



## **Potters Bar derailment: report and recommendations**

Rail Safety and Standards Board (RSSB) has issued the formal inquiry report into the circumstances that led to the derailment of a train at Potters Bar on 10 May 2002.

The formal inquiry was convened with an independent panel. As with all such inquiries the panel's task was to establish the immediate and underlying causes of the accident and make recommendations to prevent or reduce the risk of recurrence.

The length of time taken to publish this report reflects the need to gain access to the technical evidence, which consisted of a large volume of complex material, to ensure an accurate understanding of that evidence, and to obtain agreement for its use.

### **Sequence of events**

As the 1245 hrs Kings Cross to Kings Lynn, approached Potters Bar station under clear signals at a speed of about 100mph, the rear bogie of the third vehicle and the front bogie of the fourth vehicle of the four car train derailed at a set of points. Both bogies continued to run in a straight line derailed to the left. The rear bogie of the fourth vehicle took the left hand route towards the Down Slow line, and derailed as the routes diverged. The rear vehicle became detached from the rest of the train when it struck the underbridge at the south end of Potters Bar station, and eventually came to rest across both station platforms under the platform canopies. The leading three vehicles of the train came to a halt north of Potters Bar station.

Six passengers on the train died and others sustained major injuries. A pedestrian also died as a result of debris falling from the underbridge on to the road below.

### **Conclusions**

The derailment was caused by parts of the points moving as the train was passing over them. As the third vehicle of the train was passing over the points, the right hand switch rail closed against its stock rail. This occurred with the left hand switch rail closed and locked against its stock rail. As a result, a number of wheelsets met both switch rails simultaneously, and were then squeezed into derailment.

The right hand switch rail moved because the lock stretcher bar had fractured at its right hand end, at a time when the switch rail was not restrained as it should have been by the front and rear adjustable stretcher bars. This allowed the natural elasticity of the switch rail to cause it to straighten.

The lock stretcher bar fractured because it had been subjected to stresses greater than those for which it had been designed, causing fatigue cracks to develop. These stresses occurred because:

- The lock stretcher bar was the only available load path through which the point machine could move the right hand switch rail from reverse to normal, because the outer nuts at the left hand end of the front stretcher bar and those at the right hand end of the rear stretcher bar were not present.
- The lock stretcher bar was splayed in a way that caused unnecessary tensile and bending stresses in itself.
- The point machine was probably overdriving to reverse, and causing unnecessary stresses in the lock stretcher bar.

### **Underlying causes**

The panel was not able to establish with certainty how the front and rear adjustable stretcher bars came to be in the condition in which they were found following the derailment.

However, the method in common use before the accident by maintenance and renewal staff for positioning and securing the nuts on adjustable stretcher bars has been shown to contribute to their loosening and could have been a factor in this case. This method had emerged because, from the first introduction of these assemblies by BR in the 1980's, the mechanics of the system used to secure the nuts were not fully understood by those responsible for installing and maintaining the assemblies, and the importance of adopting an effective tightening procedure that would fulfil the requirements of the design of adjustable stretcher bars appears not to have been appreciated.

No procedure had been written for the installation of adjustable stretcher bar assemblies, and consequently no relevant training programme had been developed.

### **Recommendations and actions**

At an early stage of the Inquiry, the panel established that the staff whom it had interviewed had not received specific training in relation to adjustable stretcher bar assemblies. In particular the panel was concerned about the method used to ensure the positioning and locking of the stretcher bar nuts, which it considered unlikely to be a matter confined to any individual maintenance contractor. In the panel's opinion, Railtrack, then the infrastructure controller, needed to take action to ensure that clear instructions were formulated and made available to all contractors. The panel therefore made an immediate recommendation in June 2002 that Railtrack should formulate a detailed specification as to how adjustable stretcher bars should be installed and fitted, including the method to be used for positioning and securing the nuts, and should promulgate the specification to all its contractors. In response, Railtrack developed a Good Practice Guide for the

set-up and maintenance of adjustable stretcher bars, and the panel was able to comment during its development.

Although it was unable to establish with certainty how the points came to be in the condition in which they were found following the derailment, the panel has made a number of recommendations for improvements in these and other key areas, including the following:

- Review the guidance contained in the Good Practice Guide for installation and maintenance of stretcher bars in the light of in-service experience and research already carried out.
- Develop a training programme, based on the guidance in the Good Practice Guide, for the installation and maintenance of adjustable stretcher bars, and train all signal installation and maintenance staff in accordance with that programme to ensure their competence.
- Develop and implement a system of additional managerial controls to manage the risks associated with adjustable stretcher bar assemblies.
- Review the systems for defect reporting, recording and analysis.
- Review the design of the crank pivot.
- Review the system for quality control of elastomer bushes.
- Review the standards and technical documents related to the inspection and maintenance of points to ensure consistency and remove ambiguity.
- Review the arrangements for checking of flangeway gaps.
- Review the frequency of maintenance examinations.
- Ensure clarity of responsibilities for staff involved with points maintenance.
- Review the process for planning and recording of basic visual inspections.
- Review the requirements for recording reports of rough riding.
- Review bridge design.
- Review the arrangements for securing balance weights on overhead line equipment.
- Review the vehicle body/bogie connector strength requirements.
- Review the competence arrangements for Rail Incident Officers.

Throughout the period of the inquiry, the panel maintained a dialogue with the relevant industry organisations in respect of emerging issues, thus providing an opportunity for a number of these issues to be addressed before publication of this report.

RSSB has issued a full copy of the report to each member of the Railway Group and the other organisations involved in the accident. All recipients of the report need to review the findings and recommendations and take actions where appropriate to address identified deficiencies within their own systems. RSSB will track the industry's response to this report.

### **Additional explanation**

Further to the summary issued, RSSB believes it would be helpful to offer additional explanation on the condition of the stretcher bars. The following extracts from the full report are intended to give further information relating to the inquiry panel's consideration of the stretcher bar nuts.

### **The events preceding the closure of the switch rail**

The panel considers that the following preceded the closure of the right hand switch rail:

- *The front stretcher bar left hand outer nut(s) (probably only one) came loose and migrated off the bar. This not only made the front stretcher bar incapable of resisting any tendency for the switch rails to move apart, but resulted in the lock stretcher bar having to carry forces greater than intended by its designer.*
- *The rear stretcher bar right hand outer nut(s) (probably only one) came loose and migrated off the bar. This made the bar incapable of resisting any tendency for the switch rail to move apart.*

### **The panel's conclusions as to how the front stretcher bar came to be in its as-found state**

*From the evidence available, the panel has been unable to reach a clear conclusion as to how the front stretcher bar came to be in its as-found state. There are a number of aspects of the as-found state of the assembly for which, if they were the result of in-service deterioration, the panel either has no explanation, or one appears very unlikely. However, in considering whether human intervention could have left the bar in its as-found state, there are a number of issues that the panel has been unable to resolve, such as why an intervention might have taken place, when and by whom. The possibility of a malicious act cannot be ruled out, although the panel considers this to be highly unlikely.*

### **The panel's conclusions as to the state of the rear stretcher bar assembly after the technicians' intervention on 1 May 2002**

*The panel is not able to reach a definitive conclusion as to the state of the rear stretcher bar assembly immediately after the technicians' intervention on 1 May 2002.*

*The panel cannot rule out a further intervention between 1 and 10 May 2002, although if such an event had taken place, it is unclear as to how this could have led to the appearance of the deposits in the threads and on the nuts, unless they were deliberately introduced. As in the case of the front stretcher bar, the panel cannot rule out the possibility of a malicious intervention, during which the threads and nuts were deliberately contaminated, but considers this to be extremely unlikely.*

Given the above factors it is recognised that other underlying issues may exist.