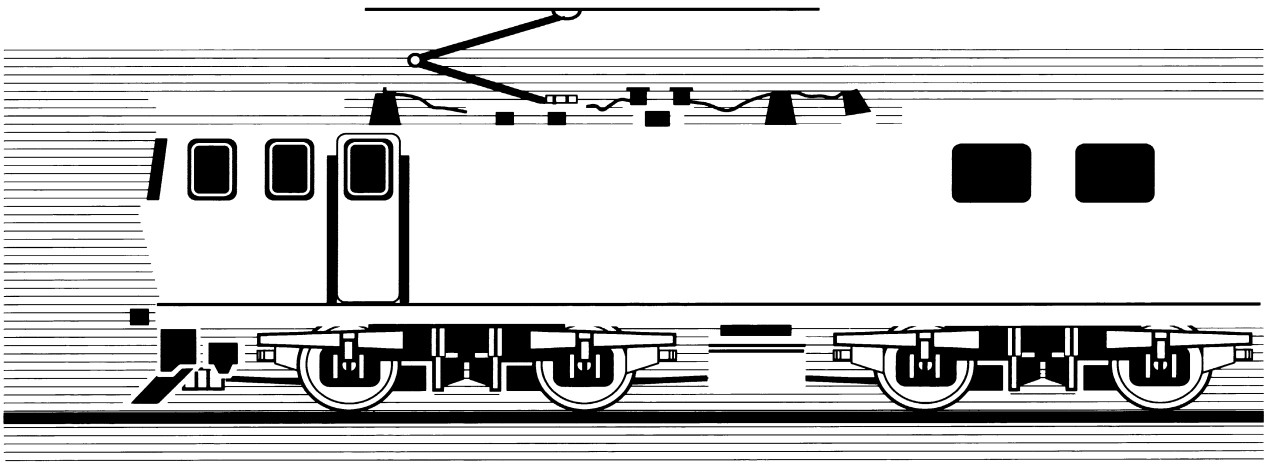
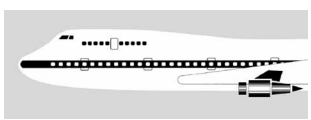
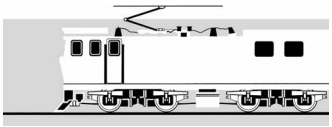


RAILWAY OCCURRENCE REPORT

04-120 **Express freight Train 726, collision with runaway locomotive, Pines** **18 August 2004**


TRANSPORT ACCIDENT INVESTIGATION COMMISSION NEW ZEALAND

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.

Report 04-120

express freight Train 726

collision with runaway locomotive

Pines

18 August 2004

Abstract

On Wednesday 18 August 2004 at about 0815, an unmanned DFT class locomotive, which had been stabled in the loop at Pines, ran away on to the Main North Line and collided with stationary Train 726, a Christchurch-Picton express freight service.

The runaway locomotive struck the second wagon in the consist of Train 726, which was standing over No.3 motor points at the south end of Pines.

There were no injuries and only minor damage to the DFT locomotive and one wagon on Train 726.

Safety issues identified were:

- the procedures for the application of the handbrake on the locomotives
- the potential for an accident had the locomotive run away prior to the arrival of Train 726 at Pines.

One safety recommendation was made to the Chief Executive of Toll NZ Consolidated Limited to address these issues.

Contents

Figures

Abbreviations

Km	kilometre(s)
km/h	kilometre(s) per hour
m	metre(s)
mm	millimetre(s)
MNL	Main North Line
t	tonne(s)
UTC	co-ordinated universal time

Data Summary

Train type and number:	express freight Train 726 DFT locomotive 7186
Date and time:	18 August 2004 at about 0815[1]
Location:	Pines between Picton and Kaikoura on the Main North Line (MNL)
Persons on board train:	1
Persons on ground:	1
Injuries:	nil
Damage:	minor to locomotive DFT 7186 and wagon JPS 277, an empty canopy wagon on Train 726
Operator:	Toll NZ Consolidated Limited (Toll Rail)
Investigator-in-charge:	V G Hoey

[1] Times in this report are New Zealand Standard Times (UTC+12) and are expressed in the 24-hour mode.

1 Factual Information

1.1 Narrative

1.1.1 On Tuesday 17 August 2004, Train 722 was a northbound express freight service from Christchurch to Picton on theMNL. The train consisted of locomotives DFT 7186 and DFT 7132 in multiple, coupled long hood[2] to long hood, hauling 770 t with a total train length of 511 m. The train was crewed by a locomotive engineer.

1.1.2 At about 0255 on Wednesday 18 August 2004, as Train 722 approached tunnel No.20, about 3 km south of Pines, the locomotive engineer saw several rocks in the centre of the track a short distance ahead. He braced himself for the impact of the collision and applied the brakes.

1.1.3 When the train stopped, the locomotive engineer informed the train controller of the collision and then examined his train for damage. The locomotive engineer found the front cowcatcher of the leading locomotive, DFT 7186, had been forced downwards and slightly backwards. The largest rock had partially disintegrated, and a sizeable remnant had been pushed into tunnel No.20, but clear of the track.

1.1.4 The locomotive engineer informed the train controller of the condition of DFT 7186. They agreed that the train should proceed at slow speed to Pines, where the damaged locomotive would be stabled in the loop to wait for inspection and possible repair.

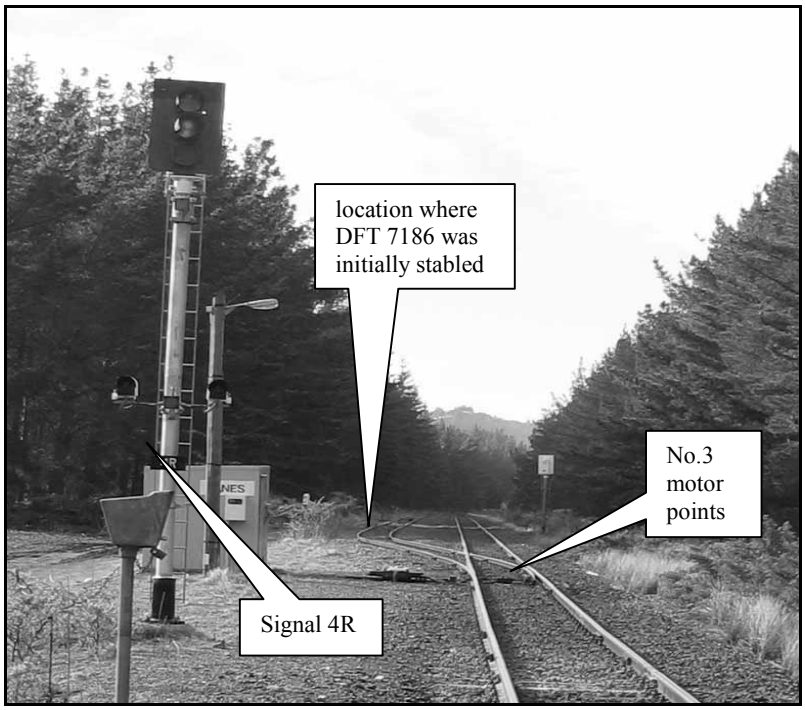


Figure 1
Pines crossing loop, looking north

1.1.5 On arrival at Pines, the locomotive engineer detached DFT 7186 and drove it onto the loop, and shut it down (see Figure 1). Having stopped DFT 7186 with the independent air brake, the locomotive engineer applied the handbrake to secure the locomotive before leaving it unattended.

1.1.6 The train was to continue to Picton with one locomotive only. Because the remaining locomotive would be long hood leading, a roving shunter[3] was summoned to act as second person[4]. The shunter arrived at about 0410, and Train 722 resumed its journey.

[2] The long hood was the non-cab end of a locomotive that housed the diesel motor and associated electrical generation equipment.
[3] A roving shunter was responsible for shunting operations over an extended area covering several remote locations.
[4] A second person was required in the locomotive cab because of reduced visibility when running long hood leading.

1.1.7 On Wednesday 18 August 2004, Train 726 was a northbound express freight service from Christchurch to Picton on the MNL. The train consisted of locomotive DX 5287 hauling 960 t with a total train length of 400 m. The train was crewed by a locomotive engineer.

1.1.8 Because of adverse weather conditions, a track ganger had been patrolling the MNL. He arranged to rendezvous with Train 726 at the south end of tunnel No.20, where the locomotive engineer assisted him to move the large rock that was in the tunnel as a result of the earlier incident with Train 722.

1.1.9 Once they had moved the rock further away from the track in the tunnel, the ganger drove to Pines, where he was to inspect the damaged DFT 7186, and the locomotive engineer continued his journey to Picton.

1.1.10 At about 0815, Train 726 arrived at Pines and the locomotive engineer stopped his train at Signal 4R because of a signalling failure. The track ganger arrived at about the same time and pulled up alongside the train and told the locomotive engineer that there was a dragging handbrake lever on one of the wagons in the train consist.

1.1.11 The track ganger reset the handbrake lever in its cradle before driving the short distance to the loop to assess the damage to the cowcatcher of DFT 7186.

1.1.12 The locomotive engineer obtained permission from the train controller to pass Signal 4R, and accelerated the train towards the main line at Pines. As he did so he saw the track ganger come from behind DFT 7186 exhibiting a "danger stop" hand signal.

1.1.13 The locomotive engineer applied the brakes and stopped the train. He saw that DFT 7186 was slowly moving down the loop towards his train. The locomotive engineer and the track ganger attempted to stop the runaway locomotive but without success. The runaway locomotive collided with wagon JPS 277, the second on Train 726, tipping it to an angle but not completely derailing the wagon. DFT 7186 did not derail.

1.2 Site information

1.2.1 The MNL between Christchurch and Picton was single line over a distance of 347.60 km. Train movements were controlled from the national train control centre in Wellington under the track warrant control[5] system, the predominant operating system on the line.

1.2.2 Pines was a track warrant station located at 220.87 km between Picton and Kaikoura. There was a loop for the purpose of crossing opposing trains (see Figure 2). The signalling and interlocking facilities at Pines were consistent with most other crossing locations in single line areas on the rail network in that safety points[6] were not installed. Pines was a crossing location only and no shunting was scheduled to occur there.

[5] Track warrant control was an operating system where occupation of the main line was controlled by instructions called track warrants issued by a train controller.

[6] Safety points were installed on loops to prevent runaway vehicles entering the main line. Safety points were interlocked with the main line motor points to ensure their movement was synchronised between a normal or reverse setting.

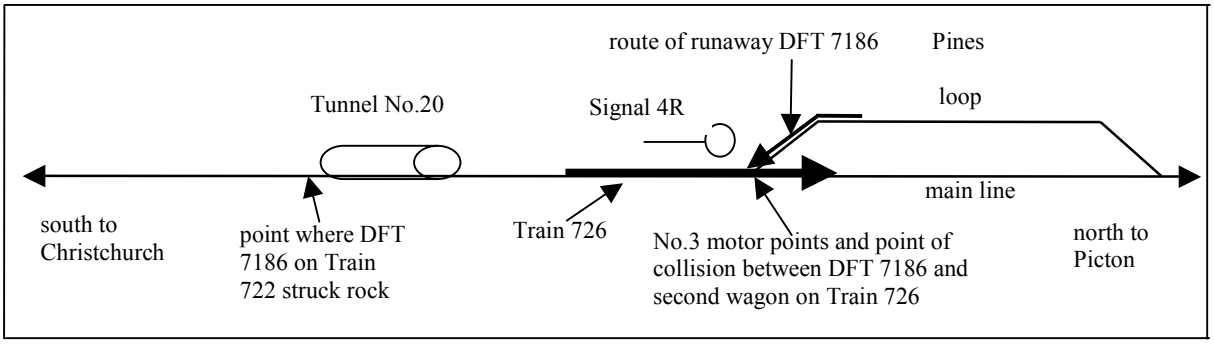


Figure 2
Track layout between Pines and tunnel No.20

1.2.3 The 945 m length of the loop at Pines sloped downhill to the south on a gradient of 1 in 280, but the gradient steepened to 1 in 130 about 300 m north of No.3 motor points.

1.2.4 From 0900 Tuesday 17 August 2004 to 1200 Wednesday 18 August 2004, a severe weather warning had been in effect for the MNL with heavy rain and strong winds.

1.2.5 A range of hills rose steeply to a height of about 540 m parallel to the track alignment where the rock fall occurred.

1.3 Locomotive DFT 7186

1.3.1 DFT 7186 was one of a fleet of 30 diesel electric mainline freight and passenger locomotives built by General Motors of Canada and entered service between 1979 and 1981. The fleet was rebuilt after being fitted with turbo-chargers between 1992 and 1997. DFT 7186 weighed 87.6 t and was equipped with a handbrake mechanism outside the locomotive on the long hood end, behind the locomotive engineer's side of the cab (see Figure 3).

1.3.2 When driving a DFT locomotive alone, braking was achieved by the independent air brake. Once the locomotive was shut down and stabled, the independent air brake would bleed off over a period of time and release the brakes. However, the handbrake, if fully applied, would keep the locomotive secured. The handbrake applied and held brake blocks onto the wheels of two axles of the lead bogie on the side of the locomotive opposite to the handbrake lever.

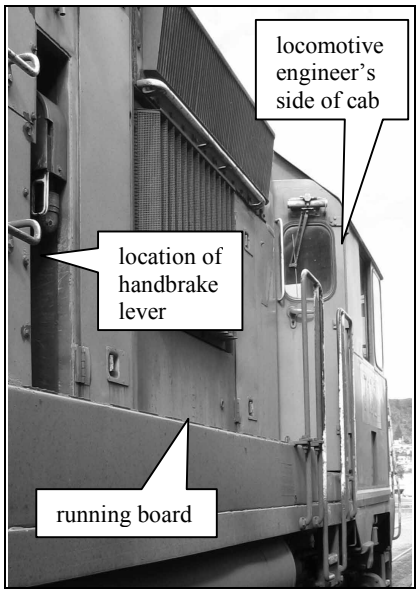


Figure 3
General location of handbrake on DFT 7186

1.3.3 The handbrake was a gear-type device that delivered a braking force equal to, or greater than, the air brakes. The handbrake was applied by use of a ratchet handle attached to a chain connected directly to the brake rigging on the bogie located under the cab. During a handbrake application, the chain assembly movement applied the brakes. Depending on the adjustment of the chain, about 6 to 8 pulls on the ratchet handle were normally required to fully apply the brake. A weighted trip mechanism released brake tension (see Figure 4).

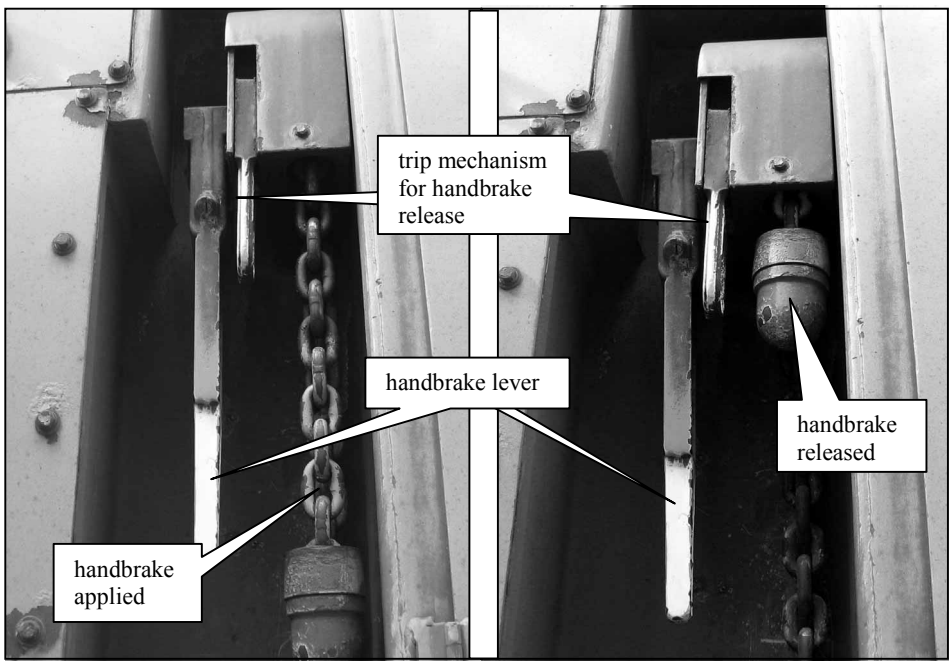


Figure 4
Handbrake applied (left) and handbrake released (right)

1.3.4 Toll Rail's mechanical code M2000 stated that DFT class locomotives were to be inspected at the following intervals:

- Full servicing — as scheduled by local team leader
- A check — after 18 000 km
- B check — after 36 000 km
- C check — after 72 000 km
- D check — after 144 000 km
- E check — after 432 000 km
- F check — after 864 000 km.

1.3.5 When locomotive engineers encountered mechanical defects on locomotives while running trains, the details of the defect were recorded in the Loco 54D repair book. No handbrake defects were recorded in the Loco 54D repair book for DFT 7186.

1.3.6 The 72000 km C check specified the following work on the bogies and underframe of DFT class locomotives:

- check operation and condition of hand brake and lubricate mechanism.

The handbrake was not programmed for examination in the A and B checks, but the C check criterion was included in the higher order checks. The last C check on DFT 7186 was performed on 23 June 2004 and no defects were identified or repairs performed on the handbrake mechanism during this check.

1.3.7 Toll Rail's operating procedures included instructions on the application and release of the handbrake. The correct use of the handbrake was included in the mainline locomotive driving safety observation carried out on locomotive engineers 3 times within a 24-month period, with no longer than 8 months separating observations.

1.3.8 Operating procedures also included instructions for stabling of locomotives at locations isolated from recognised locomotive depots. In these situations the locomotive engineer was to apply the handbrake before leaving the locomotive unattended.

1.4 Personnel

Locomotive engineer Train 722

1.4.1 The locomotive engineer of Train 722 held current certification for Grade 1 locomotive engineer's duties. He had 28 years' experience in locomotive driving duties, mostly on the MNL. He underwent a safety observation on 2 October 2003, which included a test on the procedures for the application of the locomotive handbrake.

1.4.2 The locomotive engineer had booked on at Picton at 2220 the evening before the incident, and had driven Train 721 south to Kaikoura, where he changed over to Train 722 for his return trip to Picton.

1.4.3 The locomotive engineer estimated the size of the largest rock that Train 722 struck was about 500 mm in diameter. He experienced a rumbling sensation as the locomotive struck and rode over the shattered fragments of the rocks.

1.4.4 The locomotive engineer focused on the damage to the cowcatcher and he stood on it to test its stability and security and considered it was safe enough to travel the short distance to the loop at Pines. In addition to checking the cowcatcher, he examined the traction motors on DFT 7186, but found no signs of damage.

1.4.5 After driving DFT 7186 into the loop at Pines, the locomotive engineer shut down the locomotive and went out onto the running board to the handbrake and made about 5 pulls of the lever. He said later that on the last pull he noticed the ratchet seemed to apply reasonably quickly, and because he did not wish to jam the mechanism, he did not apply any more pressure.

1.4.6 The locomotive engineer then secured the cab doors on DFT 7186 and waited in the second locomotive for the roving shunter to join him, before resuming the journey to Picton.

Locomotive engineer Train 726

1.4.7 The locomotive engineer of Train 726 held current certification for Grade 1 locomotive engineer's duties. He had 21 years' experience driving trains, mostly on the MNL.

1.4.8 On the day of the incident he had booked on at 0200 in Picton and had driven Train 723, a light locomotive[7], south to Kaikoura, where he changed over to Train 726. He had seen DFT 7186 as he passed through Pines on the journey south.

1.4.9 After the locomotive engineer of Train 726 had assisted the track ganger to move the rock in Tunnel No.20, he drove to Signal 4R at Pines and stopped because the signal was not lit.

1.4.10 The rail was slippery from the heavy rain at the time, so once the train controller had authorised him to pass the signal, he activated the locomotive's sanding mechanism to gain traction to start the heavy train. Train 726 had reached a speed of about 10 to 15 km/h when he saw the track ganger exhibiting the "danger stop" hand signal.

[7] Light locomotive described the running of locomotive(s) only on a mainline train.

1.4.11 The locomotive engineer was able to stop Train 726 in a short distance on the uphill gradient. He saw that DFT 7186 was slowly moving down the loop towards his train, and that the track ganger had placed a piece of ballast on the rail ahead of the moving locomotive in an attempt to stop it.

1.4.12 The locomotive engineer left his cab and climbed onto the running board of the runaway locomotive and tried without success to apply more pressure on the handbrake. Fearing for his own safety, he leapt off the locomotive and stood with the track ganger as they watched the runaway DFT 7186 collide with wagon JPS 277, the second wagon on Train 726, at what they later estimated to be a speed of 15 km/h.

1.4.13 The locomotive engineer notified the train controller of the incident and waited for assistance.

Track ganger

1.4.14 The track ganger had 24 years' experience in track maintenance duties working out of Blenheim and Kaikoura. He was responsible for the track between Hundalee and Wharanui, a distance of about 92 km.

1.4.15 The track ganger had been called out at about 0300 to carry out special track inspections because of the severe weather being experienced at the time. While returning to his home at Kaikoura, he received a message from 155[8] notifying him of a rock fall at 216.8 km. He went to the location, but found no evidence of any rock material near the track. He concluded that the message was a repeat of one he had received earlier relating to 216.6 km, the location of Train 722's collision.

1.4.16 Before leaving the 216.8 km, the track ganger became aware of the approach of Train 726 and arranged with the locomotive engineer to rendezvous outside Tunnel No.20 to examine the rock debris in the tunnel from Train 722's collision. The track ganger and locomotive engineer walked into the tunnel and rolled the remnant of the large rock against the tunnel wall away from the track.

1.4.17 The track ganger was to examine the damage on DFT 7186 at the loop in Pines, so after moving the rock, he drove to Pines, while Train 726 continued its journey north.

1.4.18 When the track ganger arrived at Pines, he saw Train 726 stopped at the faulty Signal 4R and noticed a dragging handbrake lever on one of the wagons. He told the locomotive engineer and reset the lever. After resetting the lever, he went to the loop and examined the damaged cowcatcher on DFT 7186. As he was doing so, he saw the locomotive wheels begin to turn slowly.

1.4.19 Realising that Train 726 had begun to move past Signal 4R, the track ganger ran to the other side of DFT 7186 exhibiting a "danger stop" hand signal to warn the locomotive engineer. Once he saw Train 726 stopping, he ran to the other end of the moving locomotive and placed a piece of ballast on the rail, but this had no effect on slowing the locomotive.

1.4.20 Meanwhile the locomotive engineer had left his train and boarded the runaway DFT 7186, attempting to apply the handbrake but this was also having no effect. The locomotive engineer jumped clear and together they moved away to a safe distance and watched the collision occur.

Supervisor operations and logistics

1.4.21 The supervisor operations and logistics from Alstom Transport[9] arrived at Pines at about 1200 on the day of the incident and made arrangements to separate DFT 7186 from Train 726. After this was done, he examined the brake blocks on the lead bogie of DFT 7186 and noticed they were not in contact with the wheel treads.

[8] 155 was the name of the central reporting operation that recorded and channelled notifications of defects to the rail infrastructure.

[9] Alstom Transport was contracted to Toll Rail to carry out the inspection and maintenance of wagons and locomotives.

1.4.22 The supervisor climbed to the running board, released and then attempted to reapply the handbrake. During this reapplication, the handbrake came up to what he later described as a tight point, which did not feel normal. He then exerted more pressure and the mechanism suddenly came free and he was able to apply the handbrake fully.

1.4.23 The supervisor re-examined the front bogie and found some freshly broken stone fragments, all about the size of a 20-cent coin, on top of the bogie frame in the area where the chain links travelled from the locomotive underframe to the bogie.

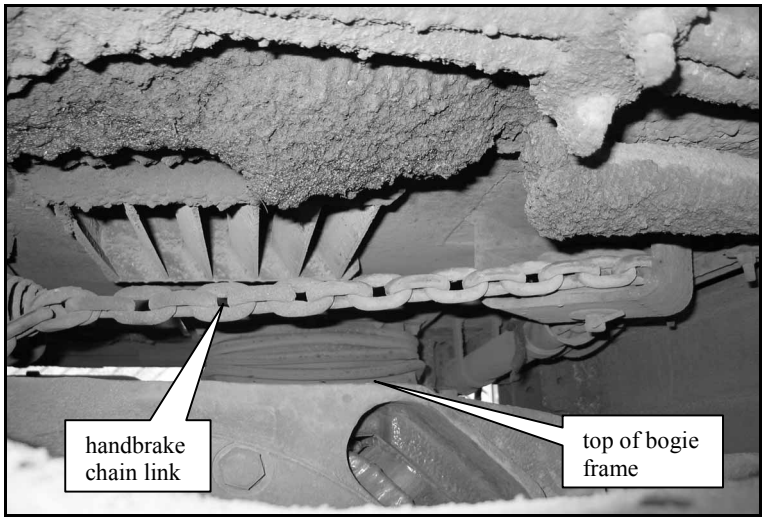


Figure 5
Handbrake chain link mechanism between locomotive underframe and bogie

2 Analysis

2.1 The handbrake mechanism on DFT 7186 had last been checked during a C check, 2 months prior to the incident. The locomotive engineer of Train 722 had no reason to suspect that that mechanism would not work correctly when he applied the handbrake at Pines. Although he considered the handbrake applied reasonably quickly, he was conscious of over-applying the handbrake that could have resulted in a jammed mechanism and probably concluded that the quick application was due to a tight adjustment.

2.2 The locomotive engineer of Train 722 had extensive experience in the stabling of locomotives at the ends of train journeys. He was aware of the vagaries in brake applications due to adjustment and locomotives sitting on curved track. Even if the locomotive engineer had any concerns about the brake application and had he done a visual check of the front bogie of DFT 7186, he would have seen that the brake blocks were in contact with the wheel treads because of the recent application of the independent air brake when bringing the locomotive to a stop.

2.3 The handbrake could be fully applied only after the Alstom supervisor had later exerted the extra pressure, which suddenly released the mechanism. The shattered fragments of rock that he found on top of the bogie had probably been lodged in the chain link mechanism after the collision with the rocks at tunnel No.20, and been ejected when he applied extra pressure.

2.4 That the supervisor was able to fully apply the handbrake repeatedly after clearing the mechanism, indicated that there was no mechanical problem with the handbrake system itself.

2.5 The shattered fragments of rock were found on top of the bogie frame after the supervisor cleared the handbrake mechanism. They were unlikely to have been there since the collision because the motion and vibration of the locomotive during the journey from the collision site to Pines would probably have dislodged them even though Train 722 travelled at slow speed.

2.6 When stabled, the braking on DFT 7186 was supplied by the air brake, but the handbrake was not fully applied. Therefore, once the air brake bled off, the handbrake would not prevent the brake blocks being released, so no braking was applied to the locomotive. A safety recommendation covering this issue has been made to the Chief Executive of Toll NZ Consolidated Limited.

2.7 Without any braking, it was only a matter of time before some event would initiate DFT 7186's movement on the descending gradient at Pines. The passing of Train 723, being just a light locomotive, would probably not have provided enough disruption to start the movement of DFT 7186. However, had it done so, DFT 7186 could have followed Train 723 and occupied the main line between Pines and Hapuku where it would have stopped at the end of the descending gradient, and probably remained unsighted to the locomotive engineers of other trains. For example, a later arrival of Train 726 in the area could have led to a more serious situation.

2.8 When Train 726 started to move off from Signal 4R at Pines, the locomotive was under full throttle and with sand being applied for traction to accelerate the fully loaded train. A high level of vibration was being transferred to the rails and was probably enough to start DFT 7186 moving.

2.9 Once DFT 7186 began to move, there was no secondary safety defence to prevent the locomotive entering the main line at Pines. There were no safety points installed on the loop to intercept a runaway vehicle. Track rationalisation over the past 20 years had seen the widespread removal of safety points from loops. Previously, safety points were installed at most loops on the rail network where the shunting of trains was a regular practice, but as the rail industry streamlined itself, the amount of shunting at crossing locations had reduced to almost nil. Cost savings were also achieved because of the reduced amount of associated equipment required to operate and maintain the points. Although the presence of safety points at all crossing locations would be desirable and would provide a defence against such isolated incidents, their installation would be impracticable and costly, and therefore difficult to justify.

3 Findings

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

3.1 Train 722 was being operated correctly and the actions of its locomotive engineer did not contribute to the collision with the rocks.

3.2 As a result of the collision between Train 722 and rocks on the track outside tunnel No.20, one or more fragments of rock probably became lodged in the handbrake chain link mechanism on DFT 7186.

3.3 When the locomotive engineer applied the handbrake of DFT 7186, the fragments of rock prevented a full application, although the locomotive engineer had no indication that it was other than fully applied.

3.4 Once the applied air brake bled off over a period of time, the locomotive was left with no braking.

3.5 The vibration of Train 726 accelerating from the stop at Signal 4R at Pines probably initiated the movement of the unsecured DFT 7186 on the loop.

3.6 Train 726 was being operated correctly and the actions of its locomotive engineer did not contribute to the collision with the runaway locomotive.

3.7 There was no secondary safety defence on the loop at Pines to prevent the runaway locomotive entering the main line.

3.8 The attempts of the track ganger and locomotive engineer of Train 726 to stop the runaway locomotive were commendable but unsuccessful.

4 Safety Recommendation

4.1 On 1 March 2005 the Commission recommended to the Chief Executive of Toll Consolidated NZ Limited that he:

> introduce a procedure for stabling of locomotives, so that the person applying the handbrake is able to confirm application by visually checking contact between the brake blocks and wheels (011/05).

4.2 On 26 April 2005 the Chief executive of Toll Consolidated NZ Limited replied in part:

> Toll Rail intends to review your recommendation through its Technical Committees to evaluate the robustness of the defence you propose and, if potential gaps are found to exist, consider alternative options that will prevent rail vehicles running away when left unattended on the controlled network. It is anticipated this review will be complete by end June 2005. A target implementation date will be advised when this review has taken place.

Approved for Publication 28 April 2005

Hon W P Jeffries
Chief Commissioner

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