

The Fourth International Conference on Through-life Engineering Services

Performance Centered Maintenance as a core policy in strategic maintenance control

Jack I. Apallius de Vos ^{a*}, Leo A.M. van Dongen ^{a,b}

^a NedTrain, PO Box 2167, 3500 GD Utrecht, The Netherlands

^b University of Twente, Faculty of Engineering Technology, PO Box 217, 7500 AE Enschede, The Netherlands

* Corresponding author. Tel.: +31-6-55847119. E-mail address: jack.apalliusdevos@nedtrain.nl

Abstract

Rolling stock maintenance in the Netherlands traditionally is performed on several levels of complexity and therefore on levels of non-availability and cost. The challenge in optimizing performance and cost of rolling stock maintenance is to integrate the policy on maintenance concepts, maintenance locations and maintenance intervals (what, when & where). NedTrain as a subsidiary of the Netherlands Railways is developing and implementing this improved concept of maintenance.

On one hand maintenance concepts are being improved based on the philosophy of Risk Based Maintenance, with customer demands on risks regarding safety, reliability, availability and cost as a basis for maintenance renewal. On the other hand - during analysis of current maintenance concepts and risk based improvements – modularization of maintenance tasks is taken into account leading to possibilities to perform these tasks on a lower complexity level, during natural non-availability moments of train sets (off-peak hours in daytime or at night) in local depots instead of larger workshops.

With this maintenance policy “Performance Centered Maintenance”, performance improvements and cost reduction are being achieved. New strategies arise for investments in depots, train equipment (e.g. Real Time Monitoring) and training of mechanics.

In this document a general overview and first results will be given of the approach.

© 2015 The Authors. Published by Elsevier B.V. This is an open access article under the CC BY-NC-ND license

(<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

Peer-review under responsibility of the Programme Chair of the Fourth International Conference on Through-life Engineering Services.

Keywords: maintenance, performance, risks, strategies, rolling stock

1. Introduction

NedTrain is the part of NS Group, in the Netherlands responsible for the cleaning, maintenance & service, and overhaul of rolling stock and components. NedTrain works 24/7 on ensuring that all trains are safe and reliable to operate, at the lowest possible cost. NedTrain’s approximately 3,000 employees manage to maintain an approximately equal number of cars. Figure 1 shows how their tasks are divided, and we explain this as follows.

- Daily maintenance takes place at 35 service locations. Thorough cleaning of inside and outside, safety inspections (clearly specified for each type of stock), and minor repairs where necessary.
- Short-term maintenance is carried out at three workshops for domestic traffic, and one workshop for international traffic. All 750 electric multiple units (EMUs) operated by NS are withdrawn for compulsory maintenance and inspection after 50,000 to 90,000 km, or 80 to 135 operating days of running service. This short cycle maintenance includes check-ups to and replacement of brake linings, wheel axles, pneumatic components, filters, oil inspections, and exchange of parts that reached replacement age. All workshops allow for easy access to the roof and under-floor equipment. It is of course important that all cars are returned to operation as soon as possible.

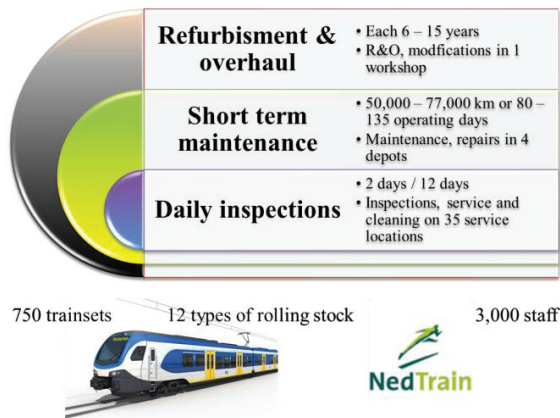


Fig. 1 NS/NedTrain maintenance logistics

- Refurbishment and modernization. Rolling stock requires long term maintenance when the train has reached half of the operational life. This includes maintenance work on the electrical, mechanical and hydraulic technology. Additionally, work on the train body is performed, both on the inside and on the outside of the train. Depending on the relevant functional and/or statutory requirements, maintenance work may involve anything from making small adjustments to full modernization. Work may include the retrofitting of air conditioning (HVAC), toilet systems with bioreactors, passenger information systems and new signaling systems.

Rolling stock maintenance traditionally is treated as static, based on fixed terms (time, mileage), supplier maintenance guides, fixed depots with given equipment, workmanship and hierarchy of maintenance complexity. All this in an environment of oligarchy with low challenges on improvements.

This maintenance structure is drastically changing in the Netherlands over the last 10 – 20 years, affecting NedTrain in a positive way in terms of organizational structure, mentality, focus on improvement of rolling stock performance and cost.

As a spin-off NedTrain started implementing new philosophies on maintenance: Performance Centered Maintenance (PCM), based on known principles of Risk Based Maintenance (RBM), a concept well known in other industries, but rather new for rolling stock: in addition also taking into account maintenance location strategies.

The next chapter 2 will describe the PCM-approach in general. In chapter 3 an elaboration of the approach is given in 2 examples. This document is ended with some first conclusions on this approach.

2. Performance Centered Maintenance in 4 steps

PCM, based on RBM, is a way of looking at maintenance in such a way that optimal maintenance is executed given customer (rolling stock operators) demands on performance

and cost. Since customer demands are not static but dynamic given the time of the year, economic climate etc., maintenance will also be dynamic.

In this chapter we will present a 4 step approach to deal with this dynamic maintenance concept.

2.1. Step 1: agree on risks

Risks on safety are obvious, but there are also risks on reliability loss, availability, image, quality and cost. In fact, the responsibility for these risks aspects is not NedTrain's, but primarily the Transport Operator's. The first question to be asked is: "what risks is the operator prepared to accept"?. Knowing these risk limits NedTrain is able to set up and modify the necessary maintenance policy. This first step might be obvious, but is hard to take in practice.

- In general, rolling stock performance, and thus maintenance, is contracted on a high level, in terms of 'number of safety issues', 'number of unavailable train sets', 'number of unplanned depot entries'. These KPI's are mostly interrelated, but are all these relations known? And what does this mean in terms of a risk matrix or other methods such as Fine and Kinney (F&K) [1]? Is safety equally important as availability or reliability?
- How strong is the gut-feeling on safety, related to image? When transforming the number of safety issues into number of fatalities, as is used in the F&K-method, it will lead to a given acceptance level. When - unfortunately - an incident occurs, public opinion and politicians will try to increase this safety level without accepting a higher cost level for maintenance.

In practice we work with an officially excepted safety risk matrix between the operator and NedTrain, combined with the agreed performance criteria and cost, whilst improving the risk matrix on management level. Important point is that there is a mutual understanding of the starting point of maintenance.

2.2. Step 2: to train Maintenance Engineers

In our opinion one of the reasons many RBM approaches fail, is because of a 'jumping to expensive software tools', without knowing exactly what to do with it. For this reason we started with developing our own tools in Excel, and training our maintenance engineers (in the specific NedTrain case we consider at least two roles in maintenance: the maintenance engineer, responsible for the cost efficient and effective 'maintenance manual' of a train type, and the reliability engineer, responsible for the analysis and improvement of the performance of a certain train type). Although time consuming, it gave us the correct insights in the details of FMECA (Failure Modes, Effects, Criticality Analysis), of maintenance interval optimization and rolling stock performance improvement, paying off in quick wins on performance.

Download English Version:

<https://daneshyari.com/en/article/1699199>

Download Persian Version:

<https://daneshyari.com/article/1699199>

[Daneshyari.com](https://daneshyari.com)