



DUTCH
SAFETY BOARD

Summary

Train derailment Hilversum



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15 January 2014

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Source photo cover: Jan Barnier - Model Centre Hilversum.

Dutch Safety Board

The aim in the Netherlands is to limit the risk of accidents and incidents as much as possible. If accidents or near accidents nevertheless occur, a thorough investigation into the causes, irrespective of who are to blame, may help to prevent similar problems from occurring in the future. It is important to ensure that the investigation is carried out independently from the parties involved. This is why the Dutch Safety Board itself selects the issues it wishes to investigate, mindful of citizens' position of independence with respect to authorities and businesses. In some cases the Dutch Safety Board is required by law to conduct an investigation.

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NB: This report is published in the Dutch and English languages. If there is a difference in interpretation between the Dutch and English versions, the Dutch text will prevail.

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On 15 January 2014, an intercity train derailed shortly following its departure from Hilversum station. The train passed a set of points (switch) that during the passage of the train shifted to a different position, leading to the derailment. Derailments of this kind are among the most serious conceivable safety breakdowns in rail transport, since they can result in a major accident. The derailment was caused by a defect in the switch. Both the quality of the switch part that experienced the defect and the general maintenance of the switch contributed to the occurrence of the derailment. In this consideration, the Safety Board above all addresses the maintenance of the railway infrastructure and the manner in which the parties involved have fulfilled their maintenance tasks.

The Dutch railway infrastructure is managed by ProRail. ProRail outsources the maintenance of that infrastructure to contractors. With regard to this process several developments have taken place over the past few years. Due to the increased pressure from a society that is demanding improved railway performance, more strongly than in the past, maintenance focuses on preventing disruptions. This is also reflected in the new management concession from the Minister of Infrastructure and the Environment to be awarded to ProRail (2015 - 2025) and the long-term railway policy in which the government aims above all at reducing disruptions to train services and increasing passenger satisfaction. In the past, maintaining the sound technical condition of the infrastructure was an independent objective in itself, but over the past few years the objective has shifted increasingly towards ensuring optimum availability of the railway infrastructure. A further development is that in the tendering process for maintenance, ProRail has stimulated more market competition, in order to make maintenance more efficient and more innovative. This tendering process itself has led to a shift in the distribution of tasks between ProRail and the maintenance contractors. ProRail now expects the contractors to use their own expertise in determining what maintenance is necessary. As a consequence, ProRail is increasingly opting to provide outline guidance for railway infrastructure maintenance and to deploy financial stimuli in order to achieve a specified railway infrastructure condition.

The developments outlined above aim to improve the quality of rail transport and to reduce the cost of train travel. These two objectives are defensible and well worth pursuing, as long as they do not take place at the expense of safety. However, considering the train derailment in Hilversum and the contribution of the railway infrastructure maintenance policy to that derailment, the Safety Board views a source of concern. There is a risk that railway infrastructure maintenance is becoming too unilaterally focused on preventing train service disruptions, while ignoring issues that are not so relevant to availability of track, but are to safety. The parties may gradually sail closer to the wind, thereby unintentionally and unnoticed, compromising too much on safety. Only when things go wrong – as in the Hilversum derailment – it becomes clear that a threshold has been passed.

The investigation into the train derailment revealed that a switch suffered serious wear, without this leading to disruptions. Because the switch did not indicate the presence of a problem, the maintenance contractor took insufficient notice of the wear during maintenance work. Such action was not required by the maintenance regulations. ProRail had limited insight into the execution and result of the maintenance work, as a consequence of which the technical deterioration of the switch also remained unnoticed by ProRail, until the moment at which the derailment took place.

Maintenance contractors have the tendency to give priority to those issues on which they can be directly called to account. In the absence of clear safety standards, and with lacking supervision by ProRail, there is no stimulus to pay sufficient attention to specific switch parts. The opposite is the case for issues that are relevant to keeping the railway infrastructure disruption-free. The requirements for the functionality of the railway infrastructure (disruptions, repair times) imposed by ProRail on the contractor are concrete as well as accountable. Any violations are guaranteed to result in a penalty. To prevent attention for safety becoming overlooked as a consequence, it is vital to employ clear safety standards and to monitor the compliance with those standards. This is a condition that applies irrespective of the form of the maintenance contract, whether it relates to the maintenance work to be carried out or to the result of that work. In the judgement of the Safety Board, current maintenance execution practice does not yet fulfil this condition. Two investigation reports recently published by the Human Environment and Transport Inspectorate, concerning railway infrastructure maintenance, underline the concerns of the Safety Board. The Board is of the opinion that ProRail needs to more firmly embed the safe condition of the railway infrastructure in its regulations for contractors. To be able to take corrective measures in good time, ProRail needs to know the condition of the railway infrastructure. This is inherent in the contract-awarding role and responsibility of the railway infrastructure manager, imposed by law. Nonetheless, the maintenance contractors need to correctly fulfil their task, within the freedom granted them.

In this connection, the State Secretary for Infrastructure and the Environment also has a task. In consultation with the railway infrastructure manager and the transport operators, the State Secretary is in the position to ensure that the objectives of availability, punctuality and safety remain in balance. From that point of view, the Safety Board believes that the State Secretary must emphatically consider the safe usability of the railway infrastructure, in the reassessment of the policy framework for railway safety currently taking place. Furthermore, the State Secretary must solidly embed this aspect in the management agreements with ProRail.

Furthermore, the Safety Board notes that also in other public services, the operational work in respect of management and maintenance is contracted out to market parties, on the basis of performance-based contracts. The train derailment in Hilversum teaches us that the related interests can gradually and unnoticed apply pressure on the management of safety risks. In that sense, the safety lessons drawn from this accident can also be relevant to other sectors.

On 15 January 2014, a passenger train derailed at a switch just outside Hilversum station. After the first section of the train had travelled in a straight direction over the switch, the rear section of the train was suddenly directed onto the adjacent track, as a result of which the train derailed. A train travelling in the opposite direction on the adjacent track was successfully brought to a standstill approximately two hundred metres before reaching the derailment site, thereby avoiding a collision. As a consequence of the derailment, a number of passengers suffered minor injuries, while serious material damage was caused to the track infrastructure and the train. The Dutch Safety Board investigated this accident, partly on the basis of its potential seriousness.

When the train travelled over the switch, a part of the switch mechanism (point machine) broke. A technical investigation revealed that the part failed due to fatigue. The fatigue fracture arose because the part in question was in practice exposed to forces that were higher and more dynamic than those taken into account in the design. In addition, this part revealed finishing defects. These additional forces were caused by the fact that during train passages, the insides of the train wheels scraped against the switchblades.¹ This 'hitting' action caused the switch blade to oscillate, whereby additional forces were applied to the part, for which it was not designed. These additional forces eventually led to a fatigue fracture.

The hitting of the switch blade (known as flange-back contact) was caused by the poor maintenance condition of the switch. Various parts of the switch were so worn that they could no longer fulfil their function, namely supporting and guiding the switch blade. As a consequence, when shifting back and forth, the switch blade experienced such a degree of resistance that it remained too close to the rail. This in turn meant that the wheels of passing trains regularly scraped along the switch blade, while this was not supposed to happen. It became clear from the investigation that these flange-back contacts were not caused by the train traffic but by the state of maintenance of the infrastructure.

The wear to the switch did not occur overnight. Maintenance should have led to repair. This was not the case. The investigation revealed that ProRail did not see any safety risk in flange-back contacts and as a consequence did not consider it necessary to prevent such contacts. A further contributing factor was that over the past few years, no incidents or accidents in the Netherlands have occurred as a result of flange-back contacts. ProRail outsources the maintenance of the railway infrastructure to contractors. Maintenance is governed by contract regulations and provisions. The maintenance regulations imposed on contractors by ProRail were insufficient to prevent flange-back contacts.

¹ The movable parts of a switch (set of points) that direct the train from one track to another are known as switch blades. A switch has two switch blades (a left-hand and a right-hand blade), which both shift to the left or right, as the points are switched. These blades are shifted by the point machine.

The regulations demonstrated gaps which were not compensated for by suitable maintenance by the contractor. It is relevant in this connection to note that increasingly, maintenance is becoming focused on the objective of preventing train service disruptions. The wear to the switch parts did not result in any disruptions. The absence of such disruption problems meant that the contractor responsible for carrying out the maintenance was not alert to the deterioration of these parts, and failed to pay sufficient attention to this situation in its maintenance activities. This situation was exacerbated by the fact that six months prior to the train derailment, a change in maintenance contractor had taken place, whereby the maintenance condition of the switch in question was not explicitly discussed. The Dutch Safety Board observed that the supervision by ProRail had no corrective effect. ProRail above all supervised the execution of maintenance work 'on paper', and itself had no knowledge of the actual condition of the switch. As a consequence, a heavily-used switch had become unsafe, without this situation being observed and dealt with.

The scenario that emerged in Hilversum was not foreseen in advance by any of the parties involved. The manufacturer of the point machine (Bombardier) and ProRail followed different principles, in respect of the load on the point machine. In its design process, Bombardier assumed that the point machine would only be exposed to normal operating forces, while ProRail did not prevent the occurrence of additional forces. The investigation revealed that the discrepancies in operating principles were not identified in time, as a result of insufficient information exchange on these issues between Bombardier and ProRail.

A number of technical problems with point machines of this type occurred several years previously. These could have revealed the failure mechanism if the parties had operated a broader perspective on learning. In tackling the previous problems, Bombardier and ProRail restricted themselves to eliminating the direct causes. As a consequence, the risk of fatigue due to flange-back contact was not adequately dealt with, despite indications that such a risk could occur. Furthermore, insufficient lessons were learned from several previous train accidents. A scenario comparable to that in Hilversum occurred in a train derailment in 2007, in Grayrigg (England). If the knowledge of this serious accident had been utilised, it would have been known that the hitting of switch blades (flange-back contacts) even over a short period of time can massively reduce the lifetime of switch parts and as such represents a safety risk that needs to be managed.

The safe usability of a switch is the result of cooperation between several parties; in this case, Bombardier, ProRail and the maintenance contractors. The degree to which these parties succeed in correctly harmonising the various processes in the chain is decisive for the safety of the overall system. The derailment in Hilversum revealed that on these aspects, there is room for improvement in current practice.

Recommendations

On the basis of its investigations, the Dutch Safety Board has issued the following recommendations:

To ProRail

1. Organise railway maintenance in such a way that the safety risks are explicitly and demonstrably managed, irrespective of other interests (such as availability and costs). Develop stimuli for maintenance contracts that offer contractors maximum encouragement in actively promoting railway safety. Monitor to ensure that contractors actually carry out the necessary maintenance and that this maintenance has the desired result.
2. Ensure that relevant design, user and maintenance information on all railway infrastructure parts is available to the various chain partners. Also encourage active knowledge sharing on (near) accidents and innovative developments (both nationally and internationally).
3. Tighten up regulations governing the (design, laying and inspection/maintenance of) switches in such a way that flange-back contacts are effectively countered. Incorporate the tightened regulations as mandatory in the (current and future) contractual agreements with the companies involved

To ProRail and the maintenance contractors

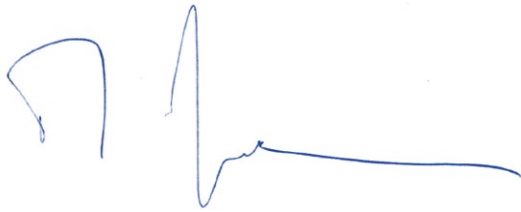
4. Together, ensure an up-to-date and complete picture of the technical condition of the railway infrastructure. Use this information for adequate management (asset management) whereby – besides monitoring the functionality and service life – safety is demonstrably guaranteed.
5. Make sure when transferring a maintenance contract, that all relevant information about the technical condition and maintenance history of the railway infrastructure in question is transferred fully and in an accessible manner to the future contractor.

To Bombardier

6. When supplying railway parts (such as the EBI switch point machine), provide users with clear, safety-related user specifications. Monitor to ensure that these requirements are met in practice, and warn users if this is not the case.

To the State Secretary for Infrastructure and the Environment

7. Make sure that the safe usability of the railway infrastructure is granted sufficient weight in relation to other interests (such as capacity and punctuality). Integrate this vision in the current rethink of the policy framework for railway safety, and bring about a situation whereby ProRail and the maintenance contractors are able to successfully act in accordance with it.

A handwritten signature in blue ink, consisting of a large, stylized 'J' followed by a series of connected loops and a long horizontal tail.

T.H.J. Joustra
Chairman of the Dutch Safety Board

A handwritten signature in blue ink, featuring a series of vertical, wavy lines followed by two long, parallel diagonal strokes.

M. Visser
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