Report 00-104

express freight Train 326

derailment

Pukekohe

6 April 2000

Abstract

At approximately 0942 hours on Thursday, 6 April 2000, Train 326, a northbound express freight, was travelling on the up main through Pukekohe when dragging brake gear on a wagon near the centre of the train hit the spreader bar of the south-end turnout from the up main line to the loop. The impact caused the facing points to open and derail 13 of the following wagons.

Safety deficiencies identified were the limitations of the clevis pin retaining the wagon brake rod, and the worn condition of the brake rod safety chains.

Tranz Rail Limited took immediate steps to address the safety deficiencies identified and no safety recommendations were required.

The Transport Accident Investigation Commission is an independent Crown entity established to determine the circumstances and causes of accidents and incidents with a view to avoiding similar occurrences in the future. Accordingly it is inappropriate that reports should be used to assign fault or blame or determine liability, since neither the investigation nor the reporting process has been undertaken for that purpose.

The Commission may make recommendations to improve transport safety. The cost of implementing any recommendation must always be balanced against its benefits. Such analysis is a matter for the regulator and the industry.

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List of Abbreviations

DED	dragging equipment detector
km	kilometre(s)
km/h	kilometre(s) per hour
LE	locomotive engineer
m	metre(s)
NIMT	North Island Main Trunk
t	tonne(s)
Tranz Rail	Tranz Rail Limited

Data Summary

Train type and number:	express freight Train 326
Date and time:	6 April 2000, 0942 hours
Location:	Pukekohe, 628.412 km North Island Main Trunk (NIMT)
Type of occurrence:	derailment
Persons on board:	crew: 1
Injuries:	nil
Nature of damage:	extensive damage to track and the 13 derailed wagons and their loads
Investigator-in-charge:	R E Howe

1. Factual Information

1.1 Narrative

1.1.1 On Thursday, 6 April 2000, express freight Train 326 was travelling between Te Rapa and Auckland. The train consist was locomotives DX 5039 and DFT 7307 and 47 bogie wagons, with a gross weight of 1800 t and a length of 792 m.

1.1.2 At about 0942 hours as the train was passing through Pukekohe at 628.412 km NIMT the leading end of dragging brake rigging on the trailing bogie of wagon UK 14035 (the 19th wagon in the consist) impacted on the spreader bar of the up main line to loop turnout at the south end of Pukekohe.

1.1.3 The impact broke the spreader bar connecting the switch rails, causing the left-hand switch rail to be pulled away from the stock rail. Figure 1 shows the broken spreader bar connection.

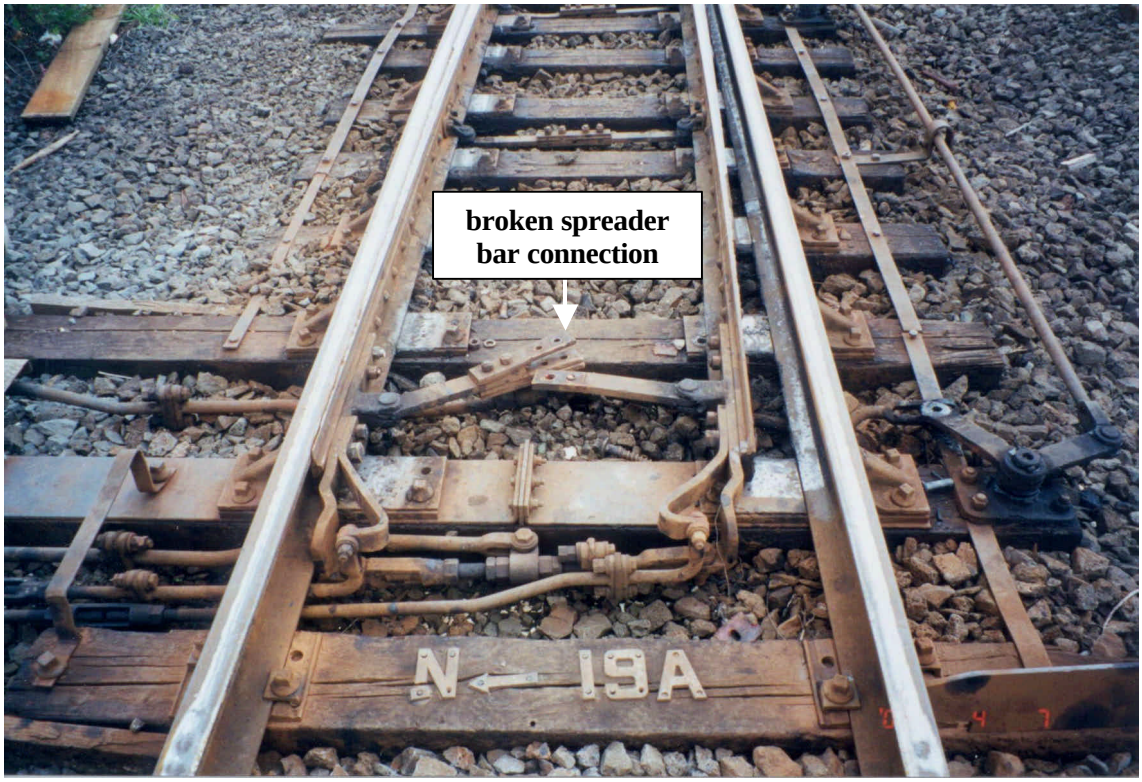

Figure 1
Looking north at the up main to loop points following the derailment

1.1.4 The gap between the stock rail and the dislodged switch blade allowed the wheels of following wagons to take 2 roads simultaneously, resulting in 13 wagons derailing.

1.1.5 The locomotive engineer (LE) stated his train speed was 55-60 km/h approaching Pukekohe. The maximum line speed was 80 km/h. He said his locomotive was about opposite Pukekohe station building when he lost the air in the brake pipe and the train jerked as the brakes were automatically applied. He assumed that a hose had burst, so he throttled back and attempted to keep his train stretched. After stopping and checking his train he found the train parted and derailed. Twenty-one wagons remained on the front portion of the train, with the last 2 wagons immediately behind UK 14035 derailed. There was a gap of approximately 150 m to the rear portion of the train. The leading 11 wagons of the rear portion were derailed, with 9 at various angles to the up main line, and foul of the down main. The rear portion of the train had stopped before the last 15 wagons reached the point of derailment.

1.2 Track damage

1.2.1 An inspection of the track showed progressive marks made by dragging gear from 626.72 km, some 1.7 km before the point of derailment. Heavy intermittent marks consistent with a bouncing brake rod[1] end were evident just before the point of derailment.

1.2.2 Approximately 90 m of the up main and the loop, including the loop to up main turnout and crossover, were badly damaged in the derailment.

1.3 Wagon UK 14035

1.3.1 Wagon UK 14035 was the last wagon remaining on the track on the front portion of the train. Inspection showed the trailing bogie brake rod was fractured. The leading end of the fractured brake rod was found imbedded below the first sleeper past the broken spreader bar on the south end turnout. The trailing end was still attached to the wagon.

1.3.2 The general arrangement of the brake gear on UK 14035 is shown in Figure 2.

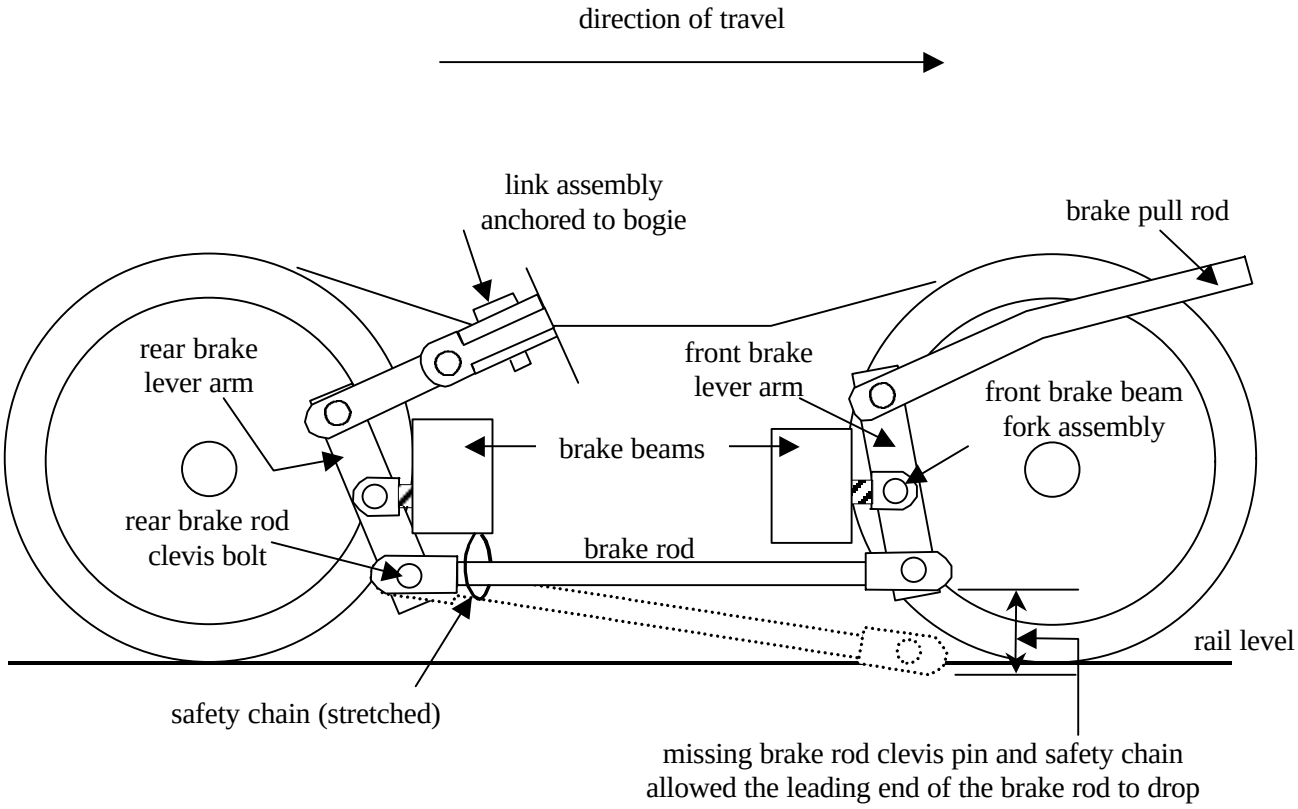

Figure 2
Diagrammatic section of the trailing bogie showing the brake gear

1.3.3 On UK 14035 the brake rod ends had been fixed by a clevis[2] pin and retaining split pin, with a safety chain at each end to retain a dragging rod. The more recent design used a bolt and welded nut connection instead of a clevis pin and split pin, in some cases with safety wires instead of safety chains. Figure 3 shows a typical installation of this type.

[1] The forked end of the brake rod left distinctive damage marks in the timber sleepers.
[2] A clevis is a connection in which a pin or bolt joins 2 parts together, one of which fits between the forked end of the other. The clevis pin was also referred to by Tranz Rail as a push rod pin or an adjust rod pin.

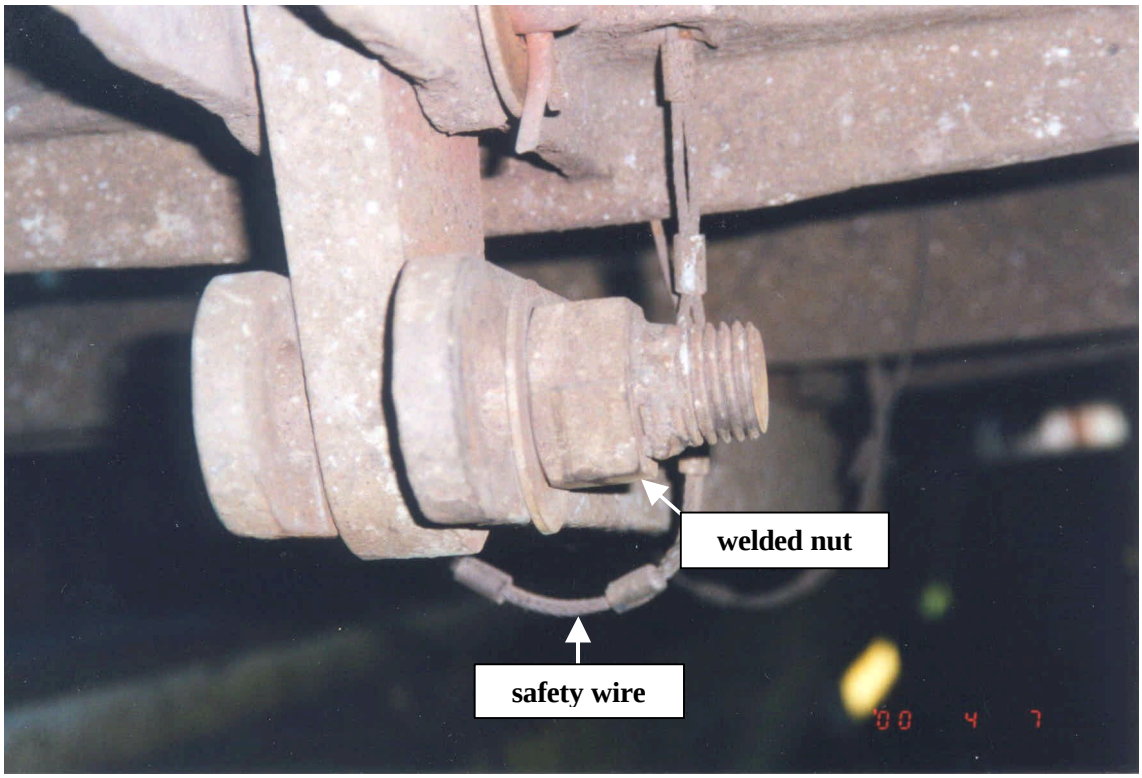

Figure 3
A typical modified support with bolt and welded nut, and safety wires

1.3.4 The trailing end safety chain on the trailing bogie on UK 14035 was still in place, but was stretched and cracked in places.

1.3.5 There was no sign of the clevis pin or split pin where the leading end of the brake rod had imbedded in the sleeper, nor were these found during inspection of the track before the point of derailment. No leading-end safety chain was found.

1.3.6 The 2 bolts fixing the leading-end safety chain to the wagon frame were in position. In each case the chain connection was worn and had failed. One connection failure looked aged, but the other connection failure looked recent, showing a shiny metal surface. Figure 4 shows typical wear in a safety chain and connecting bolts. This particular chain was supporting the leading bogie brake rod and was not affected by the derailment. The bottom of this safety chain was hanging 12 mm above rail level.

1.3.7 The brake blocks on UK 14035 were partially worn, but well within replacement limits.

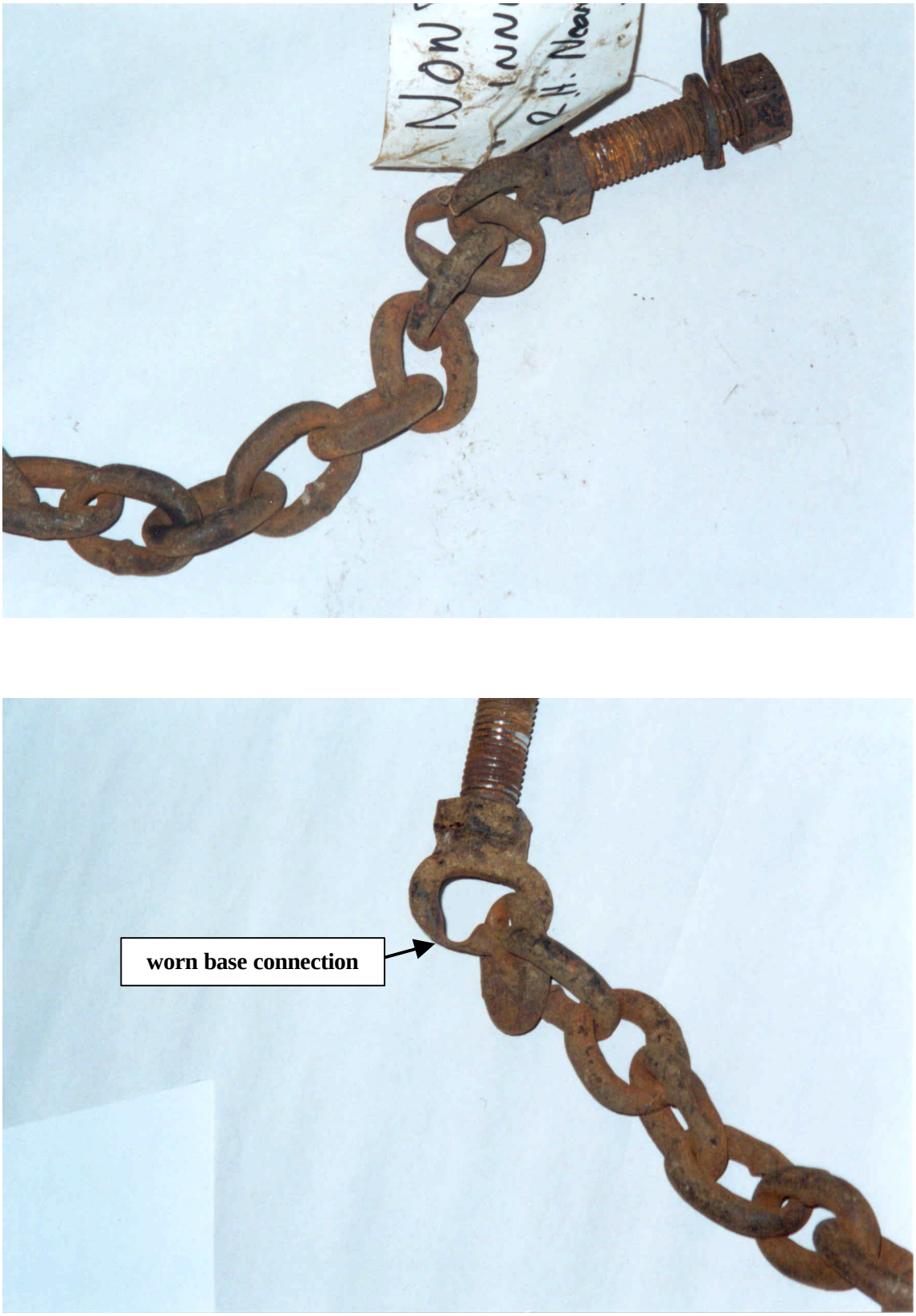

Figure 4
Worn connections from a safety chain under the leading bogie brake rod

1.4 Wagon inspection

1.4.1 At the time of the incident the Tranz Rail wagon inspection regime included 2 wagon inspection procedures covering brake rigging condition. The first was a B check, which covered safety items and was performed whenever 2 or more brake blocks were replaced, generally every 3 months, or after an incident. This replaced a previous 3 monthly check. The second was a C check, which was performed before a wagon left a depot after repairs, with an upper limit of 27 months between checks.

1.4.2 The inspection requirements for brake rigging during a B check were:

Brake rigging:	All components in place, secure and intact. Brake spreaders must be intact. Safety straps correctly fastened. No excessive wear.

1.4.3 B checks had been carried out on the following dates:

24 June 1999
17 August 1999
1 September 1999
3 November 1999

1.4.4 Tranz Rail records showed the wagon had travelled approximately 35000 km at an average gross weight of 30 t between 3 November 1999 and 6 April 2000.

1.4.5 The inspection requirements for brake rigging during C checks were:

Brake rigging:	All components in place, secure and intact. Brake spreaders must be intact. No excessive wear.

1.4.6 The last C check had been in December 1998.

1.4.7 None of the inspections of UK 14035 had resulted in any recorded work associated with the clevis pins or safety chains on the brake rigging.

1.5 Previous dragging brake gear incidents

1.5.1 The Commission has investigated a previous incident involving dragging brake gear that occurred at Hapuku, near Kaikoura on 17 November 1998 (rail occurrence report 98-120). The Hapuku incident had strong similarities to this incident. The safety strap (wire) in the Hapuku incident did not effectively retain a dragging brake rod.

1.5.2 As a result of the Hapaku incident the Commission recommended to the managing director of Tranz Rail that he:

> Issue standards and procedures to ensure that safety straps effectively restrain loose brake rodding gear clear of all obstructions within the permitted tolerances associated with rolling stock/track interaction (003/99),

and in March 1999 Tranz Rail advised that the recommendation had been adopted and was in the process of implementation.

1.5.3 Report 98-120 noted that in March 1998 Tranz Rail had initiated a programme to replace all clevis pins on standard bogie wagons with welded bolts and nuts. This programme should have resulted in all wagons being modified by approximately June 2000, based on work being carried out during a C check.

1.5.4 Report 98-120 also described how safety straps had been introduced to replace safety chains in 1996, due to the latter being more prone to wear. Despite the replacement programme since 1996, safety chains were still in service in April 2000.

1.6 Locomotive event recorders

1.6.1 The event recorders from both locomotives were extracted and the logs obtained for analysis.

1.7 Dragging equipment detection

1.7.1 Since 1993 Tranz Rail has been progressively installing a number of dragging equipment detectors (DEDs) on key lines. The DEDs were either installed stand-alone, or in conjunction with rail temperature sensors. They comprised a set of frangible arms approximately 25 mm below rail level and extending between the rails and approximately 1 m outside each rail. When an obstruction such as dragging brake gear (between rails) or dragging bond chains (outside rails) hit the frangible arm it broke a circuit and alerted train control. As of August 2000 there were 28 such installations on Tranz Rail and a further 31 were proposed.

1.7.2 The nearest DED on the route of Train 326 before Pukekohe was at Motumaoho on the East Coast Main Trunk some 107 km before the point of derailment. No dragging equipment was detected on Train 326 on 6 April 2000.

1.7.3 Two of the proposed locations for DEDs were at Whangamarino (599.51 km NIMT and 29 km before Pukekohe) and Huntly (569.27 km NIMT).

2. Analysis

2.1 Analysis of the event recorders confirmed the LE's estimate of speed. Train speed reduced from 65 km/h to 60 km/h just prior to the loss of air.

2.2 The initial dragging brake rod resulted from the loss of the brake rod clevis pin. This was a known weakness, as evidenced by the bolt and welded nut replacement programme in hand since 1998.

2.3 The safety chains were intended to restrain the brake rod following such failures, until the failure was detected and repaired. It is unlikely that the leading safety chain was present when the brake rod dropped, and even if it had been, immediate chain failure was likely based on the worn condition of the other 3 safety chains on the wagon, and the worn condition of the bolt chain connections for the missing chain.

2.4 The wear of the safety chains had developed over years and would have been present at B check inspections for some time. These inspections failed to detect this defective safety critical component, despite the clear warning given by the Hapuku derailment and the action it should have generated. Inspection and assessment of safety chains was not being effectively actioned and this deficiency has been dealt with.

2.5 Based on the condition of the brake blocks at the time of the derailment the 35000 km travelled by UK 14035 during the 6 months from the last recorded B check to the derailment was unlikely to have been achieved without the replacement of at least 2 brake blocks. A B check should have been made with each such replacement. What could not be determined was whether the B checks had been made and not recorded, or whether they had been missed. This was not directly related to the failure as the chain had been excessively worn for some time, probably during the recorded B checks, and had not been rectified. However, of concern is that these important safety critical checks were not being carried out and recorded in an auditable manner. Tranz Rail took action to address this issue as soon as it was revealed.

2.6 The actions taken by Tranz Rail since this latest incident are detailed in Section 4. The actions focused on accelerating the programme for replacing clevis pins with a bolt and welded nut, which decreased the possible need for safety chains or straps. In the interim safety chains were required to be replaced when wagons entered a depot, and must have been specifically inspected during field B checks and replaced if wear was greater than 25%. Clevis pin replacement must have been carried out on all wagons which entered a depot, and may have either been carried out when found during a field B check, or if not able to be actioned must have been programmed for early attention. This controlled approach should result in the removal of brake rod clevis pins from service by the end of 2000, with an effective defence to any future clevis pin failures in place until this was achieved.

2.7 Tranz Rail's proposed DEDs for future installation included Whangamarino, some 29 km before Pukekohe. The dragging marks indicated the rod came loose just before Pukekohe, and was unlikely to have been detected by a DED at Whangamarino if it had been installed. This confirms comments made in previous reports that an increase in DEDs will reduce but not eliminate the possibility of accidents due to dragging equipment such as brake rods.

3. Findings

Findings are listed in order of development and are not in order of priority.

3.1 The derailment was caused by damage to a turnout spreader bar permitting wagons to take 2 diverging routes.

3.2 The damage to the spreader bar was caused by an unrestrained loose brake rod.

3.3 The loose brake rod resulted from a lost clevis pin allowing the leading end of the brake rod to drop onto the track.

3.4 The clevis pin with split pin fastening arrangement was a known weak link and a programme of replacement with bolts and welded nuts had been in hand for 2 years.

3.5 The worn condition of the safety chains meant there was no defence against the foreseeable failure of the clevis pin becoming a derailment hazard.

3.6 Although wagon B check procedures for brake rigging identified excessive wear as safety critical, the excessively worn safety chains on UK 14035 were not identified and replaced during these inspections.

3.7 The Tranz Rail safety system including:

- brake gear security detail
- effective safety straps to restrain dragging brake rods
- DEDs to minimise the hazard associated with dragging equipment

failed to avoid a main line derailment affecting the safety of both main lines on a passenger route.

4. Safety Actions

4.1 Immediately following the incident Tranz Rail carried out a spot survey to identify what proportion of wagons still required the bolt and welded nut modification. Survey results showed 10% of wagons had not been modified.

4.2 On 18 July 2000 Tranz Rail issued Field Modification Instructions MW 3024 which dealt comprehensively with the issues identified by:

- consolidating earlier Field Modification Instructions
- requiring replacement of fulcrum pins as well as clevis pins with a bolt and welded nut
- requiring replacement of safety chains with safety wires
- making these two modifications compulsory for all wagons which entered a depot
- requiring B checks outside depots to identify, and either action or specifically programme, wagons requiring pin modification, and to identify and action worn chains.

4.3 In view of the safety actions taken no safety recommendations were necessary.

Approved for publication 22 November 2000

Hon. W P Jeffries
Chief Commissioner