2800 staff. As if that wasn't enough, 1994 also saw the launch of the “Tracks to ‘96” operation. This culminated in 1996 in the administrative separation of the transport and rail infrastructure activities. The final financial and

organizational separation of the two organizations had to await a new Railways Act in 2003.

Between 1996 and 2003, the infrastructure organization was actually left in a state of limbo. It was still part of NS, but it knew for certain that independence was coming. The timing was hardly opportune, but the far-reaching decision to outsource all maintenance was taken in this period. NS Infra Services and three existing rail contractors merged and regrouped. Towards the end of 1997, some 2800 NS employees were distributed between three newly formed and equivalent rail maintenance companies. All three were capable of undertaking the complete package of maintenance and upgrade work. Strukton's market share was 50%, that of Volker Stevin 30%, and of NBM Rail 20%. From 1998 on, all rail infrastructure upgrade and major maintenance projects and all process-oriented minor maintenance activities in the Netherlands have been outsourced. The consequences for the organizations involved and their employees have been enormous.

Major consequences

Maintenance outsourcing changed everyone's position and job description. Possibly the greatest change was for Railinfrabeheer staff, who slowly but surely saw all operational activities transferred, first to the NS Ingenieursbureau, and later to NS Infra Services. The remaining management task had never been explicitly identified and organized, which manifested itself mainly in the changing requirements set on the knowledge, skill and orientation of a great many staff. The task orientation shifted from almost completely technical to commercial with support from technical specialists. The figure below illustrates how jobs in the organization have changed “colour” in an eight-year period, from “blue” (technical) to more “yellow” (process-oriented).

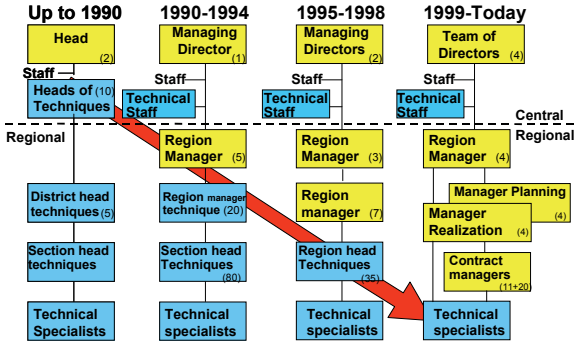

Figure 1 Shift from a technical to a more commercial orientation

Not surprisingly, the people doing the jobs did not change “colour” so fast. The management and client task had to be built from scratch. Although NS Railinfrabeheer was the client for maintenance and upgrade work, the necessary core skills, instruments and information were few and far between. An entirely new identity and culture had to be created, new tasks and processes defined, and missing control instruments and procedures developed. An impression of Railinfrabeheer's status in early 1998 can be gleaned from the following list of missing items: no explicit upkeep policy, no production plan, no planning organization, no experienced maintenance contract managers, no one had heard of life cycle management and

maintenance engineering, and, despite all maintenance being outsourced, there was no maintenance contract. Furthermore, the new maintenance companies had hardly had time to adopt a more commercial management style.

It looks with hindsight as if the government and NS had left rail infrastructure management and maintenance more or less to fend for themselves. They did not use their influence and power to establish effective rail infrastructure management. NS Railinfrabeheer and the maintenance contractors alike were thrown in at the deep end, with no opportunity to prepare.

In all probability, it is thanks to the many (ex) NS staff with their informal contacts and legendary dedication that a complete loss of control (as happened in Great Britain) was avoided. They filled the gap created when informal contacts made way for formal contracts, but before management had the instruments to control them.

Maintenance outsourcing was therefore certainly *not* a prime example of a well thought out and properly prepared tendering policy. With hindsight, there is evidence of a degree of naivety and innocence. There are several possible reasons for this state of affairs. The first is that outsourcing was fashionable in the 1990s. Then, all NS management attention was occupied with the separation of transport and infrastructure. And there was widespread confidence in the power of the “market”, if only Railinfrabeheer would start managing “remotely” and “by output”. Perhaps the aspect that best illustrates the attitude at the time is the wish to start to manage remotely and by output. No one was able to say how that was supposed to happen, and insufficient attention was given to creating a strong starting position for the client. There appeared to be little awareness of the burden on both the client and the contractors in controlling processes and deploying advanced management instruments to make maintenance outsourcing work.

Maintenance outsourcing is unusual and tricky

It was not so very long ago that maintenance was a craft, and hardly a management-intensive occupation. That view has changed drastically in the past twenty-five years. A sign of the difference is that maintenance is now taught as a main subject at the Delft and Eindhoven technical universities. The demand for these courses comes mainly from the aircraft, defence and oil industries, in response to the extreme requirements on the availability, reliability and safety of their means of production. These industries are encountering considerable pressure to render the impact of maintenance predictable, more efficient and more effective. It quickly came to be recognized that good maintenance has a significant impact on operating results (costs and performance) and that it can be managed if the right techniques are used.

Railways have been around for more than one hundred and fifty years, and so are comparatively traditional in nature. However, similarly high demands on quality and safety apply to railways too, and they are satisfied by robust technology, failsafe interlocks, technically strong and well trained staff, and a maintenance organization with a discipline almost up to military standards. Nearly all railway companies in the world still do their own maintenance. One good reason is that the combination of unique superstructure and interlock techniques, civil engineering, power engineering and electronics keeps the admission threshold for market parties challengingly high. To be in a position to outsource, therefore, a railway company is itself obliged to give

market parties a leg up, and the high admission threshold could contribute to the creation of a niche market.

Something else that makes maintenance outsourcing tricky is that the result to be achieved is difficult to specify and measure. The output is not a tangible product, such as a new set of points or a nicely painted bridge, but a performance in terms reliability, availability, maintainability, safety, health and the environment (or RAMSHE). The output is not something you can hold in your hand, but something you perceive. A complicating factor is that the average lifetime of rail infrastructure objects is more than fifty years, while a maintenance contract runs for a mere five. Too little or poorly executed maintenance is difficult to detect, and usually manifests itself later in the form of a shorter lifetime or higher maintenance or overhaul costs. Another factor is that 60%-70% of maintenance costs are personnel costs. It therefore really is a people business. The craftsmanship, experience and dedication of employees are crucial determinants of the short and long term impact of maintenance. The work they do is neither spectacular nor glamorous, but the impact is considerable: “If you think maintenance is expensive, try an accident”.

To be in a position to outsource maintenance in a controlled, efficient and effective way, alongside an experienced and competitive market there also has to be sufficient knowledge and experience. The client and contractor must also be in a position to:

- specify, measure and assess performance;
- analyse and manage risks in maintenance activities;
- identify deviations from specifications and translate them into the most efficient and effective maintenance actions;
- perform maintenance in good time;
- arrange for well trained, experienced and dedicated personnel to be available;
- be aware of the long term impacts of maintenance on operating life, costs and performance.

A management and maintenance organization does not automatically possess these competencies.

There was no maintenance market in the Netherlands or elsewhere in Europe in 1998. NS Railinfrabeheer and the three process contractors were by no means ready for outsourcing at that time, and even less ready for the public tendering of a performance contract. However, from 1998 on, both parties have grown into their new roles and have worked energetically on developing missing management skills and instruments, and on setting up and managing predominantly new processes. This development is outlined in this article with reference to the evolution of the minor maintenance contract, more commonly known as the output process contract, or OPC.

The first maintenance contract: OPC (1998)

The first OPC was drawn up in 1998 and introduced in stages. The starting point for the contract was a specified process consisting of eight steps:

1. data gathering for tendering;
2. risk assessments;
3. risk balancing;
4. quality planning;
5. selection and contract award;
6. drawing up and accepting various plans;
7. reporting;
8. handling nonconformities.

The actual contract has three components: the conditions, the terms of reference and the specifications.

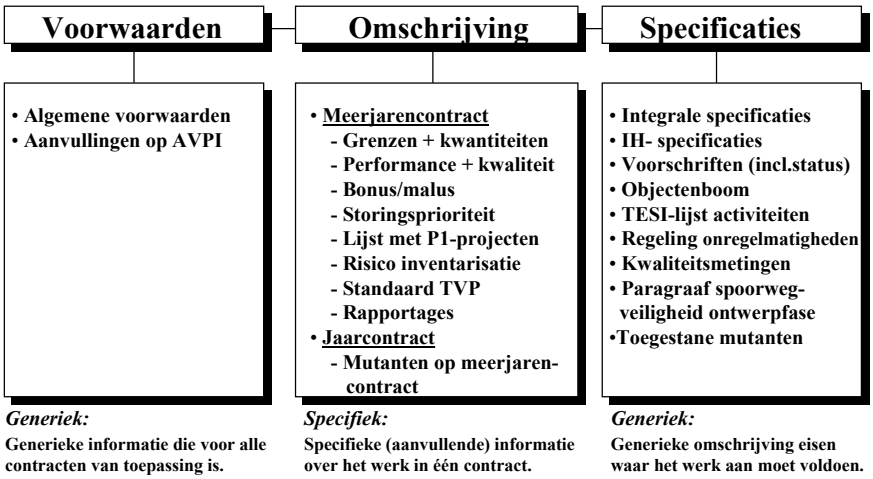

Figure 2 OPC structure (1998)

The criteria established for the OPC were consistency, lack of ambiguity, a well thought-out contracting process and professional instruments. The salient features are:

- thirty-nine geographically distributed contracts;
- a five-year master contract with annual agreements on variations;
- a separate approval scheme for maintenance, including breakdown recovery;
- a comprehensive contract for minor maintenance to the track, engineering structures, telecommunication facilities, interlocks, energy supply and crossings;
- consistency in the contracts; the OPC model is the standard;
- contracting guidelines, which expand upon the eight process steps;
- a generic risk analysis as a basis for distributing specific risks;
- an open budget to justify the proposal, in accordance with standard estimating model M31;
- specifications on four interrelated levels: RAMSHE, composite quality indicators, upkeep specifications, and activity specifications (activity specifications are used in cases where upkeep specifications are impractical);

- safety risk surveys; S&H plan, including rail safety;
- prescribed inspections, linked to the upkeep specifications;
- After the contract was fully developed in 1998, all staff involved at the three process contractors and Railinfrabeheer were given extensive training on the structure and working method. A Railinfrabeheer multidisciplinary project team then introduced the thirty-nine OPC contracts in batches over a five-year period.

An OPC evaluation in 2001 concluded that, although satisfactory, the contract had several shortcomings, which may be summarized as follows:

- the operation of market forces, which was a mainstay of the contract, had not materialized;
- there was no clear understanding of the relationship between money and RAMS performance;
- there were insufficient operational specifications and instruments for management by output;
- the contracts for each track section manager were interpreted and structured inconsistently through a lack of central coordination;
- there was insufficient partnership in the chain, with process contractors too focused on their own profits, while Railinfrabeheer produced inadequate output specifications.
- The evaluation concluded specifically that the contract was a sound basis, but that partnership needed to improve, and a clear understanding was needed of the costs, the performance, and how they interrelate. This was the background to the OPC+ project, which was an extension of OPC 1998. The objective of the OPC+ project was to start to manage more intelligently and effectively, and to clarify the relationship between costs and quality through collaboration on proper performance throughout the infrastructure chain.

Improved maintenance contract: OPC+ (2002)

Partnership and insight into implementation would appear to be in conflict with outsourcing and a businesslike relationship. The solution that was identified borrowed from professional management and maintenance techniques in the aviation, oil and gas industries, which also form the basis for the European quality standard EN 50126. The process embodied in the standard opens the path towards cohesive RAMS management for railway authorities and suppliers throughout the European Union. Processes for specifying and measuring the RAMS requirements are the cornerstone of this standard, alongside the associated upkeep management techniques. The process of preventing breakdowns starts with a systematic risk analysis to identify potential breakdowns, the associated cause, and the impact on performance and costs. If the analysis reveals that the risks of a breakdown are too high, this would prompt an examination of possible ways to prevent it. This might involve more intense or a different kind of inspection, accelerated component replacement, more frequent lubrication, complete overhaul, and so on. The output is recorded in the upkeep concept, which therefore specifies why and how maintenance, overhaul and inspections are used in controlling risks. Ultimately, three

birds are killed with one stone: (1) a clear picture of the relationship between performance risks and maintenance activities; (2) a proper understanding of the costs involved; and (3) structured records, allowing various parties to communicate their experience. The sharing of experience, knowledge and information creates a climate of continuous improvement.

The sector process model was developed to help achieve a clear division of tasks and roles (an important aspect of OPC+). The course of the proceedings is then visible, from the conclusion of contracts with central government and transport operators, through the process contract with the process contractor, to the work carried out by the maintenance engineer.

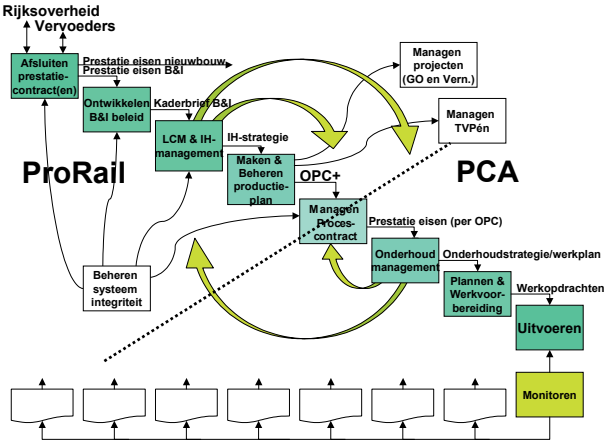

Figure 3 The sector process model

ProRail and the process contractors were supposed to start to work together as if a single process was involved. Risk management was therefore added alongside the contract management process; better known as the upkeep management / maintenance management process. The OPC contract remained intact, but six new elements were added:

1. a partnership agreement;
2. risk analyses and upkeep concepts as information and as instruments for the upkeep management / maintenance management process;
3. a maintenance plan derived from the upkeep concept, with a standardized estimate (i.e. M31), based on standardized units with unit prices;
4. a new management principle: management by performance and settlement based on units;
5. an improved management process based on RAMS QPIs and standard daily, weekly and monthly reports;
6. an upkeep management process for continuous improvement upkeep management / maintenance management process).

The OPC+ project organization was disbanded in 2005 and the results weighed up. The benefits were a substantially improved performance, a far deeper understanding of the maintenance plan and the estimated and actual maintenance costs, insight into the relationship between risks and controls, and better management reports. Unfortunately, there were also some drawbacks: rising

maintenance costs (partly because of outsourcing, see Appendix), a heavy administrative burden requiring much attention to be given to input settlement, no insight into actual maintenance costs, a mixture of input and output specifications, a diffuse management focus with a strong process bias, and fragmented contract management across four regions and eleven contract managers. Furthermore, the transfer of tasks and employees from ProRail to the process contractors was controversial, and many questioned its merit and necessity.

Widely differing views existed on the results achieved by OPC+. Relations between ProRail and the process contractors improved, as did the insights into the maintenance plan, but insufficient attention was paid to improving the price-performance ratio and the actual implementation. Although performance was better than before maintenance was outsourced, costs had also risen substantially. The Appendix addresses the price and performance trends, and their influence on outsourcing.

It became clear in 2005 that achieving lower maintenance costs called for more than merely tweaking the contract model or better partnership. Contract management would also have to be strengthened, and a clearer insight was needed into the implementation, with a focus on improving the price-performance ratio. A way had to be found to meet the target for the first public maintenance contract tenders in 2006. The plan was to fully utilize the potential of public tendering and a performance contract. A necessary initial step was to strengthen the ProRail organization. To clarify this aspect, there follows an explanation of the organization's development and of the future form of the performance contract.

Development of the organization

The actual inception of ProRail InfraManagement coincided with the transfer of 2800 NS employees to the maintenance contractors at the end of 1997. From then on, all maintenance activities and related RAMSHE performance and costs would have to be driven by contracts supervised by contract managers. This was a unique situation with an enormous risk of failure[1]. It can be seen with hindsight that the chosen organization structure was inadequate for the enormous organizational and cultural changes about to confront the former Railinfrabeheer. The structure opted for in the 1996-1997 period was a staff-line organization with four autonomous regions. Control was asserted through the line, with staff support for line management. The director of Railinfrabeheer managed four regional directors with responsibilities for management and upkeep in their respective regions. To support them they had a legal affairs manager, a techno-economic manager for planning, and a maintenance and upgrade manager for contract management. The maintenance and renewal manager supervised the project leaders for major maintenance and upgrade projects, and the track section managers for minor maintenance contracts.

In the first year after 1998 the training and development of the track section managers was still supported by a central project team. This arrangement came to an end in 1999, after which the eleven track section managers were on their own. Although the AKI Department[2] nominally had a contract model manager, he was located in a central staff department and had no responsibility whatsoever for the

[1] The demise of Railtrack in Great Britain is a prime example of what can happen.
[2] Which was responsible for tendering, cost management and purchasing.

results or the working methods of the track section managers. The consequence was a gradual but sustained fragmentation of the control of minor maintenance costs and performance. A complicating factor was that the policy and specifications produced by product management were a less than perfect match for the contract model and the contract strategy. They were certainly prolific, but little that emerged was in a form that a track section manager would find useful in his OPC contract. What made matters worse was that what emerged never anticipated events.

Yet another project leader was appointed in 2001 when the OPC+ project was set up to tighten control of minor maintenance. The project leader made various drastic changes, but even he was not responsible for the operational results. The project leader therefore focused on the change process and paid scant attention to the technical content and results. After all, that was what the “line” was for. In view of the complexity and impact of the changes, the project could have paid more attention to their substantial price and performance consequences. OPC+ therefore had several drawbacks, as mentioned above in this article.

From the disappointment with OPC+ came an awareness that the ProRail organization needed more clout in minor maintenance contract management. The pieces of the jigsaw fell into place in 2005 with the formation and development of the new business units within the new ProRail structure. InfraManagement (IM) produced an outlook document outlining the ambitions for and approach to the changes. It led, among other things, to the Structure, Formation and Development plan. The change to the IM organization was defined in terms of eight clusters comprising interrelated activities and processes. Operational Management (i.e. minor maintenance contract management) was one of the four core processes. The other three were Product Management, Planning, and Information Management. A manager was appointed for each of the core processes. The result was a matrix organization in which the process managers and the regional managers worked on achieving the IM business plan. The figure below shows the matrix organization structure.

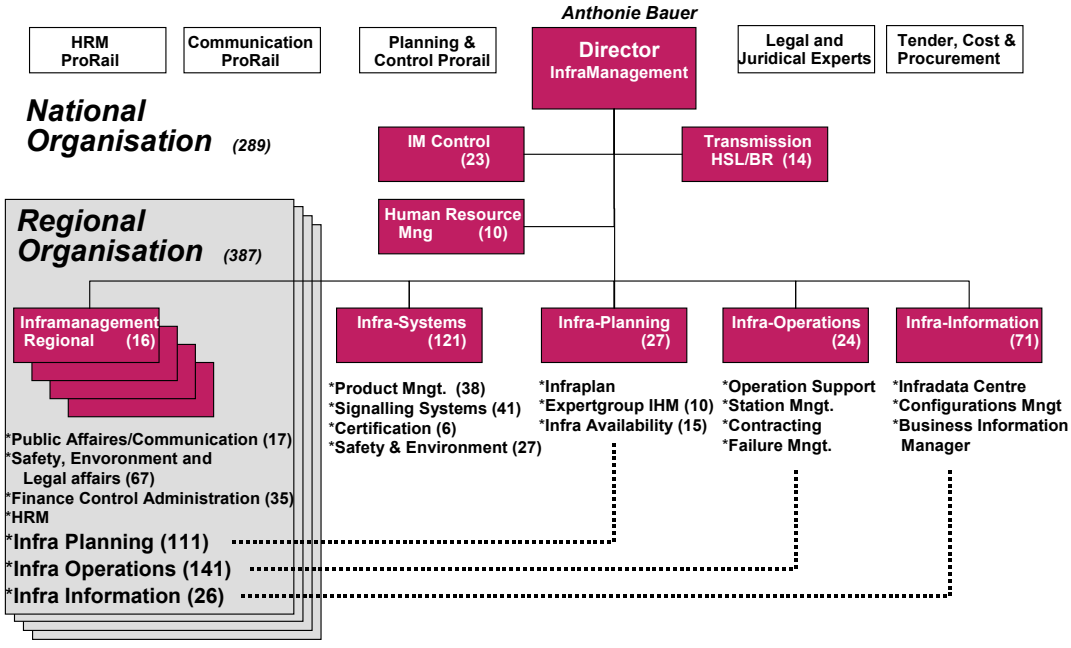

Figure 4 InfraManagement matrix organization since 2006

A matrix organization involves dual leadership. This means that the product is managed from two directions, in which local knowledge and authority combine with national optimization and coordination. The Regional Director is responsible for the day-to-day minor maintenance output, and the Maintenance Manager reports to him in the hierarchy. The Infrastructure Operations Manager is concerned more with how the minor maintenance output is achieved, so the Maintenance Manager reports to him for functional purposes.

This organizational change means that the Maintenance Manager now has two managers, which might create confusion, although so far that has not happened. On the contrary, the presence of the Infrastructure Operations Manager has enhanced the focus, resolve and result orientation. More attention is now given to the substance of the maintenance process, suggesting that a proper balance is being struck between hierarchical and functional control. The arrival of the Operations Manager is likewise expected to improve the position and control of the track section managers. This is vital, because as a group they have been in a fairly isolated position since 1998, also with little contact with each other, even though they are the actual operational (contract) managers who deliver the RAMS product on ProRail's behalf. It is they who make what other people agree and plan.

The purpose of changing the organization was to make it work as a single process, or a single chain. The incorporation of the strategic principles has facilitated and created a framework for Infrastructure Planning, the information systems and Infrastructure Operations. The process involved is sequential, with feedback on imperfections followed by any necessary amendments to policy, plans and execution. Everything has to be oriented to achieving the objectives and plans through contracts and contract managers. It is not a question of every man for himself, but everyone contributes to someone else in the chain.

The changes in the minor maintenance process were substantial in terms of both quantity and complexity, but also enjoy widespread support in the IM organization. It was a logical step that was appropriate to the position of and challenges facing ProRail. The timing of the organizational change was therefore just right for minor maintenance contract management, which was facing the challenge of the first public minor maintenance contract tender. Control will therefore shift from activities (input) to performance (output). This is possibly a unique development in global rail circles. A challenge indeed. Thanks to eight years of minor maintenance outsourcing experience, ProRail and the market would now seem to be ripe for each other. The question is whether they really are.

Managing by input or output

There was talk as early as 1998 of Railinfrabeheer needing to manage by output and remotely. Now, eight years on, we can conclude that neither the client nor the contractor were then ready for this step: there was no contract, the process contractors still had no work order system, the maintenance plans that existed were rudimentary at best, and there was hardly any understanding of the relationship between performance, costs and minor maintenance activities.

Managing by input (i.e. on effort or activity) makes the contractor something of a temporary employment agency for people and a hire company for machines. Managing by output (i.e. on performance or result) means that the client stipulates

the quality requirements for the product or service. The contractor then has to possess the knowledge and experience to select and apply the most effective and efficient working method. This may sound simple and attractive, but it works only if the client and contractor have mastered management by input and output. They both have to understand the relationship between activities and performance and how to control them. The choice of style of management is therefore determined by the level of development of the entire sector. The summary below outlines the contractual relationship appropriate to the two styles of management.

	INPUT CONTRACT	OUTPUT CONTRACT
Gericht op	Te realiseren werkzaamheden in detail beschrijven.	Te realiseren resultaten binnen randvoorwaarden beknopt beschrijven.
Relatie	Vanuit tegenstelling contractueel details vastleggen. De aannemer "levert handjes".	Vanuit een gezamenlijk streven naar verbetering beschreven. Uitgangspunt is de deskundigheid van de aannemer.
Karakter	Win/Loose. Vanuit een belangen-tegenstelling. Opdrachtgever streeft naar lage prijs, aannemer een hoge	Win/Win. Samen streven naar verbetering waarbij opdrachtgever en aannemer "winst moeten maken"
Benadering	Besloten	Open
Geest	Interne controle	Wederzijdse uitdaging
Aandachtsvelden	- Meer-/minderwerk - Afname-protocol	- Vaststelen resultaten - Verbeteringsmogelijkheden
Expertise	Opdrachtgever beschikt over detailkennis van de uitvoering	Opdrachtgever heeft globale kennis over de uitvoering maar veel over specificeren, meten en managen.
Innovatief	Nauwelijks	Uitdrukkelijk
Keuze aannemer	Nadruk op prijs en levertijd	Nadruk op prijs-prestatie en meerwaarde
Belang aannemer	Profilering als uitvoerder	Profilering als comaker met toegevoegde waarde en continuïteit werkpakket

Volgens: "Uitbesteden van onderhoud", SUTO, Herman van den Hoogen en Simon Sjamaar

Figure 5 A closer look at input and output contracts

The multidimensional management playing field created in management by performance generally gives more freedom to the client and contractor. Stalemate is therefore less likely, because one party's problem can usually be made to match the other party's solution.

It is not true that one chosen style of management necessarily excludes others. The various styles of management are not absolute concepts, but are defined relative to each other[3], see Figure 6. If management by output is opted for, then management by input might be a peripheral position temporarily, but it can always be brought back nearer to the centre. Management by output, or by performance, may be beneficial, but it must always be used in combination with other systems of forming an opinion. Hans de Bruijn holds that a client that relies completely on performance measurement risks attracting only its perverse, or negative, effects. On the other hand, a client whose response is to rely completely on management by input will be evoking new and different perverse effects.

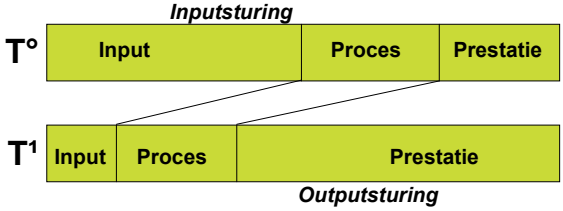

Figure 6 The relative meaning of the style of management

[3] According to Hans de Bruijn: "Prestatiemeting in de publieke sector (Performance measurement in the public sector)".

Misconceptions surrounding management by output are able to abound because people often overlook that this management style can happily coexist with management by input. Some of these misconceptions are rectified below.

- Management by output (or management by performance) is too often viewed incorrectly as an end in its own right, rather than as a means of improving results. It makes considerable demands on process control and requires specific instruments.
- In many people's minds, management by output involves far less knowledge, paper and information, although the opposite is true. Far more of these items are needed because of the requirement for explicit *and demonstrable* control of the relationship between costs and performance.
- Management by output is often incorrectly taken to imply that details of what happens in maintenance (i.e. the input) are no longer the legitimate concern of the client. This is nonsense. Managing and knowing what happens are two different things. They can coexist quite happily.

If a client does not know how to assert control on the output, he would be well advised not to start. Decision-makers often fail to appreciate this point. A sector has to be ripe for management by output. Only a professional asset manager is qualified, and there has to be a growth path leading up to that point.

Specification triangle

Fortunately, ProRail in 1998 did not opt for management by output in the same way as their counterparts in Great Britain at the time. One of the causes of Railtrack's demise was that specification and control were based almost exclusively on RAMS from the outset. The approach taken in the Netherlands was different. The choices and development process of how to specify and manage in the Netherlands can best be illustrated by the specification triangle below (Figure 7). It was devised in 1998 and is still proving its value.

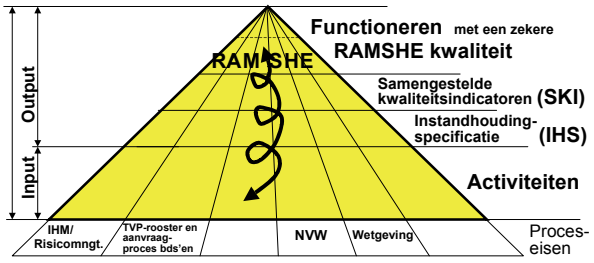

Figure 7 The specification triangle

The highest level of control is the performance of the rail infrastructure at a given RAMSHE quality[4]. The lowest level of control is on activities. Process requirements can be considered the foundation on which control is built. The highest level is referred to as output and the lowest as input. We should bear in mind that input and output are different sides of the same management coin. We should also bear in mind that output can be specified, and therefore controlled, on a variety of levels. An example follows. The highest level specifications for rail safety (the S in

[4] RAMSHE stands for reliability, availability, maintainability, safety, health and the environment.

RAMSHE) are concerned with the number of train derailments or collisions. This is a high and abstract level, and everyone wishes and hopes that both the specification and the implementation never differ from zero. What you actually want is to control rail safety on the demonstrable *prevention* of the risk. One way would be to control on an underlying level, for example the minimum technical upkeep specifications. An example is the minimum technical standards for the number of loose fastenings, the track gauge and the running surface profile of the track construction. As long as you keep above this minimum standard, you know that the probability of derailment is zero.

It often appears possible in practice to apply an algorithm to combine multiple upkeep specifications into a single new specification. ProRail refers to specifications of this kind as composite quality indicators. An example is the k value for track geometry, which is a single number representing multiple upkeep specifications. A composite quality indicator is considered to be a separate specification level for control purposes.

The three output specification levels – RAMS, composite quality indicator, and upkeep specification – and the input requirements in terms of activities and process requirements, constitute the specification triangle. The triangle actually expresses the relationship between the RAMSHE quality of the infrastructure and the activities that maintenance workers have to perform to achieve it. The intermediate output specifications (composite quality indicator and upkeep specification) facilitate proactive control by maintenance workers, who respond when a measurement tends towards a technical lower limit.

Development history of the style of management

ProRail started in 1998 on management by work plan and upkeep specifications. Four years later, about 2002, a clause was added to the OPC to facilitate and encourage partnership between the client and the contractor. There was an accompanying shift in control, based on the principle of “managing by quality and settlement of completed units”; a sort of management by input and output mix. The complexity of this management mix started to become clear in 2005 or 2006. There was seen to be too sharp a focus on settlement and the administrative process. It was duly decided to base the first contract to be put out to public tender in 2006-2007 on a performance contract. Figure 8 below summarizes the history of style of management applied to the minor maintenance contract (OPC).

The decision to draw up a performance contract was taken in 2005. The contract was based on a market analysis and a detailed model of how to structure and define management by performance. Both analyses pointed to the feasibility of management by performance as a solution to the problems with the management mix. However, it was also clear that some necessary management instruments were missing. The section below describes the performance contract management model and identifies the management instruments still to be developed.

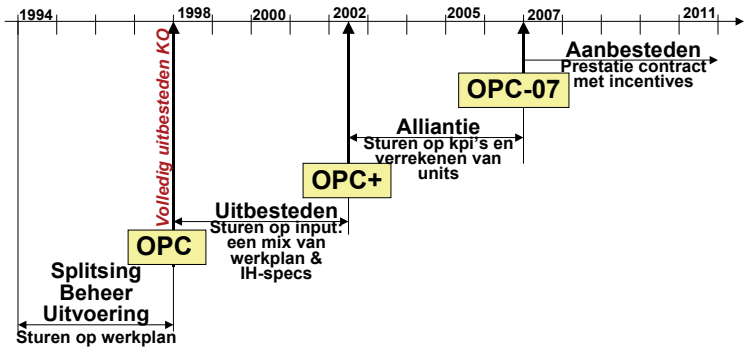

Figure 8 Development process of minor maintenance (OPC)

Maintenance put out to tender in 2007

In 2007, in accordance with agreements with the government and the Netherlands Competition Authority, ProRail was obliged to embark on putting minor maintenance out to tender. The practice of distributing and extending the thirty-nine maintenance contracts in one-to-one negotiations with the three maintenance contractors had to be phased out. The practice had been accepted for eight years to give the new rail infrastructure maintenance market time to develop. The time had now arrived to let the market do its work: to improve the price-performance ratio through competition.

However, competition arises only if there is sufficient supply, there are enough expert contractors, and contractors can be distinguished from each other; there must be something to improve and therefore earn. Unfortunately, a European maintenance market has yet to develop. The Netherlands is the only country in Europe that outsources 100% of maintenance. Great Britain once did, but reversed the decision in 2005 in response to dramatically poor results. For the time being, therefore, ProRail will have to assume that competition will emerge within its own country. A fourth maintenance contractor has now come forward, but the certification process is demonstrating how high the threshold – i.e. ProRail's requirements on expertise – is for a new party.

To make the conditions for competition between the three incumbent process contract contractors as conducive as possible, ProRail decided to reduce the number of maintenance contracts from thirty-nine to approximately nineteen, or about a half. Combining two “old” process contracts into a single new contract means that at least one process contractor always loses a contract and at least two stand to gain one. Other advantages of combining the contracts are an expected fall in overheads, less frequent tendering and a doubling of contract volume from approximately 30 mio (5yr*6mio) to approximately 60 mio, which will clearly help to attract (new) market parties.

The style of management must also change in order to give market parties the freedom to improve the price-performance ratio, as a way of distinguishing themselves from the competition. The change is from managing by achieving the work plan (i.e. input) to managing by achieving a desired performance (i.e. output). Only then is there any incentive and opportunity for the contractors to distinguish themselves. A precondition is accurate specification by ProRail of the desired performance, which must also be measurable and controllable.

Performance specifications in the maintenance contract

The crucial question in the development of the performance contract in 2005-2006 was which elements of performance to manage by: functionality & RAMSHE quality, composite quality indicators, or on the basis of upkeep specifications. Experience gained in the 1998-2005 period also suggested that there should be a high-level specification for the contractor's contribution to achieving the lowest life cycle expenses, or the longest possible operational life. The high-level requirement is relevant because of the difference between the five-year contract term and the fifty-three year rail infrastructure average lifetime. The contractor must not be allowed to neglect the infrastructure at the cost of a shorter lifetime or higher life cycle expenses. The performance specification developed has the following general form:

- it is based on the specification triangle;
- “sustainability” was added to the high level RAMSHE requirements so as to manage explicitly by contribution to the life cycle;
- the high-level availability and reliability requirement (the RA in RAMSHE) is conveniently specifiable and controllable at the highest level through the number, duration and seriousness of train service disrupting disturbances;
- the high-level maintainability requirement (the M in RAMSHE) is also controllable at the highest level through requirements on the number and duration of train free periods, possibly in a maintenance schedule;
- it was unacceptable to manage rail safety (the S in RAMSHE) on the highest level through the number of collisions and derailments. Management of this aspect needs to be on a level at which it is possible to demonstrate that rail safety risk is under control. A methodology was developed to determine the appropriate level, as explained in a subsequent section;
- health and the environment (the HE in RAMSHE) high-level requirements, which are specified through process requirements arising from legislation and set down in associated regulations. Examples are the new framework for safe working (NVW), the safety management system (VMS), working conditions legislation, and environmental legislation;
- what remains is the new high-level requirement, sustainability. No one knew exactly what form this would take, but the same methodology was used as for the development of the specification for rail safety.

The division into specification levels is shown diagrammatically below.

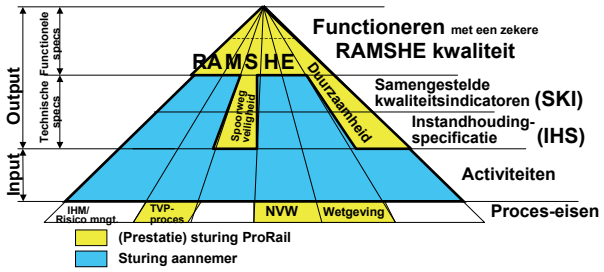

Figure 9 The various specification levels in the performance contract

The yellow figure separates the lowest specification and control level of each high-level requirement by which ProRail intends to manage. It is clear that management is not by activities (input) and that rail safety and sustainability are specified on a far lower level. A methodology was devised for determining this level selectively and consciously, on the basis of risk management instruments previously developed by ProRail for upkeep management.

Risk management and the performance specifications for safety and sustainability

The result of a performance contract is not a tangible product, but a service; arranging for satisfactory performance at a given RAMSHE quality. Risk management is a technology that facilitates the explicit management of a service. The underlying instrument is the risk analysis and upkeep concept. This is a systematic and structured record of all risks that might threaten the RAMSHE quality. In practice this comprises the entire spectrum of possible disruptions. A control strategy is then determined for each risk: state-dependent, use-dependent or breakdown-dependent maintenance. Controls are then chosen on the basis of the selected strategy. The controls take the form of inspections, maintenance measures and minimum acceptable upkeep specifications.

ProRail performed risk analyses and drew up upkeep concepts for all systems in the 2004-2005 period. These were used as a way of categorizing the controls and specifications in terms of safety and sustainability risks. Figure 13 below illustrates this by means of process steps 1 to 4.

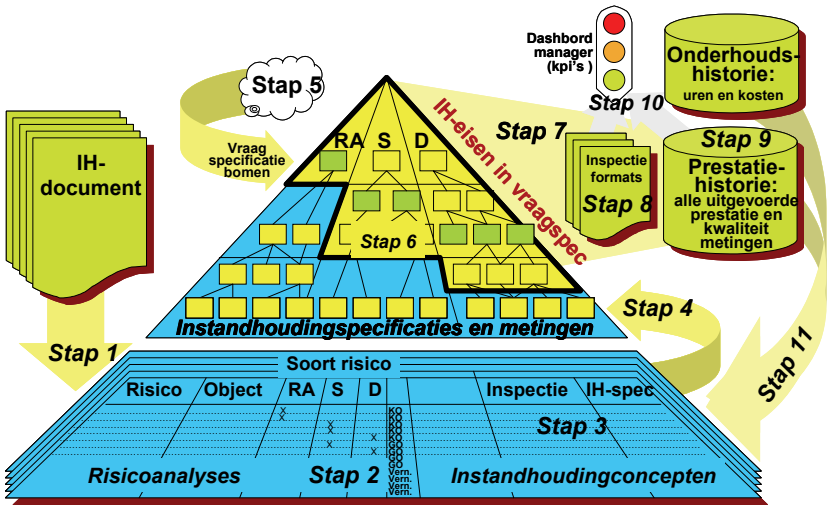

Figure 10 Development methodology for the demand specification

These controls and upkeep specifications were then grouped into separate subspecifications based on a system engineering technique; specification trees were constructed for rail safety and sustainability, see process steps 5 and 6 in the above Figure 10. The generic requirements tree for sustainability is shown as an example in Figure 11 below. Unfortunately, the chosen layout is not easy to read, but it nonetheless gives an impression of a tree of this kind.

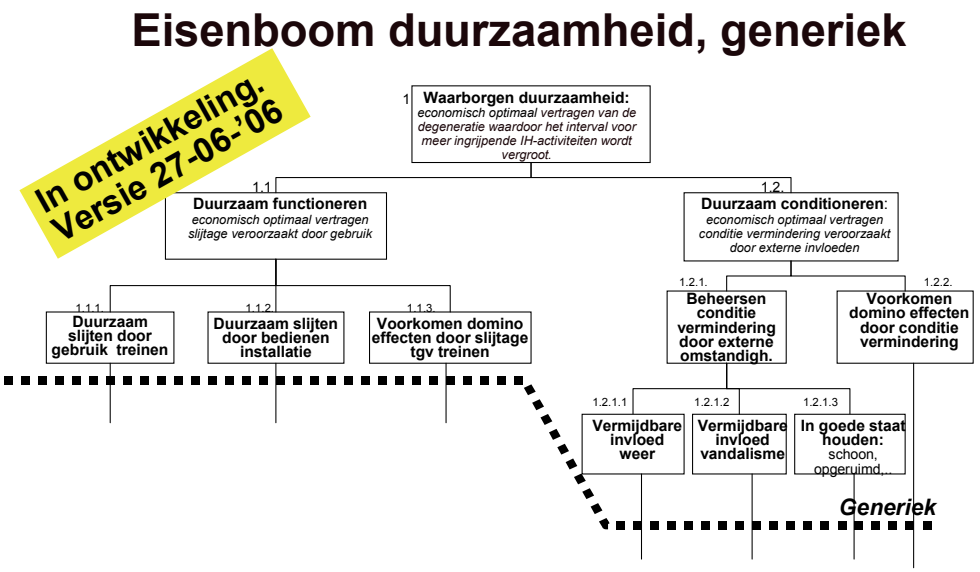

Figure 11 Generic requirements tree for sustainability

Specifications and inspections were organized by subsystem, greatly clarifying the view both overall and in depth. It was then a fairly simple matter to group related specifications together. An essential point was insight into how the specifications could be measured. After all “Only if you can specify *and measure* something can you manage it”. The measurement method is the key to managing. Distilling a large quantity of measurement data into key performance indicators (KPIs) - see steps 7 - 10 in Figure 10 - enables a manager to maintain an overall view and focus on what is happening.

Specialists, such as inspectors and ProRail technical specialists, can always refer to the underlying inspection reports and measurements to find out what is actually happening when a KPI status jumps to orange or red. It is therefore essential for all inspections and quality measurements to be available in digital form in a database; see step 9 in Figure 13. Only then is it possible to distil KPIs from the large quantity of data.

The performance database is necessary not only for the control and management of the performance contract, but also for the evaluation and updating of the risk analyses and upkeep concepts, see step 11 in Figure 10. This maintenance history is required in addition to the performance history. Both databases are indispensable for a professional asset manager, as are their translation into risk-analyses and upkeep concepts. This information is necessary not only to be able to establish the relationship between performance risks (quality) and controls (costs) but also to be able to convey the historical knowledge and experience to engineering consultancies, consultants and other maintenance contractors. This practical knowledge will enable them to contribute sooner and more effectively to the continuous improvement process. This is particularly relevant when a maintenance contract transfers from one contractor to another. The new contractor should not have to start from zero, but should be able to build upon knowledge and experience from the past. This will guarantee the continuity that is essential for both the client and the contractors.

Until recently there was insufficient insight and awareness of this kind. Maintenance contractors therefore still record a vast number of inspections on paper and provide no details of actual maintenance history. Indeed, ProRail never explicitly asked them to do so. It is to be hoped that this situation is set to change. The change is being driven by four motives: guaranteeing continuity in tendering (1), controlling and managing a performance contract (2), the requirements on a professional asset manager (3) and the national government's explicit demands on ProRail[5] for transparency in managing the relationship between costs, performance and objectives (4).

The above shows that the ProRail of today is in a position to draw up a well founded performance specification for a performance contract. However, various instruments and conditions needed to then actually manage a performance contract successfully are missing. Everything looks fine on paper, but there are signs that the sector is not ready. This has mainly to do with a poor match between instruments and processes, and the performance of people. This is not actually surprising considering that the FTRAs[6] of everyone in maintenance have changed fundamentally. This change has disturbed a historical balance, and a new equilibrium has yet to be established. In conclusion, there follows an assessment of the current situation (2006-2007) with an analysis of the weaknesses in the management of maintenance and the underlying causes.

Assessment of the current situation

The management and maintenance of rail infrastructure was the domain of technical people until 1996. The division of NS into a transport and an infrastructure organization meant that economists and business administration experts became involved. The outsourcing of maintenance then added contract managers. Technical knowledge was thus relegated to the background. However, this knowledge was the glue that held the old maintenance organization together, and from which it derived its strength. It has not been replaced by an alternative binding value. The consequence has been fragmentation and suboptimization. Economists, technicians and contract managers may either meddle with or ignore each other's fields, without sufficient understanding of the consequences. This is a potentially dangerous phenomenon, but one which is not unique to the rail infrastructure sector (see Appendix 2). To recap: the management is no longer a good match for maintenance practice because of insufficient knowledge.

Several organizational changes were made in ProRail IM in 2005 with a view to improving the focus of management on execution: the appointment of an Infrastructure Operations Manager, the creation of the Central Contracting Management Team and the introduction of system managers in product management. The much sharper operational and technical focus achieved by these organizational changes has enabled management to be matched to execution and for a bridge to be forged between technicians, contract managers and economists. The changes are also vital, because only with them will it be possible to tackle several demonstrable weaknesses in the current management. The most important weaknesses and the underlying causes are as follows.

[5] See the four conditions set by the national government on ProRail with respect to management by output (Article 20 in the management concession).
[6] FTRA = Functions, Tasks, Responsibilities, Authorities.

1. The contract (read track section) manager operates in isolation, and has insufficient support;
2. The technical regulations are incompatible with the requirements set by a contract manager;
3. ProRail has no satisfactory or complete view of the maintenance activities performed, the performance inspections and object information;
4. Quality assurance (“the supervision”) is insufficiently documented;
5. Insufficient safeguards of stewardship (i.e. diligence);
6. There is no doubt that the people in the operation, whether in ProRail or the process contractors, have a sense of responsibility for the everyday safe condition and reliability of the rail infrastructure. However, outsourcing has introduced the risk that the duty of care will fall between two stools, through powerlessness rather than unwillingness. This situation can occur because of ProRail's lack of a clear overall view of quality and maintenance history, and contractors' natural tendency to control maintenance as a project, thus overlooking how strongly the result depends on the initiative, qualities and commitment of their individual workers. Unless a process contractor's stewardship attitude is strong enough, management by performance will be doomed to failure;
7. Making a new binding value an integral part of the sector;
8. Insufficient documentation and transfer of know-how.

The demerger of NS and the outsourcing of all operational activities has caused many drastic changes in a short time. The outsourcing of small-scale maintenance was the most drastic change as far as infrastructure management was concerned, because of the requirement to manage explicitly by output and performance, the shortage of appropriate management experience and the need to find a new identity, with a new binding value. All these aspects were largely overlooked at the time. As a consequence, eight years on, the management of minor maintenance is inadequately embedded with appropriate instruments in the process chain from ProRail management to process contractor's worker.

The rail infrastructure sector in the Netherlands would appear to be at a watershed. What will happen next depends on whether a new binding value is defined, allowing a spectrum of new fields to complement and strengthen each other. Many of the current weaknesses in control can be traced back to this shortcoming. It will have to be eliminated if there is to be any question of “the successful outsourcing of maintenance” and if we are to have any rightful claim to the title “best infrastructure manager in Europe”.

Utrecht,

December 2006

Jan Swier, strategic consultant, ProRail IM.

Actualisation (Januari 2009)

With the introduction of the matrix organization and the appointment of a manager Operations the situation has improved significantly. Initiative, control and self consciousness are back at ProRail Operations. ProRail Infra Management acts more and more as one integrated process and the quality of the information(systems) is improving every year. The first maintenance performance contracts are successfully tendered. New contractors enter the maintenance market. Risk- & Life cycle management techniques are active used instruments more end more integrated in the whole rail sector. Performance is growing and maintenance costs are going down after many years.