NO. 95-109

TRAIN 860

RUNAWAY WAGON

OMOTO (NEAR GREYMOUTH)

2 MAY 1995

ABSTRACT

On 2 May 1995 at about 2042 hours one wagon of an eastbound freight operated by New Zealand Rail Limited (NZRL) between Greymouth and Middleton, derailed near Omoto whilst ascending a grade at slow speed. The derailed wagon was the second last wagon on the train and derailed all wheels. As a result the coupling and air connections to the last wagon parted and it ran back down the grade for approximately 4 kilometres. The causal factor of the derailment was uneven loading and causal factors for the runaway wagon were substandard repairs to the wagon braking system and non-compliance with established procedures to identify such problems. The safety deficiencies addressed in this report are compliance with requirements for train examination and testing prior to departure from a terminal station, the standard of temporary repairs to braking gear, and the control of the loading of scrap metal.

TRANSPORT ACCIDENT INVESTIGATION COMMISSION

RAIL OCCURRENCE NO. 95-109

Train Type and Number:	Greymouth - Middleton Freight 860
Date and Time:	2 May 1995, 2042 hours
Location:	Omoto, 209.356 kilometres, Midland Line (1.4 kilometres east of Greymouth)
Type of Occurrence:	Runaway wagon
Persons on Board:	One
Injuries:	Nil
Nature of Damage:	Nil
Information Sources:	Transport Accident Investigation Commission field investigation
Investigator in Charge:	R E Howe

1. NARRATIVE

1.1 On 2 May 1995, Train 860 was an eastbound freight travelling from Greymouth to Middleton. It consisted of two DC locomotives and 12 loaded wagons, the last 3 of which contained steel scrap. The gross weight of the train was 421 tonnes.

1.2 The train was operated by Locomotive Engineer (No. 1). He had been a Locomotive Engineer for 20 years and was qualified and certified to operate freight trains in the section concerned.

1.3 At about 2042 hours while travelling over a section with a 10 km/h speed restriction in force between 209.000 kilometres and 209.700 kilometres, Locomotive Engineer (LE) (No. 1) noticed a sudden loss of air pressure in the train brake pipe system which immediately brought the train to a stop. Train speed prior to air loss was 10 km/h as recorded by event recorder.

1.4 Expecting to find the usual cause of loss of brake pipe pressure, ie, a burst hose connecting wagons in the train, LE (No. 1) advised Train Control of his problem and intent, and equipped with hand-held radio, spanner and hose, walked the length of the train (approximately 190 m).

1.5 On reaching the end of the train LE (No. 1) found LB 6678 as the last wagon in the train consist. It was derailed, all four wheels, but still coupled to the rest of the train and with air connected. Air was escaping out of the open tap at the rear of LB 6678. LE (No. 1) walked a short distance back looking for detached wagons, but after going back a distance approximating that which the train had travelled since the brake pipe leak occurred and finding none, he started to look for the Train End Monitor (TEM)[1], assuming that LB 6678 may have been the last wagon in the train.

1.6 At approximately 2100 hours the Terminal Manager, Greymouth, arrived at the site and advised LE (No. 1) of the runaway wagon UR 3683 which had been located at Greymouth.

1.7 At approximately 2045 hours the Terminal Manager received a call from a local resident advising him that a wagon with a flashing red light had gone across the Greymouth Road crossing at a "good speed" heading towards Hokitika.

1.8 The Terminal Manager found UR 3683 at approximately 2050 hours at the Raleigh Street level crossing, (212.80 kilometres Midland Line). It was rolling gently from Hokitika towards Greymouth having been stopped and reversed by the ascending 1 in 150 grade from the 212.80 kilometre towards Hokitika.

1.9 From the times reported and distances involved it is likely the wagon reached a speed of at least 40 km/h at the foot of the average 1 in 120 down grade from the point of detachment to Mawhera Quay level crossing (210.81 kilometre Midland Line), a distance of 1.4 kilometres. From there it travelled approximately 2 kilometres on level track and crossed 5 more level crossings before coming to rest at an unknown point on the Hokitika Line 1 in 150 ascending grade at a total estimated distance from the point of detachment of 3.8 kilometres. It then ran back down the grade and came to rest at approximately 212.80 kilometres Midland Line, a distance of 3.4 kilometres from the point of detachment and 2 kilometres west of Greymouth. (Meterages on this section of NZRL track are continuous with zero for the Hokitika Line commencing at the end of the Midland Line at 213.057 kilometres.)

---

[1] The TEM is a device placed on the last wagon on a freight train. It is coupled to the brake pipe and doubles as a flashing red rear light device and a means of displaying and transmitting air pipe pressure at the rear of the train.

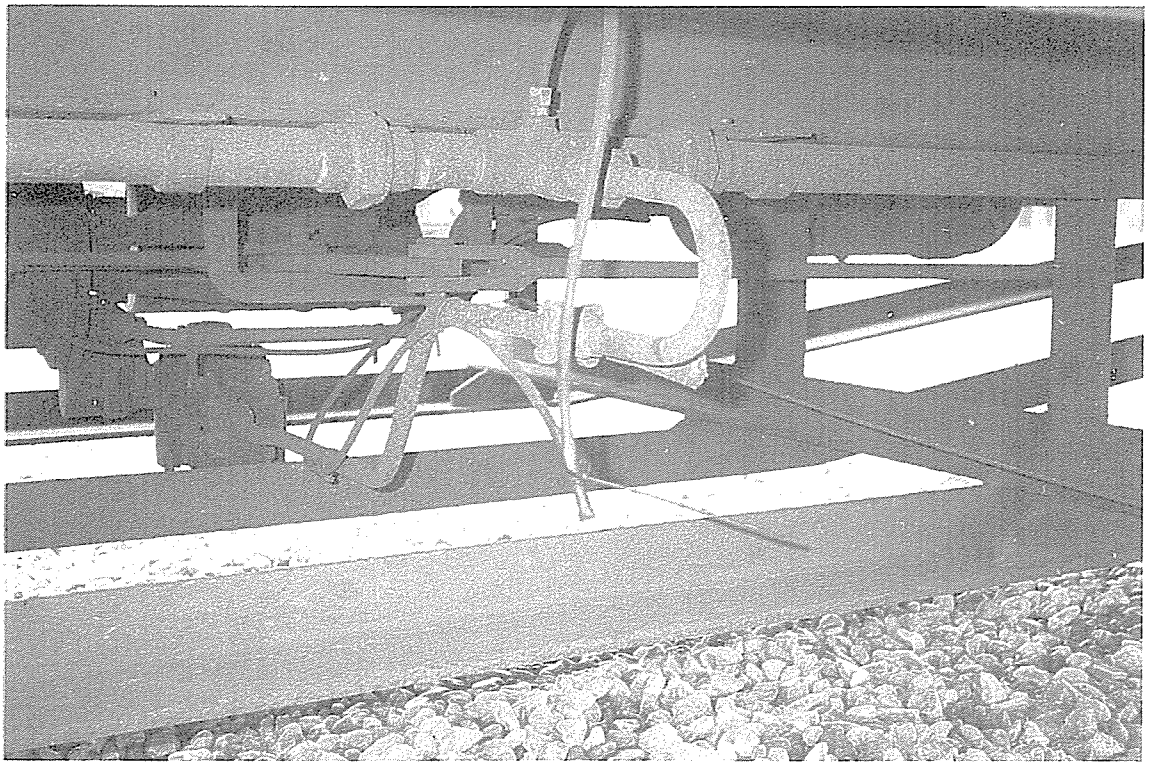

Fig. 1
Underside of wagon UR 3683 showing crimped and tied nylon tube

1.10 Of the six level crossings traversed by the runaway wagon four were protected with flashing lights and bells, one was protected by half arm barriers and flashing lights and bells and one was an unprotected crossing (Raleigh Street where the wagon came to rest). The crossing alarms in the area were switched to automatic and those at Mawhera Quay were seen to operate. The nature and weight of the wagon (a bogie wagon loaded with scrap metal to 42.5 tonne gross weight) were such as to ensure operation of the activating track circuits at the 5 protected level crossings.

The Derailment

1.11 The initiation of the incident was the derailment of wagon LB 6678 whilst negotiating a minimum 200 m radius right hand compound curve in direction of travel on a 1 in 66 ascending grade. The train was travelling at 10 km/h due to a temporary speed restriction imposed from 209.00 kilometres to 209.700 kilometres for track renewals.

1.12 Witness marks on the head of the left hand (high) rail in direction of travel indicated where the flange of the lightly loaded trailing left hand wheel of LB 6678 had climbed the gauge face of the rail, crossed the head, and dropped to the outside of the curve.

1.13 Investigation of wagon LB 6678 in Greymouth following recovery showed it to be loaded with scrap metal (bulldozer parts) in such a way that any movement of the load during the derailment or recovery was unlikely. The wagon was visibly down on the right hand side in direction of travel; a difference of 50 mm in height was measured. The cause was found to be an approximate 4 tonne counterbalance weight lying lengthwise from the leading right front corner of the wagon to the right hand edge at the centre of the wagon. When weighed the 6.5 tare wagon had a 9.5 tonne load giving a gross weight of 16 tonne. An indication of the imbalance was obtained by lifting each end separately whilst pivoting on the other. A lift of 8 tonne was required to lift the leading end of the wagon compared with 6.5 tonne to lift the trailing end. While this in itself would not create a derailment condition the effect of the out of balance between the right hand and left hand wheels of both axles caused by the positioning of the counterbalance weight resulted in weight relief on the left hand trailing wheel and eventual derailment.

The Runaway

1.14 In normal circumstances the breaking of the coupling between LB 6678 and UR 3683 should have resulted in the immediate application of the brakes on UR 3683. This forms the fail-safe principle of train brake design that air pressure keeps the brakes off and loss of air pressure automatically applies the brakes. However automatic brake application did not occur in this case.

1.15 Investigation and testing of wagon UR 3683 revealed substandard temporary repairs had been carried out involving the crimping and tying of a leaking 10 mm diameter nylon tube feeding train pipe air to the release valve. (Fig. 1) This had rendered the brakes on the wagon inoperative.

1.16 Evaluation of the wagon history of UR 3683 and associated brake block wear indicated it had been running with inoperative brakes for 2 to 3 months despite inspections and procedures which were intended to enable such conditions to be found and actioned.

UR wagon Braking Systems

1.17 In common with most NZRL wagons the braking system on wagon UR 6383 was based on air stored at pressure in an auxiliary reservoir activating the brakes through a triple valve when the train pipe pressure was decreased or lost.

1.18 The original braking system on UR wagons was based on a 25 mm diameter train pipe and a manual brake release valve. With this system, when a wagon was placed in a yard from a train consist and train air was disconnected and exhausted, its brakes would apply due to the air pressure retained in the auxiliary reservoir operating the brake cylinders through the triple valve. To allow shunting movements and wagon placement, release wires were available on each side of the wagon. These were pulled by shunters to open a valve and discharge the air pressure in the auxiliary reservoir, thus releasing the brakes. The necessity to hold them for 3 to 4 minutes to achieve this was a time consuming exercise.

1.19 As part of general wagon upgrading UR wagons were fitted with a larger train pipe (32 mm diameter) and automatic release capability. This meant that one pull of the release wire would allow the auxiliary reservoir to empty while the shunter attended to other wagons. Once the auxiliary reservoir was discharged it was necessary to ensure it was recharged the next time train pipe pressure was applied. To achieve this the release valve had to be reseated after discharge to allow air passage from the triple valve to the auxiliary reservoir. The 10 mm nylon tube connecting the train pipe to the release valve was the means of achieving the valve reseating.

1.20 The original leak in the connecting tube did not affect the operation of the release valve as there was sufficient train pipe pressure to overcome the leak and reseat the valve. As soon as the tube was crimped and tied there was no means of reseating the release valve following the first discharge of the auxiliary reservoir thereafter. Thus whenever train pipe pressure was applied there was a major air leak from the unseated release valve as it vented air from the triple valve which was intended to recharge the auxiliary reservoir. As the auxiliary reservoir did not recharge brake application was not possible.

Train Despatch Procedures

1.21 The train was tested and made up ready for departure by another Locomotive Engineer, LE (No. 2), and a Rail Operator at the end of their shift ready for LE (No. 1) to depart at the beginning of his shift. This is common and accepted practice on NZRL.

1.22 LE (No. 2) had been an LE for six years. Although his annual certificate was marked as expired April 1995 his certification had been extended to December 1995 as part of NZRL's structured introduction of biennial re-certification of Operations staff to replace annual re-certification: biennial re-certification commenced February 1995. He was qualified and certified for the duties required.

1.23 The Rail Operator had been a Train Examiner Operations prior to a recent change of classification. He was qualified and certified for the duties required.

1.24 There were two specific tests that should have revealed the problem on wagon UR 3683:

- Terminal brake test at an original starting station.
- Brake pipe leakage test

1.25 The Terminal Test procedures are laid out in automatic Air Brake Rule 160(e). As carried out for Train 860 this required the Rail Operator to walk the train from front to rear on one side with the brakes applied to check that all hoses were coupled and cocks fully open and that the air brakes had applied on each vehicle. Before proceeding back to the locomotive the Rail Operator was required to check out the operation of the TEM and then request the release of the brakes. He was then required, on the opposite side if practicable, to see that all brakes were properly released. These procedures were carried out by the Rail Operator of Train 860.

1.26 During the course of this test he found a KS wagon in the middle of the train, the brakes of which were not applied. On requesting a release and reapplication of brakes from LE (No. 2) the brakes applied. The Rail Operator did not notice that the brakes on UR 3683 had not applied.

1.27 Brake application can be judged in two ways, ie, by observing the brake piston rod in the extended position and by visual assessment of the fit of brake blocks to wheels.

1.28 Brake block fit can be observed on either side of any wagon but brake pistons are on one side only. The side of the train on which they are located will occur randomly on the side of the train walked by a Train Operator. In the case of UR 3683 the piston was on the side walked with the brakes applied (right hand side).

1.29 Although the test was performed in the dark there was some yard illumination and the Train Operator had a torch. The weather was fine and clear and overall visibility was described as "normal".

1.30 Examination of UR 3683 following the incident showed that with brakes off the brake shoes were virtually sitting on the wheel, although not bearing, and would have visually implied brake "on" condition.

1.31 During the terminal brake test the Train Operator did not notice any air leaks as he traversed the train on each side. This was despite the fact that any attempt to increase train pipe pressure and maintain it for release of brakes would have immediately resulted in leakage at the release valve on UR 3683. The release valve, like the piston, was located on the right hand side of the wagon.

1.32 Automatic Air Brake Rule 160(e) also requires a brake pipe leakage test to be carried out by the LE during a Terminal Test. The procedures for this are laid down in Rail Operating Code Section 30.1.2. LE (No. 2) did not carry out this test. He stated "he could hear leaks or see them by using the flowmeter on the train when using the maintaining feature to maintain brake pipe pressure at constant pressure". Based on this he stated he had no reason to believe there was any leakage.

1.33 The Code requirements are that, for good control of train brakes, pipe leakage should not exceed 35 KPa per minute and trains must not leave a terminal station if leakage is in excess of 50 KPa per minute. During tests on wagon UR 3683 the leakage at the release valve was measured at 390 KPa per minute. It is quite possible the compressors on the two locomotives at the head of Train 860 would have overcome the leak on wagon UR 3683 even when the locomotives' engines were at idle, without any noticeable movement on the locomotive's flowmeter.

Wagon History

1.34 There are two specific programmed wagon inspections forming part of NZRL's maintenance system. The purpose of these includes identifying and correcting defects such as that present

on UR 3683, ie, a specific brake test at medium time interval and a warranty inspection at short time interval. Both of these tests have been extended recently with regard to specified time period between tests and this has an effect on their relevance to wagon UR 3683.

1.35 The last brake test was in June 1993. "6/93" was stencilled on the wagon and is considered to indicate the date of the last test correctly although the computerised service history of the wagon indicated the last test was 15 February 1992. (The service history of all NZRL wagons is kept on a national computerised database.) As at June 1993 brake tests were required annually. This requirement was changed in May 1994 to a 24 monthly service for wagons. Associated with the May 1994 change in service times was a transition table to ensure an orderly change from 12 monthly to 24 monthly services. For a last test June 1993, the transition table required the new test in December 1994. As at the date of the incident UR 3683 had not been tested since June 1993 but the interval had not exceeded the new NZRL 24 monthly requirement.

1.36 In February 1995 UR 3683 was given a "Green" warranty certificate meaning it was fit for service. At the time such certificates were required to be issued monthly and attached to the wagon. This was the latest such certificate on wagon UR 3683. Such warranty checks were intended to include checks with air on although it was recognised this was not always practicable. It is not known whether UR 3683's February 1995 warranty included inspection with air on.

1.37 On 13 March 1995 NZRL introduced new Mechanical Equipment Inspection Procedures (Company Procedure C/021) which changed the wagon inspection interval with respect to warranty to three months.

1.38 As at 2 May 1995 when the incident occurred wagon UR 3683 was not overdue for inspection under the new procedures.

1.39 The brake blocks on UR 3683 were last renewed on 14 December 1994 at a recorded kilometrage of 147815. At the time of the incident the recorded kilometrage was 153609. UR 3683 had thus travelled approximately 6,000 kilometres on those brake blocks.

1.40 The brake blocks on UR 3683 were Westinghouse short blocks composed of high phosphorus cast iron. NZRL experience is that the expected life of such brake blocks is 5,000 kilometres to 10,000 kilometres dependent on aspects such as grade, train size and train handling. This life is based on physical wear down to a pre-determined and marked maximum wear line on each brake block.

1.41 The brake blocks on wagon UR 3683 showed only 10% wear indicating they had been inoperative for a considerable period of time estimated at two to three months.

2. FINDINGS

2.1 The train was being operated normally prior to the derailment.

2.2 The derailment of LB 6788 was caused by a lightly loaded wheel mounting the outside of a curve at low speed.

2.3 The light wheel loading was caused by uneven loading of scrap metal.

2.4 The parting of couplings and detachment of wagon UR 3683 was a predictable result of such a derailment.

2.5 The failure of the brakes to apply on wagon UR 3683 was the result of substandard repairs to the wagon's braking system.

2.6 Lack of compliance with the procedures laid down for a terminal brake test at original starting stations resulted in repeated failures to reveal the defect.

2.7 Procedures laid down for terminal brake tests and brake pipe leakage tests were sufficient to identify the defect in wagon UR 3683.

2.8 The brake pipe leakage test which was intended to reveal a defect such as that on wagon UR 3683 was not carried out during the terminal brake test for Train 860 on 2 May 1995.

2.9 Brake pipe leakage tests had either not been carried out or had failed to identify the defect over a two to three month period.

2.10 Lack of compliance with the procedures for terminal brake tests and brake pipe leakage tests resulted in the defect in wagon UR 3683 going undetected over a two to three month period.

2.11 The instructions and procedures in place to prevent incidences such as this are considered adequate. The incident was caused by a failure to comply with these instructions and procedures.

3. SAFETY ACTIONS

As a result of liaison during the course of the investigation the following safety actions have been taken by NZRL:

3.1 The uneven loading of scrap in Greymouth had been an ongoing problem with one customer. Following the derailment NZRL laid down specific requirements for continued acceptance of such loads and introduced a checking system for compliance. There have been no problems since May 1995.

3.2 All NZRL Area Managers were advised of the circumstances surrounding the runaway wagon and the fact that terminal tests and brake leakage tests had failed to identify the wagon defect. A specific follow-up with inspection staff was made to ensure future compliance.

3.3 All Depot Managers were advised of the details of the original substandard repair and the result of that repair. A specific follow-up with all maintenance staff was made to reinforce the need for compliance with procedures for marking up vehicles with temporary repairs for attention at the earliest opportunity and certainly not later than the completion of the trip.

3.4 It is considered the safety actions taken by NZRL are appropriate to the incident and no further safety recommendations are required.

17 October 1995

M F Dunphy
Chief Commissioner

on UR 3683, ie, a specific brake test at medium time interval and a warranty inspection at short time interval. Both of these tests have been extended recently with regard to specified time period between tests and this has an effect on their relevance to wagon UR 3683.

1.35 The last brake test was in June 1993. "6/93" was stencilled on the wagon and is considered to indicate the date of the last test correctly although the computerised service history of the wagon indicated the last test was 15 February 1992. (The service history of all NZRL wagons is kept on a national computerised database.) As at June 1993 brake tests were required annually. This requirement was changed in May 1994 to a 24 monthly service for wagons. Associated with the May 1994 change in service times was a transition table to ensure an orderly change from 12 monthly to 24 monthly services. For a last test June 1993, the transition table required the new test in December 1994. As at the date of the incident UR 3683 had not been tested since June 1993 but the interval had not exceeded the new NZRL 24 monthly requirement.

1.36 In February 1995 UR 3683 was given a "Green" warranty certificate meaning it was fit for service. At the time such certificates were required to be issued monthly and attached to the wagon. This was the latest such certificate on wagon UR 3683. Such warranty checks were intended to include checks with air on although it was recognised this was not always practicable. It is not known whether UR 3683's February 1995 warranty included inspection with air on.

1.37 On 13 March 1995 NZRL introduced new Mechanical Equipment Inspection Procedures (Company Procedure C/021) which changed the wagon inspection interval with respect to warranty to three months.

1.38 As at 2 May 1995 when the incident occurred wagon UR 3683 was not overdue for inspection under the new procedures.

1.39 The brake blocks on UR 3683 were last renewed on 14 December 1994 at a recorded kilometrage of 147815. At the time of the incident the recorded kilometrage was 153609. UR 3683 had thus travelled approximately 6,000 kilometres on those brake blocks.

1.40 The brake blocks on UR 3683 were Westinghouse short blocks composed of high phosphorus cast iron. NZRL experience is that the expected life of such brake blocks is 5,000 kilometres to 10,000 kilometres dependent on aspects such as grade, train size and train handling. This life is based on physical wear down to a pre-determined and marked maximum wear line on each brake block.

1.41 The brake blocks on wagon UR 3683 showed only 10% wear indicating they had been inoperative for a considerable period of time estimated at two to three months.

2. FINDINGS

2.1 The train was being operated normally prior to the derailment.

2.2 The derailment of LB 6788 was caused by a lightly loaded wheel mounting the outside of a curve at low speed.

2.3 The light wheel loading was caused by uneven loading of scrap metal.

2.4 The parting of couplings and detachment of wagon UR 3683 was a predictable result of such a derailment.

2.5 The failure of the brakes to apply on wagon UR 3683 was the result of substandard repairs to the wagon's braking system.

2.6 Lack of compliance with the procedures laid down for a terminal brake test at original starting stations resulted in repeated failures to reveal the defect.

2.7 Procedures laid down for terminal brake tests and brake pipe leakage tests were sufficient to identify the defect in wagon UR 3683.

2.8 The brake pipe leakage test which was intended to reveal a defect such as that on wagon UR 3683 was not carried out during the terminal brake test for Train 860 on 2 May 1995.

2.9 Brake pipe leakage tests had either not been carried out or had failed to identify the defect over a two to three month period.

2.10 Lack of compliance with the procedures for terminal brake tests and brake pipe leakage tests resulted in the defect in wagon UR 3683 going undetected over a two to three month period.

2.11 The instructions and procedures in place to prevent incidences such as this are considered adequate. The incident was caused by a failure to comply with these instructions and procedures.

3. SAFETY ACTIONS

As a result of liaison during the course of the investigation the following safety actions have been taken by NZRL:

3.1 The uneven loading of scrap in Greymouth had been an ongoing problem with one customer. Following the derailment NZRL laid down specific requirements for continued acceptance of such loads and introduced a checking system for compliance. There have been no problems since May 1995.

3.2 All NZRL Area Managers were advised of the circumstances surrounding the runaway wagon and the fact that terminal tests and brake leakage tests had failed to identify the wagon defect. A specific follow-up with inspection staff was made to ensure future compliance.

3.3 All Depot Managers were advised of the details of the original substandard repair and the result of that repair. A specific follow-up with all maintenance staff was made to reinforce the need for compliance with procedures for marking up vehicles with temporary repairs for attention at the earliest opportunity and certainly not later than the completion of the trip.

3.4 It is considered the safety actions taken by NZRL are appropriate to the incident and no further safety recommendations are required.

17 October 1995

M F Dunphy
Chief Commissioner