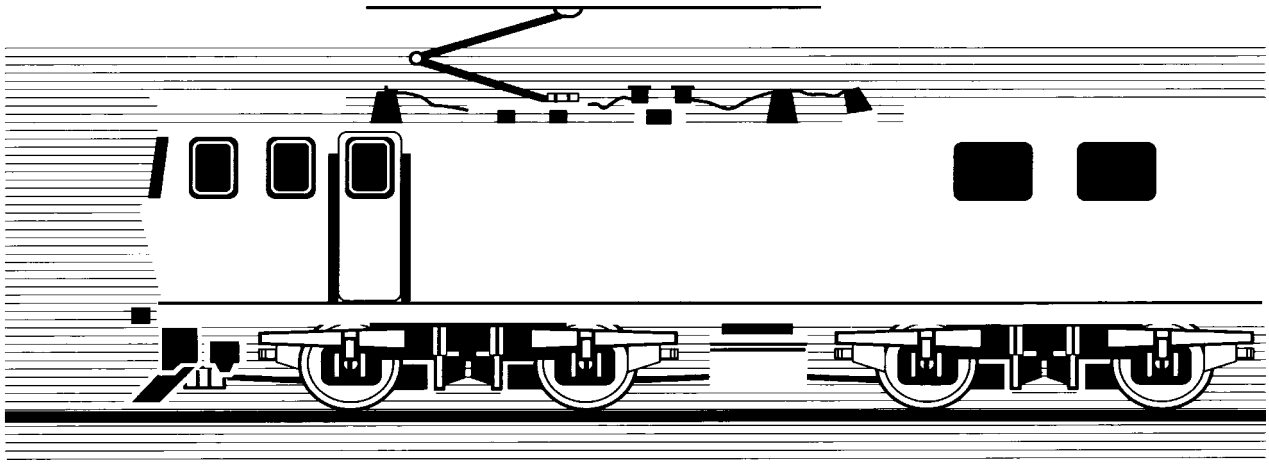
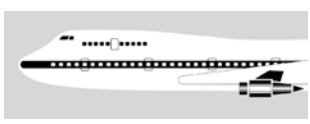
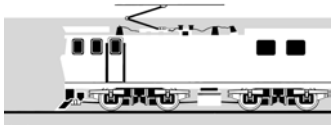


RAILWAY OCCURRENCE REPORT

02-101	derailments due to washouts and slips, various trains and locations	between 3 January 2002 and 19 January 2002


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 02-101

express freight Train 841, Buller Gorge, 3 January 2002
express freight Train 929, Rangitata, 4 January 2002
express freight Train 720, Mina, 19 January 2002

derailments due to washouts and slips

Abstract

This report examines 3 derailments due to washouts and slips (occurrences 02-101, 02-102 and 02-103) caused by inclement weather in the South Island during January 2002. No serious injuries were sustained but the opportunity existed in each case for more serious and potentially life threatening injuries to have occurred.

Safety issues identified by these incidents included:

- the lack of a formalised early warning river flow level notification process for the Rangitata River
- the lack of staff available to respond to operating contingencies during the holiday period
- the lack of adequate relief arrangements to cover track staff annual leave programmes
- the lack of a defined process for implementing special track inspections during inclement weather
- the length of time between special track inspections and the arrival of the first train

Three safety recommendations were made to the operator to address these safety issues.

Contents

Figures

Abbreviations

cumecs	cubic metres per second
hr	hour(s)
km	kilometre(s)
km/h	kilometres per hour
m	metre(s)
t	tonne(s)
TC	train controller
Tranz Rail	Tranz Rail Limited

Data Summary

Rail Occurrence No.	Train	Date	Time[1]	Km & Line	Locality
02-101	express freight 929	04-01-02	About 2150	Rangitata River Bridge Main South Line	Between Hinds and Rangitata
02-102	express freight 841	03-01-02	About 2245	106.5 Stillwater – Westport Line	Buller Gorge, between Inangahua and Westport
02-103	express freight 720	19-01-02	About 0030	117.9 Main North Line	Mina

Type of occurrences: derailments due to washouts and slips

Injuries: nil

Damage: various track, locomotive and wagon damage

Operator: Tranz Rail Limited (Tranz Rail)

Investigator-in-charge D L Bevin

[1] Times in this report are New Zealand Daylight Time (UTC + 13 hours) and are expressed in the 24-hour mode.

1 Introduction

1.1 During January 2002 a number of washouts and slips caused derailments of train services in the South Island. Because of commonality they have been combined in this report The incidents are summarised below:

- **Occurrence 02-101:** on Friday 4 January 2002, Train 929 ran into a track subsidence beside the Rangitata River on the Main South Line near Rangitata, resulting in the 2 locomotives and 5 wagons derailing and toppling into the river.
- **Occurrence 02-102:** on Thursday 3 January 2002, Train 841 ran into a slip covering the track in the Buller Gorge on the Westport – Stillwater Line, resulting in the 2 locomotives being derailed.
- **Occurrence 02-103:** on Saturday 19 January 2002, Train 720 ran into a track subsidence near Mina on the Main North Line, resulting in the locomotive and 10 wagons being derailed.

1.2 The factual information and analysis applicable to each incident are dealt with separately, followed by an analysis summary and common sections covering all findings and safety recommendations.

1.3 Tranz Rail's Infrastructure Group Track Code T003 specified 3 track and structures inspection regimes:

1.3.1 Normal scheduled inspections: Instruction P20 (in part) stated:

> These inspections ensure that the track and structures are safe for the passage of trains at authorised speeds until the next scheduled inspection.

1.3.2 Special Inspections: Instruction P22 (in part) stated:

> In times of danger special inspections shall be carried out. Length Gangers must arrange for such inspections as considered necessary to safeguard the passage of trains when:
>
> there is a likelihood of damage or obstruction to the line due to storm, flooding, earthquake, fire or wind.

1.3.3 Holiday Inspections and Suspended Services: Instruction P23 (in part) stated:

> Inspection days may be rescheduled…when holidays fall on normal inspection days …
>
> When regular services have been cancelled or suspended, if there have been no trains for 5 days, an inspection is not required. Where services are to be reinstated an inspection is required at least the day before resumption of traffic to allow time for repair etc.

2 02-101, Train 929, Rangitata, 4 January 2002

2.1 Factual Information

Narrative

2.1.1 On Friday 4 January 2002, Train 929 was a southbound express freight travelling from Christchurch to Dunedin. The consist was a DX locomotive and a DC locomotive in multiple with 28 loaded wagons for a total gross tonnage of 1107 t and length of 512 m and was crewed by a locomotive engineer.

2.1.2 When Train 929 left Christchurch there had been intermittent rain and the locomotive engineer was aware that there had also been continual heavy rain during the previous 24 hours in the catchment areas of the Rakaia and Rangitata Rivers. Consequently he cautiously approached the first of these bridges, the Rakaia River Bridge, and as he crossed it he noticed that the river was running full and that the level was quite high.

2.1.3 At about 2140 Train 929 approached the Rangitata River Bridge (Bridge 57) and the locomotive engineer reduced speed for a semi-permanent[2] 40 km/h speed restriction that was in effect on the bridge for maintenance purposes. Because he was concerned about the weather and its effect on the Rangitata River he remained vigilant and maintained good control of the train. He later estimated his speed to have been about 30 km/h.

2.1.4 From the northern end of the bridge, the locomotive engineer noticed that the river level was not very high, however, as he approached the southern end of the bridge, he noticed about 100 m ahead on the track formation "new metal…it looked like ballast that was all clean and grey" and, although the track alignment appeared to be correct, there was a "dark line" on the river side of the sleepers. He recognised these as signs of a potential new slip and made an emergency brake application. He also tried to activate the emergency button on the locomotive radio[3] as he vacated his seat and crossed to the opposite side of the locomotive, but he pressed the base call button[4] in error.

2.1.5 As the locomotive traversed the washout, it toppled from the track formation and crashed into the river below. It came to rest on its side with the cab quickly filling with water. The locomotive engineer, who had been thrown back to his original side of the cab as the locomotive tipped, eventually located a broken window and was able to escape from the cab and climb on to the side of the locomotive above the water level.

2.1.6 Because it was almost dark and the water around the locomotive was fast moving, the locomotive engineer thought it would be safer to stay where he was until help arrived. However, the locomotive shifted under the force of the water and when he heard another wagon topple from the track formation and into the river behind him he decided to make his way to the bank where he climbed to the top of the track formation. He saw a member of the public coming across the field towards him, so he made his way over to this person who provided a mobile telephone for him to ring the emergency services.

2.2 Locomotive event recorder

2.2.1 The locomotive event recorder was damaged by immersion in water so it was not possible to access the locomotive performance data.

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[2] Semi-permanent speed restrictions are long-term speed restrictions that are not included in the Working Timetable. They are notified on Bulletins.

[3] When pressed this button sent an emergency radio signal to the train controller.

[4] When pressed, the base call button registered the locomotive and train number in the radio calls computer for the train controller and advised him that the locomotive engineer wanted to converse with him.

Figure 1
The leading locomotive, DX5195, after the water level had subsided

Figure 2
The second locomotive, DC4686, lying at right-angles to the track formation

Analysis 1

1. The locomotive engineer's cautious approach to the Rangitata River bridge as a result of his prior knowledge of the continual heavy rain in the catchment area, together with the 40 km/h semi-permanent speed restriction in effect for the bridge, meant that the train was travelling at reduced speed as it approached the washout. This was reflected by the fact that in the short distance from the southern bridge abutment to the washout site he had time to identify the washout and respond by making an emergency brake application and attempt to send an emergency radio alarm before crossing to the other side of the cab.

2. The locomotive engineer's inadvertent pressing of the radio base call button rather than the emergency button was understandable given his situation. There was no subsequent delay in arranging emergency services because a member of the public had already raised the alarm.

3. No confirmation of the speed of the train was available because data held in the locomotive event recorder had been lost. However, at the locomotive engineer's estimate of about 30 km/h when it left the south abutment of Bridge 57, he would have had less than 12 seconds to react once he saw and recognised the washout before the locomotive went into it.

2.3 Site information

2.3.1 The Rangitata River bridges were located on the Main South Line between Hinds and Rangitata. Bridge 57, the northern bridge, was located at 127.20 km, was 610 m long and crossed the main channel. The second bridge, Bridge 58, located at 129.52 km, was 317 m long and crossed the south branch of the river. The distance between the bridges was about 2.3 kms.

2.3.2 A reference to Bridge 57 in the inspection regime contained in the Essential Features List, required that an inspection of the northern and southern track formations to Bridge 57 be carried out during heavy rain.

2.3.3 There was a semi-permanent speed restriction of 40 km/h in effect on Bridge 57 for maintenance purposes. This restriction was not related to weather or river flow conditions.

2.3.4 A groyne (groyne 1), constructed of concrete blocks, waste concrete and other materials, had been built some years earlier about 300 metres south of the southern abutment of Bridge 57. It stretched from the track formation about 50 m into the river bed.

2.3.5 From groyne 1, an expanse of land that was covered in vegetation including poplar trees, ran north, adjacent to the track formation, towards the southern abutment of the bridge. At its widest point, this land was about 70 m from the track formation (see Figure 3).

2.3.6 Groyne 2, of similar construction to groyne 1, was positioned about 50 m from the track formation at the tip of a second outcrop of land (see Figure 3).

2.3.7 A further 20 m north, or downstream of groyne 1, a row of old railway wagons filled with concrete had been placed alongside the track formation for about 70 m towards Bridge 57. They had been placed there in about 1957 to add stability to the side of the track formation.

2.3.8 The washout was about 100 m long, starting about 97 m beyond the southern abutment of Bridge 57 and continuing south to a point about 90 m before groyne 1. It was adjacent to the north end of a row of concrete-filled railway wagons (refer Figure 3).

2.3.9 About 4 km upstream from Bridge 57, a section of the river bank had been designed to collapse should the river flow exceed 1500 cumecs, to allow water to flow into the south branch. This method of flood protection had gradually been superseded by the introduction of other initiatives and the south branch had become dry and was mostly farmed or covered in gorse and vegetation.

2.3.10 The last washout affecting the track formation at Rangitata in the 10 years prior to January 2002 had been in December 1995.

2.3.11 In 1999 Tranz Rail's regional manager, track and structures, southern, had written to the group general manager, infrastructure, advising of his concerns about the limited amount of river protection work that had been done since April 1998. The letter stated that although the track formation had been rebuilt in 1996, it was by no means secure and was porous when under flood. The letter concluded that despite the work already done, the track formation at Rangitata was still vulnerable to failure in a significant flood.

2.3.12 Since 1996 Tranz Rail had gained resource consent for the construction of a further 3 groynes out from the track formation into the river bed and 2 further groynes upstream on the true right (direction of flow) bank. It had not been possible to establish the timescale for this work to be carried out but at least some of the work on the groynes had been undertaken at the time of the washout.

2.4 River level flows and early warning process

2.4.1 River level early warning systems with formal notification arrangements were in place between Tranz Rail and the Canterbury Regional Council (the Regional Council) for the Waimakariri, Selwyn and Rakaia Rivers. Although notification arrangements were not formalised for specific levels of the Rangitata River prior to the accident, Tranz Rail was a recipient of general flood warning alerts issued by the Regional Council.

2.4.2 The Regional Council operated a flow recorder for the Rangitata River at the Rangitata Gorge, about 33 km upstream from Bridge 57 (see Figure 4). The peak flow on the day of the accident was recorded at 0815 as 1496 cumecs. Following the accident, the Regional Council advised that the estimated time for a recorded flow to reach Bridge 57 would have been between 4 and 5 hours, so the peak flow at the bridge would have been between 1215 and 1315.

2.4.3 Historic information supplied by the Regional Council showed that the mean annual flood flow level was 1098 cumecs and that the return period for a flow level of 1496 cumecs was 3 years[5]. The highest flood peak flow recorded recently was 2169 cumecs in December 1995 which caused significant damage to both rail and road infrastructures.

2.4.4 Notifications from the Regional Council were directed to the network control manager and the train control emergency telephone within Tranz Rail.

2.4.5 There had been a Regional Council telephone number established in 1996 through which river level information could be accessed. Tranz Rail did not regularly access this number.

2.4.6 Tranz Rail stated that it believed a direct link to the river flow gauge at the Rangitata Gorge was not necessary as the existing early warning process did work but was not supported by solid communication protocols.

[5] On average a flow of 1496 cumecs could be expected every 3 years.

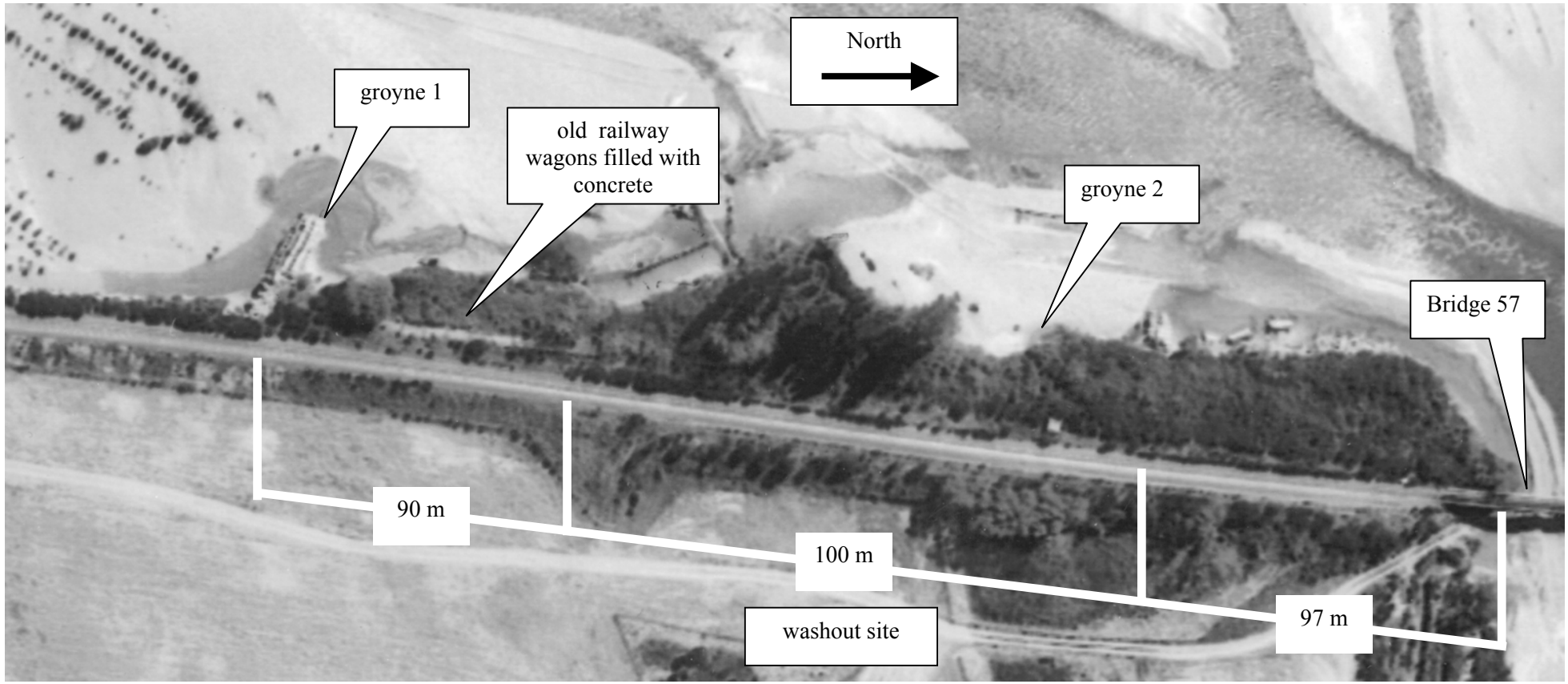

Figure 3
Aerial view of the washout site taken in March 2001
(reproduced from a photograph courtesy of Transit New Zealand)

Analysis 2

1. The potential for a washout to occur as a result of the limited amount of repair and upgrading work done on Rangitata River flood protection was recognised at Tranz Rail's regional office level and had been repeated to head office in February 1999. Although some improvement work had subsequently been authorised and undertaken, it did not appear to have been given a high priority and, as a result, the ongoing damage was probably occurring more quickly than the repair work was progressing. Because flood protection upgrading had not been completed, it would have been prudent for Tranz Rail to have monitored the flow and channels of the river during peak flows to ensure that they were not creating a risk to the track formation.

2. The porous nature and condition of the track formation was confirmed by the fact that although the river level of 1496 cumecs was high, it was not an uncommon occurrence. The peak river flow on the day of the accident was 30% less than that recorded in 1995 and the track formation protection groynes should have been able to withstand such a flow. Although the river flow was not unusually high, it is possible that the channel nearest to the embankment was carrying an abnormally large amount of the flow. This could account for the eventual loss of the land and poplar trees from alongside the formation.

3. By advising Tranz Rail of the rising water level in the Rangitata River the Regional Council gave the company ample time to respond. The fact that the distance between the measuring site and the bridge was not mentioned probably indicated an assumption by the flood controller that Tranz Rail were aware of it. Although there was a notification process in place for river levels in the Rangitata River, it seems to have been more generalised than the formal process in place for other rivers in the Canterbury region.

4. How Tranz Rail considered that in this case the early warning process had worked, but had not been supported by effective communication, was not clear. The special inspection arranged by the train controller had been undertaken between 3 and 4 hours before the peak flow reached the bridge and, when it finally did reach the bridge, there were no staff on duty to monitor the situation. The misunderstanding regarding the water level at the bridge at the time of the notification probably came about because the flood controller assumed that train control was aware of the location of the measuring gauge, whereas train control assumed that the gauge was situated at the bridge.

2.5 The flood process

2.5.1 Groyne 1 was designed to protect the land mass by deflecting flood waters back into the river. However, over a period of time the land mass had been eroded by the flood water flowing around the end and back behind the groyne (see Figure 3).

2.5.2 The water then scoured out the land beneath the concrete-filled wagons and reached the track formation (see Figure 6). Once it reached the formation the water ran against it in a northerly direction towards the rail bridge, about 300 m away. As the water level rose the track formation became saturated and piping or seepage occurred. As the land mass was eroded the track formation became further exposed and accessible to the force of the river.

2.5.3 Following the flood, groyne 2 was left isolated in the river (see Figure 7) as the landmass which had earlier reached it from the track formation (see Figure 3) had disappeared.

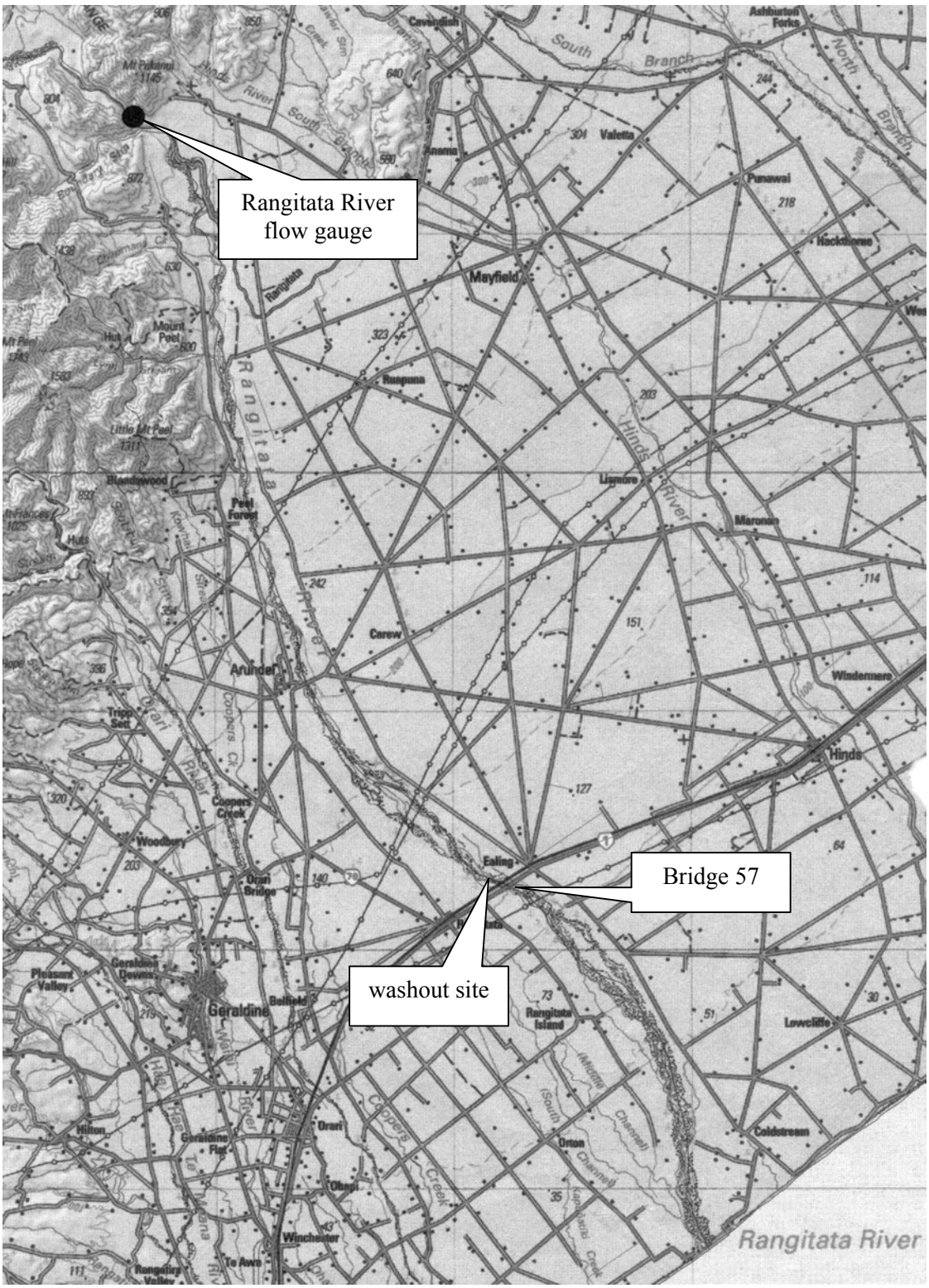

Figure 4
Map showing location of the Rangitata River Rail Bridge and the flow recorder at Rangitata Gorge
(map courtesy of Canterbury Regional Council)

2.5.4 At the request of the track and structures manager a local farmer had inspected the site several times during the day; his last visit having been at about 1700. At that time he had noticed that most of the poplar trees on the land mass protecting the track formation were still in place and he advised the track and structures manager that he thought the water level had receded since his previous visit. He was not unduly concerned by the conditions, although it appeared that one of the groynes may have been damaged as a result of the water flow and he recommended that the track and structures manager carry out an inspection of the site the following day.

2.5.5 A Regional Council representative had visited the site at 0700, 1030 and 1330 on the day. His last visit was timed to coincide with the anticipated peak flow of the river. Although his inspections were primarily for flood protection purposes, he said he would have reported anything of concern regarding the bridges or the track formation to Tranz Rail. He did notice some minor seepage through the track formation but when he left the site after his last visit he was satisfied that there was no reason for concern regarding the effect of the river level on the track formation.

Figure 5
Looking downstream at groyne 1

2.5.6 Another farmer who lived about 5 kms downstream of Bridge 58 had viewed the river from the track formation at about 2000. He farmed much of the south branch and was concerned that the main channel might overflow into the south branch and flood his property. Accompanied by his son, he had driven to the railway line. As they approached the site, they saw a northbound freight train (Train 922), which had just travelled over the track formation, moving away from them in the distance. They left their vehicle and walked along the formation to view the river but did not go as far as the area where the washout occurred. They saw nothing that concerned them and, as they had just seen a train cross the formation without incident, they left the site and returned home.

Figure 6
Looking upstream at the northernmost concrete filled railway wagon with the track formation to the left (photograph taken the day after the flood)

Figure 7
Groyne 2 after the land between it and the track formation had been washed away

Analysis 3

1. Between 0800 and 2000 about 8 visits were made to the track formation; the first a special inspection by the senior track maintainer and his colleague, at least 3 by a local farmer at the request of the track and structures manager and 4 more by other parties. With the exception of the locomotive engineers on passing trains, no Tranz Rail staff visited the site from about 0900, when the special inspection was completed, until after the accident nearly 13 hours later.

2. The land mass and most of the poplar trees appeared to have largely withstood the full force of the peak of the river flow. However, some time after the local farmer's last visit the remaining trees collapsed, which probably had the effect of accelerating the erosion rate at the site. However, it was possible that the erosion of the track formation had been going on for some time but had not been visible because of the overhanging vegetation. There had been a dramatic change in the condition of the track formation between the time the local farmer did his last inspection at about 1700 hours, and the arrival of Train 929. The loss of the remaining poplar trees and surrounding land mass probably accounted for the change.

3. Evidence of seepage through the track formation had been visible at the site suggesting that the river had been flowing against the track formation for some time, possibly cutting off the toe of the track formation, although probably hidden from view. The track formation was left waterlogged and significantly weakened and probably collapsed as the water receded, a phenomenon known as the "draw down" effect. The passage of Train 922 over the track formation while it was in this weakened state probably further contributed to its deterioration.

2.6 The train controllers

2.6.1 At about 0800 the train controller who was working on the Main North Line desk (TC1) received the call from the flood controller for the Regional Council. He was told that the Rangitata River was running high and that he might like to get the Rangitata River rail bridge checked. The level of the river had been given as 1400 cumecs and he was told that the river was probably at or near its peak as the rain had stopped in the catchment area.

2.6.2 The bridge was not in TC1's jurisdiction, so he passed the information on to the Main South Line train controller (TC2), in whose area of control it was, but in doing so he mistakenly quoted the river level as 14 000 cumecs. TC2 asked TC1 when the peak of the river flow was and TC1 replied that he believed the river was at peak flow at that time.

2.6.3 At about 0810, TC2 attempted to contact the track and structures manager for the area on his office telephone in Christchurch but received an answer phone message. This gave a mobile telephone number so TC2 tried to contact him on that number. Again the response was an answer phone message but this time he left a message and asked the track and structures manager to contact him. He then rang the track and structures manager's home telephone number and left a similar message on that answer phone, after which he rang the track inspector for the area and also left a message on his answer phone.

2.6.4 TC2 said that since he had been working on the Christchurch train control desks this was the first time that he had received information relating to river flow levels from the Regional Council. Because he was initially unsure of what action to take, he had discussed it with TC1. He was unaware of any arrangement for the Regional Council to provide such information to train control.

2.6.5 At about 0813 TC2 received a radio call from a senior track maintainer at Temuka who requested time on track for a hi-rail vehicle to move south from Temuka to the 156.5 km towards Timaru. TC2 was aware that the length ganger for the Rangitata Bridge section was on annual leave, so he arranged for this senior track maintainer to instead go north to inspect Bridge 57 before the passage of Train 901 Christchurch to Invercargill *Southerner* passenger express, which was scheduled through the area at about 0945.

2.6.6 At about 0835 the senior track maintainer again called TC2, this time from the 130.87 km, between Rangitata and Hinds, and requested time on track for the hi-rail vehicle to travel north to the 126.0 km to check Bridges 57 and 58 and the track formation between them. He estimated he would be clear of the track by 0900 and TC2 authorised the movement. When the special inspection had been completed, he again contacted TC2 and advised that the bridges and track formation were safe for the passage of Train 901 and that he would again check the area before the passage of the next expected train, which was Train 902, the Invercargill to Christchurch *Southerner* passenger express. No request was received by TC2 for a temporary speed restriction to be implemented through the area at that time.

2.6.7 At about 0903 the track inspector responded to the telephone message left by TC2 and told him that he was on leave until the next Monday. TC2 was surprised and said that they did not appear to receive holiday lists from any gangers any more. The track inspector replied that he should have received one as a call-out list for the track staff had been made up 2 or 3 weeks before Christmas. TC2 told the track inspector that the water level was rising and that a figure of 14 000 cumecs had been quoted by the Regional Council, although he was unsure exactly what that meant. The conversation was then terminated. The Engineering Services Southern Region call-out list had been emailed to the train control manager on 11 December 2001 and showed that the track inspector was on leave from 29 December 2001 until 6 January 2002 and was not on-call, although he was available by mobile telephone if required.

2.6.8 At about 0913 the track and structures manager contacted TC2 and they discussed the rising river level. He asked at what time the peak was expected and was told by TC2 that he understood it was at its peak at that time. TC2 also told him that a senior track maintainer had completed an inspection of the track formation and bridges at Rangitata and given clearance for the passage of Train 901 and that he was going to do another inspection ahead of Train 902 later in the day. The track and structures manager was satisfied with that but said he would also contact a local farmer and get him to assess the highest point at the bridge, and that he might impose a 10 km/h speed restriction, depending on the height of the water. He said he would contact TC2 again once that had been arranged.

2.6.9 The track and structures manager telephoned TC2 later and asked that a 25km/h speed restriction be implemented over the Rangitata River bridges and the track formation between them. TC2 endorsed the train control diagram accordingly. The track and structures manager had not given specific times during which the temporary speed restriction was expected to remain in effect nor the kilometrage points between which it was to apply but TC2 expected it to remain in effect until further notice. Because of the small number of trains scheduled to run through the section, it was agreed that speed boards would not be erected but that train control would verbally advise the locomotive engineers of these trains of the speed restriction.

2.6.10 At about 0920 TC2 instructed the locomotive engineer of Train 901 to reduce speed to 25 km/h over the Rangitata Bridge because of the reported high river level. The locomotive engineer acknowledged the request and advised TC2 that the river level in the Rakaia River, which he had just crossed, was also high and running swiftly. He had noticed several large trees in the middle of the river and was concerned that if they moved with the water they could cause damage to the bridge. He suggested to TC2 that he try and get a ganger to have a look at it. TC2 passed this information on to the track and structures manager who said he would arrange for someone to go and check the bridge. The Rakaia River Bridge (Bridge 53) was located at the 64.9 km, about 62 km north of the Rangitata River Bridge.

2.6.11 At about 1432 TC2 instructed the locomotive engineer of Train 925, a Christchurch to Dunedin express freight train, to reduce speed to 25 km/h over the Rakaia River bridge and also advised him of the 25 km/h temporary speed restriction that was in effect over the Rangitata River bridges and the track formation between them.

2.6.12 As well, TC2 had been experiencing an intermittent signalling fault at Ashburton and at about 1440 he received a radio call from a signal maintainer advising that he had located the cause of the fault but that he was having trouble contacting track staff to effect repairs. He told TC2 that he had left a message on the track and structures manager's telephone but had not heard back from him and said that if he did not get the fault fixed he would have to put a 10 km/h speed restriction on all trains travelling through Ashburton and Tinwald because, as a result of the fault, the level crossing alarms would not be operating. TC2 told him that track staff at Ashburton were on leave but that track maintainers from Timaru were working and suggested he try and contact them.

2.6.13 At about 1445 TC2 received a call from a railway contractor at the 66.6 km, near Rakaia, who wanted to check the Rakaia River bridge by travelling over it on Train 925. TC2 spoke by radio with the locomotive engineer of Train 925 and arranged for the contractor to be picked up at a point near the bridge and conveyed across it for inspection purposes. TC2 did not hear again from the contractor following his inspection.

2.6.14 At about 1450 TC2 commenced his shift handover to the incoming train controller, TC3, and told him of the 25 km/h speed restriction in place over, and between, Bridges 57 and 58 at Rangitata. He confirmed with TC3 that he had advised the locomotive engineer of Train 925 of the restriction but had not yet advised the locomotive engineer of Train 902, which was at that time about an hour away from the site. He also told TC3 that the senior track maintainer was going to do a special inspection through the area ahead of Train 902 but at that stage he had not heard from him. When TC2 checked the train control diagram some days later he noted that there had not been a special inspection ahead of Train 902.

2.6.15 The locomotive engineer of Train 902 called TC3 at about 1521 to say that he was ready to depart from Timaru and TC3 advised him of the 25 km/h speed restriction in effect at Rangitata. He told the locomotive engineer that he was not sure when the section had last been patrolled but that it had not been done since the start of his shift at 1500. The locomotive engineer replied that he thought it had last been looked at prior to him running through the section that morning on Train 901. TC3 said that he thought it must be clearing itself if no other inspections had been done.

2.6.16 At about 1647 TC3 contacted the locomotive engineer of Train 902 after he had passed through the site and asked him for an update on the situation. The locomotive engineer said that the river level appeared to have dropped from when he had seen it earlier in the day. He added that water was starting to seep out of the river into the ground and that there was more water there than there was in the morning. After TC3 heard that he contacted the locomotive engineer of Train 925, which was the next train through the area, and told him to restrict his speed to 25 km/h between and including the Rangitata bridges. He also told him that although the river level was dropping he should travel cautiously through the area, at least on the southbound trip.

2.6.17 The locomotive engineer of Train 925 said later that after passing the site, he felt that the 25 km/h temporary speed restriction had been a bit of an overreaction to the situation. It was still daylight when he travelled back through the area on Train 922 at about 2000 but there had been no mention from train control that the temporary speed restriction was still in effect. This was about 1 hour 40 minutes before Train 929 entered the site and derailed.

2.6.18 At about 2140 TC3 tried to respond to a radio base call from Train 929 but could not lock-on or get any response despite trying both verbal and base calls on 2 different repeaters. At almost the same time the train controller working on the Main North Line desk received a call from the Police saying that a train had toppled in to the Rangitata River and that emergency services

were on the way. He passed this information on to TC3 who immediately arranged for track staff to respond.

Analysis 4

1. When TC1 received information regarding the river flow, he had not realised that the reading was taken at a site about 33 km upstream and that the peak flow would not reach Bridge 57 at Rangitata for several hours, so he assumed that the river flow related to the bridge at that time. Although TC1 was not operating the Main South Line train control desk at the time he had considerable experience on it and it was therefore probable that other train controllers who operated that desk also would have been unaware of the distance of the gauge from the bridge, and may have assumed that it was at the bridge.

2. When the notification was received TC2 also assumed that the reading related to Bridge 57 at that time. Given that the notification had not included any advice as to where the reading had been taken, and there was no procedure in place for notifications on the Rangitata River, these assumptions were understandable. Nevertheless, the manner in which he responded to the notification was consistent with the procedure for handling other adverse weather notifications. However, this accident highlighted shortcomings in the handling of such notifications in general.

3. It was not surprising that TC2 had never before received river flow information from the Regional Council. He didn't work only on the Main South Line train control desk and the number of notifications received, when spread among the number of different train controllers who worked the desk, meant that he would have had few opportunities to receive or respond to such notifications. His unfamiliarity with the process to deal with such information highlighted a shortcoming in the procedures for the handling of notifications of adverse weather conditions by train controllers. However, since this incident Tranz Rail has introduced a documented procedure to cover such notifications and a copy is attached to this report as Appendix 1. In view of the action taken no safety recommendation covering this issue was made.

4. TC2's efforts to get a special inspection of Bridge 57 carried out prior to the arrival of Train 901 was hindered by his inability to contact the on-call track and structures manager and because he had not had access to an up-to-date call-out list of the relief length gangers. If such a list had been available, he may have been able to contact alternative staff, although being a holiday period, it was possible that they were also on leave. As a result, when he received a radio call from the senior track maintainer at Temuka he arranged for him to do a special inspection, rather than lose further time waiting for the track and structures manager to respond. This ensured a track clearance was received for Train 901 prior to its arrival on site and probably avoided a delay to the train.

5. Although TC3 had been made aware of the expected track inspection during the shift handover, he did not attempt to contact the track staff concerned to confirm arrangements before he dispatched Train 902 into the section. His action was probably based on the assumption that as there had been no further inspection patrols from the track staff since that undertaken earlier in the day, the situation in the area must have improved. In fact the planned special inspection ahead of Train 902 had been inadvertently overlooked by the track maintainers.

6. When Train 902 travelled through the site at about 1600, the locomotive engineer noticed that the river level had dropped but he would not have known that it had not been at its peak when he saw it earlier, while passing through on Train 901. The river level had peaked about 3 hours after his trip through on Train 901 and 3 hours prior to his return trip on Train 902.

7. The locomotive engineer of Train 902 would not have realised that the water he saw seeping through the track formation when he returned on Train 902 was caused by piping[6], the reason the track and structures manager had initially implemented the 25 km/h temporary speed restriction over that section of track formation.

8. When TC3 was told of the water seeping through the track formation he also would not have associated that with any potential track formation weakness, although he took the added precaution of confirming the 25 km/h speed restriction with the locomotive engineer of the next train through the area. The Regional Council staff member had also seen some seepage through the embankment when he inspected the site at about 1330 but he also probably did not recognise the significance of it.

9. TC3's comment to the locomotive engineer of Train 925 that the "restriction was just for this trip on the way down", would have suggested to the locomotive engineer that the speed restriction would not be in effect on his return trip on Train 922 and this would have been confirmed during his trip through the site when he had felt that there was nothing to give any cause for concern. As a result he was probably not expecting the speed restriction to still be in effect when he returned about 3 hours later.

10. TC3's response to the radio base call from Train 929 had been expeditious and he had tried alternative channels in his attempts to establish contact. However, he could not have known that the radio base call was in fact meant to be an emergency signal and he was still trying to make contact when the Main North Line train controller advised him of the accident.

2.7 The track and structures manager

2.7.1 The track formation from Rakaia at the 68 km to the 154.5 km, south of Temuka covered a distance of 86.5 kms and included the Rangitata site. The area was the southern most part of the Main South Line responsibilities of the track and structures manager in Christchurch and was under the day-to-day jurisdiction of the length ganger at Ashburton, who was on annual leave at the time. There was an authorised staff establishment of 2 at Ashburton, including the length ganger, but the second position had been vacant for about 6 months.

2.7.2 The track and structures manager said that at the time his area had been operating with between 3 and 4 vacancies. To meet the Company's requirement of as many staff as possible being booked off over the holiday period, the only track work activity undertaken was track inspections to a reduced schedule. The nearest staff available for call-outs in his area were in Christchurch as all other staff had been booked off on leave.

2.7.3 The track and structures manager was also on annual leave on the day of the accident but was on-call, however he had been temporarily outside of mobile telephone coverage when TC2 had tried to contact him. It was not until about 0913 that he received the message and was able to respond.

2.7.4 During his conversation with TC2 the track and structures manager said he would contact a local farmer to gauge the level of the river. The farmer had lived on the banks of the Rangitata River for nearly 50 years and over that time had gained a significant knowledge and experience of the river. The track and structures manager respected this knowledge and had an informal arrangement whereby he could contact the farmer to obtain up-to-date information and assessments on the river in times of high level flows. He arranged for the farmer to regularly inspect the site during the day and report back to him but at the time the farmer made his first inspection the river had not reached its peak flow level.

[6] A term used to describe leaching or subsurface erosion.

2.7.5 From the farmer's initial information the track and structures manager felt that there may have been an overreaction to the situation. He said that from river levels given to him, he was not concerned about damage to the track formation from either a washout or erosion caused by the actions of the river, but rather caused by piping. As a result of this concern he imposed a 25 km/h temporary speed restriction to be in effect during the hours of daylight that day.

2.7.6 The track and structures manager said that piping had occurred at this site for many years and had not caused any major concerns. However, since he had taken charge of the area he had developed a strategy whereby he either had the length ganger in attendance or implemented a temporary speed restriction with special inspections arranged ahead of passenger services. He was satisfied that the action taken by TC2 was adequate as he was not expecting a particularly large river flow and, because of the holiday period, he knew he probably would have had difficulty finding available staff to assist.

2.7.7 There was no initial evidence to suggest to the track and structures manager that the river protection groynes had been affected by the river flows being experienced that day.

2.7.8 The track and structures manager had discussed the erection of speed boards with TC2 and it was agreed that, because he expected the speed restriction to be in effect for less than 24 hours and there were relatively few trains scheduled to run, speed boards would not be erected and train control would verbally advise locomotive engineers of the temporary speed restriction as they approached the site. He believed that for short term duration temporary speed restrictions it was permissible for speed boards not to be erected.

2.7.9 The track and structures manager's decision not to continue the temporary speed restriction beyond daylight hours was based on:

- the information he had received during the day, which indicated that the water level was dropping
- no problems had been reported from the initial special inspection
- the semi-permanent 40 km/h speed restriction already in effect on Bridge 57
- arrangements were in place for a second special inspection before Train 902 passed through the area

His decision was not confirmed with train control.

2.7.10 When the track and structures manager had been advised by TC2 of the logs in the Rakaia River he made arrangements for the railway contractor to undertake a site inspection. The railway contractor had telephoned him from the site later to tell him what action he had taken. The railway contractor then stayed on site at train control's request and rode across the bridge on Train 925 to conduct an inspection. The track and structures manager said that he could have instructed the contractor to move on to the Rangitata River site but felt by this time that the river level there would have subsided.

2.7.11 When the track and structures manager arrived on site immediately after the incident he noticed that there was water pooling on the ground on the opposite side of the track formation to the river, between the track formation and State Highway 1, which was consistent with piping having occurred.

Analysis 5

1. It is possible that had the track and structures manager been immediately contactable and made aware of the situation at Rangitata he would have arranged for a special inspection of the area using his own staff. Had this happened the requirement for a temporary speed restriction would have been assessed by staff on site from where they could have given TC2 all the relevant information relating to the speed restriction and arranged for the erection of speed boards. However, the reduced number of his own suitably qualified staff on duty meant that he may have had problems getting staff to attend.

2. There were 2 track staff positions in Ashburton but only one was filled. The track and structures manager's adherence to Tranz Rail's requirement that as many staff as possible be booked off duty over the Christmas / New Year period meant that his ability to get staff with local knowledge to the site was impaired and it was most likely that, even if there had been a full complement of staff at Ashburton, they would both have been booked off duty in compliance with the company directive.

3. By the time the track and structures manager had made contact with TC2, the special inspection had been completed and the opportunity for him to effectively manage the initial response to the notification had been lost. He did not receive any feedback from the senior track maintainer following the special inspection.

4. From the track and structures manager's previous experience, and supported by information from initial reports of the river levels from the farmer, he was more concerned about damage to the track formation from piping rather than either a washout or erosion. He was not on-site at the time and did not know that the river had not reached its peak flow at the time of the first reports from the farmer.

5. While the track and structures manager's initial assessment regarding river levels had been confirmed by reports from the farmer, the flood controller at the Regional Council had felt that the potential for flooding was such that he had contacted train control and expressly mentioned the Rangitata River Bridge. This should have prompted a more proactive response with regard to an inspection of the site. However, by the time he had been advised of the situation a special inspection had been completed and he would reasonably have expected that if any problems had been identified he would have been advised. The fact that he had not heard anything to the contrary probably reinforced his belief that the river levels and potential flood risk had been overrated.

6. During the time the farmer lived beside the river he had developed an extensive knowledge of its movements, and the track and structures manager had an informal arrangement whereby he used that knowledge during potential high river flows. While such information was useful, in this instance it appears to have been used as a basis for decision making rather than the more appropriate action of arranging for the situation at the bridge to be monitored by Tranz Rail staff, particularly as the track and structures manager had concerns about water seeping through the track formation.

7. No evidence of piping had been reported to the track and structures manager following the special inspection so it was likely that it commenced after the river level had peaked and begun to subside. The Regional Council representative who was at the river at 1330 noticed some seeping which would suggest its appearance coincided with the peak river flow.

2.8 Special track inspections

2.8.1 Although intermittent rain had been falling in Christchurch and South Canterbury during the morning, conditions were such that there was no suggestion of a need for a special inspection of

the Rangitata River bridges or track formation and at the time the special inspection was run prior to Train 901, the water level peak flow measured at the Rangitata Gorge had not yet reached the Rangitata site.

Analysis 6

1. The heavy rainfall that led to the high water level in the Rangitata River had occurred in the river catchment area, several kilometres inland from the eventual derailment site, and meant that Tranz Rail staff would have been unaware of it. It was raining only intermittently in Christchurch, and not at all where the track and structures manager was, so the need for a special track inspection as detailed in the Essential Features List would probably not have been considered necessary.

2. The long-standing practice of booking as many track staff off-duty as possible during holiday periods meant that there was no length ganger available at Ashburton to implement a special inspection. However, even if staff had been on duty, it is unlikely that they would have taken such action given the weather conditions that existed in the area at the time, even though they would have been aware that the site was a potential trouble spot. However, the presence of a staff member would have been of immense value to the train controllers as it would have provided them with an effective point of contact through which to co-ordinate activities.

3. Although track inspection requirements were altered during the holiday period to reflect reduced traffic flows, and to provide an opportunity to reduce staff, these changes meant that the response time to an occurrence could be significantly extended while the train controller tried to contact call-out staff. In the absence of local staff, a comprehensive list of available relief or call-out staff, capable of carrying out such duties in overlapping areas, should have been available to enable a quick response in such circumstances. A similar unavailability of staff was identified in occurrence 02-102 concerning Train 841 derailing in the Buller Gorge in January 2002.

4. Although Tranz Rail's procedures specified that the length ganger was responsible for arranging special track inspections, TC2's attempts to contact the track inspector for this purpose were justified for the following reasons:

    - he had not been able to make immediate contact with the track and structures manager and he urgently needed competent track staff to do a special inspection of the site before Train 901 travelled through
    - he knew that the length ganger at Ashburton was on leave but did not have a call-out list for the holiday period for relief length gangers
    - the title "track inspector" probably created an expectation that this person could, and would, do a special inspection.

5. While special inspections of potential track problem areas prior to the passage of a train were a positive safety action, their effectiveness was dependent on the amount of time between the inspection and the train passing through the site because an unmonitored deterioration of the site could occur during that time. In this case, the time difference was 45 minutes, which was probably excessive.

6. The senior track maintainer was not expecting this additional work when he first contacted TC2 and, when requested to undertake the special inspection, probably wanted to get it done as soon as he could, so he could get back to his own work. He would also have been conscious of the need to avoid a delay to Train 901 and this would also have influenced his decision to get the inspection done as soon as possible.

2.9 Call-out lists

2.9.1 Tranz Rail's Network Code Section 4.01 gave the following contact requirement that applied to the roles identified at any time:

> The whereabouts (or contact number) of all Area Managers and Managers/Supervisors must be known at their headquarters during normal working hours. At other times Area Managers and Supervisors must leave information with their Manager and/or Train Control on where they or their deputy can be located when away from home. If they will not be available for emergency callouts, they must make arrangements for a competent person to act in their stead.

2.9.2 A copy of the Engineering Services Southern Region call-out list covering managerial and supervisory positions during the Christmas/New Year period was supplied by Tranz Rail. It showed that the track and structures manager was on annual leave from 22 December 2001 to 6 January 2002 but that he was on-call during that time. The track inspector for the area was shown as on leave from 29 December 2001 to 6 January 2002 and, although he was not on-call, he was contactable by mobile phone if necessary. The list had been forwarded by e-mail to the train control manager.

2.9.3 A computerised master list of on-call staff was held on the respective train control desks for reference by train controllers. Alterations to that list were prepared by the respective work groups and forwarded to the train control manager, who distributed the relevant alterations to the train control desks where they were then made by a delegated member of the train control staff assigned to that desk. However, there appeared to be no documented requirement for track and structures managers to distribute a call-out list of length gangers and track maintenance staff for holiday periods and Tranz Rail was unable to provide one for the Rangitata area for the Christmas/New Year period, although the track and structures manager had prepared such a list for his own use.

Analysis 7

1. The copy of the Engineering Services Southern call-out list for managers and supervisors held in the train control office and which TC2 had used to contact the track inspector had not been updated to incorporate changes for the Christmas/New Year period, even though an updated list had been emailed to the train control manager. If the call-out list had been up-to-date, TC2 would have known that the track inspector was on leave from 29 December 2001 until 6 January 2002 and was not on-call during that time. There was no reason to believe that the list of amendments for the Christmas/New Year period had not been received in train control, however the changes had not been incorporated into the master call-out list held on the Main South Line train control desk.

2. The lack of an up-to-date call-out list for track staff other than managers and supervisory staff reduced the options available to TC2 to call an alternative appropriately certified track staff member in response to the situation.

3. There was no formal arrangement in place for an on-call staff member to cover the absence of the Ashburton length ganger.

2.10 Implementation of temporary speed restrictions

2.10.1 Tranz Rail advised that its process for implementing temporary speed restrictions in response to adverse weather conditions was the same as that for standard temporary speed restrictions and that speed boards were to be erected as soon as possible after the restriction was imposed.

2.10.2 Tranz Rail's Rules and Regulations Rule 90 (l) stated in part that when a train controller was notified of a speed restriction, he must immediately arrange that, until the restriction is notified by train advice, the locomotive engineers of all trains that will pass over the defective place are advised particulars.

2.10.3 Tranz Rail's Rail Operating Rules and Procedures Rule 912 (c) Advice to Train Control stated:

> When it is found necessary to temporarily reduce the speed of trains the person in charge at the defective place must immediately:
>
> Advise particulars of the restriction to Train Control who must:
>
> Arrange for the Locomotive Engineers of all trains which will pass over the defective place to be advised particulars until the restriction is notified.

2.10.4 Tranz Rail's Rail Operating Rules and Procedures Rule 912 (e) Erection of Speed Boards stated in part that the person in charge at the defective place must:

> Arrange for the placing of … Temporary Speed boards which must be maintained until normal speed may be resumed.

2.10.5 The train controller was required to enter the details of the temporary speed restriction into Amicus, a computer system that provided integrated information management for customer billing, freight movement, vehicle status and train operations with Tranz Rail. However, during his shift TC2 also had responsibility for the Stillwater to Westport Line where a train had run in to a slip in the Buller Gorge the previous night (see occurrence 02-102) and he said that as a result of the increased workload generated by the recovery programme he had omitted to do this.

2.10.6 Screen TCSP[7] provided the ability to process speed restriction information and track outages as soon as they became available from track staff and allowed immediate access for viewing or printing accurate information on all restrictions that were in force throughout the network. When a train controller was advised of a temporary speed restriction the following details were required to be entered:

- line
- metrage from
- metrage to
- stations between
- speed
- Up, Down or single track
- reason code
- boards applied (yes or no)
- gang responsible
- comment or extra explanation if required

Once the information was confirmed, the restriction was entered into the system and a new list of speed restrictions was then automatically printed to pre-selected locations on the route.

[7] An input screen within the Amicus computer system used by train controllers to input data.

2.10.7 Tranz Rail estimated that it would take about 30 seconds to enter a speed restriction into the system and said that the procedure was detailed in Amicus user guides and operating procedure process charts.

2.10.8 The track and structures manager said that when he had implemented the temporary speed restriction he had asked for it to be in effect "during daylight hours". TC2 said that he had not been given any expiry time and believed "it would remain in effect until the ganger called him to remove it." The Amicus screen gave the train controller a check list of information required for the preparation of a temporary speed restriction advice. The time during which the speed restriction was to remain in effect was not required because such temporary restrictions remained in place until they were actively lifted or cancelled by an authorised person.

Analysis 8

1. The track and structures manager had been unable to provide the exact kilometrage points between which the temporary speed restriction was to apply because he was not on site when he was talking to TC2. The requirement for kilometrage points was listed in the Amicus input screen check list and, had the requirement to enter the speed restriction into Amicus been adhered to, reasonably accurate kilometrage points could have been established from the train control diagram. Although the exact kilometrage points were required for the Amicus input screen the use of clearly defined geographical points, Bridges 57 and 58 and the track formation between them, meant that the area covered by the speed restriction was clearly defined and easily recognisable by locomotive engineers.

2. Agreement had been was reached between the track and structures manager and TC2 that speed boards would not be erected alongside the track. Again, the Amicus input screen required that the existence or not of speed boards be recorded for printing on the updated list. The decision not to erect speed boards at the site, together with the fact that there was no updated speed restriction printout list available to locomotive engineers, meant that the only means of notifying them of the temporary speed restriction was by verbal advice from the train controller. As a result there were no defences in place to warn locomotive engineers if the train controller did not do so. The informal process used to implement the speed restriction probably lead to the later confusion about when and if it had been lifted.

3. There had been no input from any on-site Tranz Rail staff prior to the 25 km/h temporary speed restriction being imposed and it was not possible to determine by whose authority and at what time the temporary speed restriction had been lifted, but it was probably between the passing of Trains 925 and 922 through the site. It is possible that the speed restriction was not formally lifted or cancelled but rather had simply lapsed after a certain time, for example "during daylight hours". However, Train 922 had travelled through the area in daylight and the locomotive engineer had not been advised of the speed restriction, although he was probably not surprised as he had earlier travelled through the area on Train 925 and had thought then that the 25 km/h speed restriction in place at that time had been an overreaction to the conditions encountered.

4. TC2's expectation that the temporary speed restriction would remain in effect until he was formally requested to remove it was reasonable given that he was expecting the senior track maintainer to do another inspection run ahead of Train 902.

2.11 Track maintenance staff

2.11.1 The senior track maintainer had been employed by Tranz Rail for about 26 years, most of which had been in the South Canterbury area. He was aware of the requirement to carry out track inspections in inclement weather, but did not know that the length ganger for the neighbouring section covering the Rangitata River bridges was on leave when the inspection was required.

2.11.2 The senior track maintainer was responsible to the track and structures manager in Dunedin, while the Ashburton section was under the control of the track and structures manager in Christchurch. However, when requested to do so by TC2, he had immediately travelled north to Rangitata, accompanied by an acting track maintainer, and carried out a special inspection before the passage of Train 901. It was not uncommon in the interests of achieving improved utilisation of staff for them to cross area managers' boundaries.

2.11.3 During the inspection, they stopped the hi-rail vehicle and inspected the track formation on foot but saw nothing that caused them any concern. They noted that the river was flowing faster on the southern side of the main channel than the northern side but that overall it was not running as high as the acting track maintainer had seen in the past, notably in 1995. They completed their inspection and off-tracked but the senior track maintainer did not remember arranging with TC2 for another inspection to be done ahead of Train 902.

2.11.4 The senior track maintainer and the acting track maintainer then returned south to Temuka by State Highway 1 to continue their planned work. When this was completed they returned to Timaru to have their vehicle serviced because it was defective. It was returned to them about 1500 and they again travelled north to Ashburton on State Highway 1, to work on a defective insulation joint that had been reported to them.

2.11.5 The acting track maintainer said that he had spoken to TC3 at about 1700 on completion of the work at Ashburton but no mention had been made of a requirement to do another inspection at Rangitata so they returned to Timaru. When they crossed the State Highway 1 bridge over the Rangitata River, which ran parallel to the rail bridge, they noticed that the water level had dropped and they felt there was nothing that warranted a further inspection. However, they did not communicate this to train control.

2.11.6 Between 0905, when the senior track maintainer had completed his special inspection, and 1500, when he crossed the river on the State Highway 1 road bridge while returning to Ashburton, the river level had peaked and dropped. When he next crossed the river at about 1715 on his return to Timaru the level had dropped even further.

Analysis 9

1. During their inspection, the track maintainers had walked along the track formation and it was reasonable to expect that had there been any evidence of piping or seepage at that time they would have seen it and reported it. The fact that the senior track maintainer gave track clearance to TC2 for the passage of Train 901, together with the fact that he did not contact the track and structures manager, indicated that he had no concerns about the site as a result of the inspection.

2. The second special inspection had probably been forgotten by the track maintainers because of their diverse workload following the initial inspection. They were working at Ashburton at the time Train 902 travelled over the site.

3 02-102, Train 841, Buller Gorge, 3 January 2002

3.1 Factual Information

Narrative

3.1.1 On Thursday 3 January 2002, express freight Train 841 was a westbound Christchurch to Ngakawau empty coal train and consisted of 2 DX class locomotives in multiple hauling 19 empty coal wagons for a total tonnage of 309 t and length of 309 m. The train was crewed by one locomotive engineer.

3.1.2 The locomotive engineer commenced duty in Westport at his rostered time of 1700 on Thursday 3 January 2002 and drove by car to Greymouth where he took up the running of express freight Train 844, an eastbound Greymouth to Christchurch loaded coal train, which he drove to Moana. At Moana he changed over to Train 841 and commenced his return journey to Westport.

3.1.3 It was raining heavily as Train 841 passed through Reefton, about 30 km from the entrance to the Buller Gorge but had eased to drizzle when it passed through Inangahua at about 2225 and entered the gorge. The locomotive engineer made compulsory Buller Gorge radio calls (see 3.6 Compulsory radio calls) to train control at Mackley and Berlins, the latter at about 2240, both of which were acknowledged by the train controller.

3.1.4 The locomotive engineer had just returned his radio handpiece to the holder when he noticed a large pile of rocks about 15 m high between 250 and 300 m ahead of the train. Because of the darkness and the rain it took him another 2 or 3 seconds to establish if it was a slip across the line or the hillside at the end of the straight he was travelling over. While he was still about 150 m away he realised it was a slip and made an emergency brake application. He tried to make an emergency radio transmission to train control but missed the button as he dived to the floor, where he lay as the locomotive ran into the slip, collided with something solid and deflected off the track to the left. The emergency brake application immediately prior to running into the slip transmitted an emergency radio signal to train control.

3.1.5 The locomotive came to a stop and when the locomotive engineer stood up he found it was leaning over about 10 to 15 degrees. He sent an emergency radio call to train control that was responded to immediately and he advised the train controller of the derailment and also that he was not injured.

3.1.6 Westport track staff were called back from leave to go to the derailment site, which was only accessible by hi-rail vehicle, to assist the locomotive engineer.

3.1.7 The Stillwater to Westport Line travelled adjacent to the Buller River and through the Buller Gorge, from the 93 km to the 126 km between Tiriroa and Inangahua. The Essential Features List required that inspections be undertaken at the following sites within the gorge during heavy rain:

- From the 96.0 km to the 96.5 km – **Buller River scouring embankment** causes drop outs / slumps
- From the 104.0 km to the 115.5 km – **All up hill faces prone to slips** mud, rock and scrub

3.1.8 The slip occurred at the 106.5 km between Tiriroa and Inangahua. Although this was within an identified area it was not a known particular trouble spot and there had not been any slips there previously.

3.2 Site information

Figure 8
Looking south at the derailment site (photograph courtesy of Tranz Rail)

3.2.1 There was no procedure in place between the West Coast Regional Council and Tranz Rail for the measuring and reporting of river or rainfall levels. The nearest rain gauge operated by the West Coast Regional Council was about 8 km east of the derailment site.

3.3 The locomotive engineer

3.3.1 The locomotive engineer had about 25 years experience and held a grade 1 certificate. He had been based at Westport for 5 years before the accident.

3.3.2 It had rained heavily during the night of 2 January and the rivers in the area had flooded. As a result the length ganger, although officially on leave, had been called back to work on 3 January to clear debris from the track at Granity, about 28 km north of Westport, towards Ngakawau.

3.3.3 Before the locomotive engineer had departed from Westport he had spoken to the length ganger who told him that, despite the heavy rain the night before, the Buller Gorge had been basically alright during an inspection earlier that day, although some water had gone over the track at Cascades and there was a 10 km/h speed restriction at that point. He was also told by the length ganger that there was no one available to patrol the Buller Gorge at night.

3.3.4 When Train 841 entered the Buller Gorge it was drizzling although it had been raining heavily at Reefton. The locomotive engineer had no concerns about conditions within the gorge. It had been fine all day before he left Westport and with only drizzle to contend with in the gorge he did not expect problems. He said that there had been 2 washouts at Cascades early in December that closed the track for about a week while repairs were carried out.

3.3.5 The locomotive engineer expressed concerns about the continued absence of track staff at Westport once the train programme had started again. In the interests of safety he felt it was necessary to have staff available to come to a locomotive engineer's assistance in the event of an emergency. Track staff had been called back from leave at 2240 to go to his assistance but did not get to him until 0010.

3.3.6 Tranz Rail's procedures included the use of a helicopter in response to emergencies in the Buller Gorge. It was expected that emergency services and the helicopter would be called if contact was not established with a train or there were known injuries to crew.

3.4 The train controller

3.4.1 Train control for the West Coast of the South Island was undertaken from the national train control centre in Wellington. The train controller with responsibilities for that area had commenced work at 1500 and during the evening had been made aware of the extreme weather conditions on the West Coast by members of the public who had telephoned to advise him of high running rivers, both towards Hokitika, south of Greymouth, and at Ikamatua on the Stillwater to Westport Line. He had passed this information on to the acting track and structures manager in Greymouth, who advised that an inspection had already been done on the Stillwater to Westport Line but that he would arrange a special inspection of the Hokitika Line, which subsequently resulted in the Hokitika Line being closed because of a washed out culvert.

3.4.2 The inspection of the Stillwater to Westport line referred to by the acting track and structures manager was in relation to the resumption of train services rather than a special inspection in response to adverse weather conditions.

3.4.3 The train controller had received a compulsory radio call from the locomotive engineer of Train 841 at Berlins, which was followed within seconds by an emergency radio call. He was able to contact the locomotive engineer about 30 seconds later and was advised of the circumstances. After ascertaining that the locomotive engineer was uninjured, he contacted the acting track and structures manager in Greymouth again because he knew the track staff at Westport were on leave. The train controller was told to call the Westport staff back from leave to attend the scene.

3.4.4 The train controller had been surprised that no special inspection was planned for the Buller Gorge as he knew from his extensive experience that the line was historically unstable and had only recently been closed for several days because of slips.

3.5 Track staff and inspections

3.5.1 Staff in Reefton and Westport had been booked off duty to meet Tranz Rail's requirement that as many staff as possible take annual leave during the holiday period. The only track work activities being undertaken were track inspections to a reduced schedule, so the nearest staff available for call-outs on the Westport - Stillwater Line were in Greymouth.

3.5.2 There had been no train movements through the Buller Gorge since 24 December 2001, 7 days earlier, and Train 841 was the first scheduled train after that break. Tranz Rail's Infrastructure Group Track Code Clause P23 Holiday Inspections and Suspended Services stated in part that:

> When regular services have been cancelled or suspended, if there have been no trains for five (5) days, an inspection is not required. Where services are to be reinstated an inspection is required at least the day before resumption of traffic to allow time for repair, etc.

3.5.3 An inspection had been done on 3 January 2002, prior to the commencement of train operations in accordance with Code requirements. Because track staff in both Westport and Reefton were on annual leave the inspection was undertaken by an Acting Track Inspector from Greymouth. He travelled by road to Westport from where he commenced his inspection run.

3.5.4 During the inspection run, the Acting Track Inspector found debris on the track at Cascade, at the 121.0 km within the Buller Gorge. Water from an overflowing culvert had washed out some sleeper bays but he cleared the damage and was satisfied that it was safe for trains to run. He did not encounter any further problems during his inspection.

3.5.5 Tranz Rail's Infrastructure Group Track Code T003, Instruction P22 stated in part that:

> In times of danger special inspections shall be carried out. Length Gangers must arrange for such inspections as considered necessary to safeguard the passage of trains when:
>
> there is a likelihood of damage or obstruction to the line due to storm, flooding, earthquake, fire or wind.

3.5.6 Track maintainers could run inspection patrols if requested by the train controller on the advice of locomotive engineers or make their own decision to do so, based on local knowledge. However, heavy rain was often localised so track maintainers were dependent on locomotive engineers to advise of the need for special inspections.

3.6 Compulsory radio calls

3.6.1 Tranz Rail's Working Timetable Section L8 stated in part:

> It is recognised that it is beneficial that the location of trains in the Buller Gorge be more accurately defined as an aid to pin-pointing the area to which assistance be directed should it be required when communication is not possible.
>
> To facilitate this, notice boards denoting "Compulsory Call Location" have been erected in the Buller Gorge at the following locations:
>
> - Te Kuha (at 126.09 km)
> - Cascade (at 120.80 km)
> - Tiriroa (at 115.81 km)
> - Berlin (at 106.00 km)
> - Mackley (at 99.60 km)
>
> At each compulsory call location the Locomotive Engineer of an ATC train MUST base call Train Control …Train Control upon receiving a radio call from such locations will acknowledge the call as soon as possible and MUST record the progress of the train with the time called, on the Train Control diagram.

Analysis 10

1. The inspection that had been done earlier in the day and prior to the resumption of train services over the line met Code requirements but did not fulfil the requirements of a special inspection, nor was it expected to. However, because of Tranz Rail's requirements regarding annual leave there were no local staff to gauge weather conditions in the region or to determine requirements for special inspections.

2. The inspection through the Buller Gorge had been done at about 0900, nearly 14 hours before Train 841 ran into the slip. Given the train controller's concerns about possible conditions in the Buller Gorge as a result of advice from members of the public, it would have been prudent for the acting track and structures manager to have arranged a special inspection prior to Train 841 travelling through the area.

3. Track inspections prior to the recommencement of train services were a Code requirement but their effectiveness was dependent on the amount of time between the inspection and the running of the first train, as an unmonitored deterioration of the track foundation or infrastructure could occur during that time. In this case the time difference was probably excessive. A similar issue regarding the timing of track inspections ahead of train services was identified in occurrence 02-101 concerning Train 929, which derailed and plunged into the Rangitata River in January 2002.

4. The adequacy of relief arrangements to cover leave was highlighted by the need to call staff at Westport back from leave to provide assistance to the locomotive engineer. It took 90 minutes for assistance to reach him, probably about the same time as it would if they had not been on leave, but there was a certain element of luck in that they were available and willing to be called back from leave. If this had not been the case the nearest staff would have been in Greymouth, at least 2 hours drive away.

5. Although the use of a helicopter was included in Tranz Rail's emergency procedures it is doubtful that it would have been used in this instance as contact was made with the train, and there were no injuries. Weather conditions at the time may also have precluded its use.

6. The long-standing practice of booking as many staff off-duty as possible during the holiday period meant that there was no length ganger available in either Westport or Reefton and, because of inadequate relief arrangements, Tranz Rail was dependent on the goodwill of staff on leave to be called back to work in emergency circumstances. However, this arrangement was effective only until the trains started running again at which time it would have been prudent to have ensured a length ganger was rostered back on duty to cover such requirements as inspections and emergencies. Again, this is particularly important in remote or inhospitable areas.

7. A similar issue regarding unavailability of staff was identified in occurrence 02-101 concerning Train 929, which derailed and plunged into the Rangitata River in January 2002.

4 02-103, Train 720, Mina, 19 January 2002

4.1 Factual Information

Narrative

4.1.1 On Saturday 19 January 2002, Train 720 was a northbound express freight travelling between Christchurch and Picton. The train consisted of a DX class locomotive and 20 wagons for a total tonnage of 586 t and length of 322 m.

4.1.2 Train 720 departed from Christchurch at 2035 and proceeded to Waipara where the locomotive engineer held a track warrant to cross opposing Train 735. On arrival at Waipara, the locomotive engineer was advised that Train 735 had stalled at the 122.00 km, between Spotswood and Tormore, and he was issued with a new track warrant to proceed to Tormore, about 38 km further north, to provide assistance to the disabled train.

4.1.3 On arrival at Tormore, the locomotive engineer uncoupled his locomotive from the train in preparation for going to assist Train 735. He received another track warrant from train control and then proceeded to the 122.00 km where Train 735 was disabled, passing over a culvert at the 117.90 km as he did so.

4.1.4 The locomotive crew from Train 735 coupled the assisting locomotive to the front of the disabled train, which was then hauled back to Tormore. This necessitated the locomotive of Train 720 running in reverse. The locomotive engineer of Train 720 again crossed the culvert at the 117.90 km on the way back to Tormore. On arrival the assisting locomotive was uncoupled from Train 735 and attached again to Train 720. Train 735 continued under its own power.

4.1.5 After the locomotive engineer of Train 720 had received a new track warrant from train control he departed from Tormore, bound for Ferniehurst. At that time the rain was getting heavier and by the time the train passed through Domett, about 5 km short of the washout site, it was very heavy and visibility was significantly reduced.

4.1.6 The locomotive engineer recalled that he was doing between 50 - 60 km/h as he approached the 117.00 km peg at about 0030 around a 65 km/h maximum speed right hand curve, when he noticed some ballast over the right hand rail. He made a minimum brake application and said that the locomotive bounced around as it rode over the ballast and crossed a small washout before it went into a bigger washout. The locomotive rode out of the second washout but the impact threw the locomotive engineer from his seat and up to the roof of the cab before he landed back on his seat again.

4.1.7 During this time, the locomotive engineer had applied the emergency brakes and hit the emergency radio button. He thought that the locomotive had derailed because of the rough riding but then re-railed itself because all of the locomotive's wheels were back on the rails when the train stopped. The locomotive had become detached from the rest of the train. During the impact the leading bogie had come up and hit the underside of the locomotive cab and frame and buckled the cab floor.

4.1.8 The locomotive engineer was shaken and suffered bruising, cuts and scratches as a result of being thrown around the cab. When he went back to ascertain the damage he found several washouts, extensive track damage and 10 wagons of his train derailed.

4.2 Site information

Figure 9
The washout site looking south, the direction from which Train 720 approached (photograph courtesy of Tranz Rail)

4.2.1 The 117.90 km peg was approached from the south around a 900 m right-hand curve. The authorised speed for the curve was 90 km/h, which was also the maximum authorised line speed for the area.

4.2.2 The culvert at the 117.90 km peg was originally an open culvert with hardwood timber beams 325 mm x 300 mm x 2.1 m. The original opening was about 1 m wide by 1.5 m deep, giving a maximum full depth waterway of 1.5 m^2.

4.2.3 In 1982 the timber beams were reported as decayed and a 750 mm diameter concrete pipe was placed in the opening. The short bridge beams were replaced and back-filled with ballast. The 750 mm pipe was about 2.5 m below the rail level and provided a waterway area of about 0.4 m^2.

4.2.4 About 10 m on the western side of the track was an access road that ran parallel to the track for several hundred metres in both directions. Beneath this road there was another culvert consisting of a 750 mm concrete pipe, the outflow from which was directly opposite the culvert under the railway track formation (see Figure 10).

4.2.5 A boundary fence ran alongside and below the access road. The water ran off under the fence and into the culvert beneath the access road. There was a layer of netting attached to the lower boundary fence wires to prevent stock climbing under the fence at the water run off point.

4.2.6 In the depression immediately west of the access road, the level to which the water had banked up could be determined from a watermark of debris in the surrounding field (see Figure 11). As the water runoff increased during the rain, the layer of netting had trapped a large amount of debris. As a result of the water building up behind it, the netting detached from the boundary fence and was pushed into the opening to the culvert beneath the access road where it subsequently blocked the water flow. The netting was later recovered from the culvert entrance.

Figure 10
The eastern intake for the culvert beneath the track formation, taken from the access road following the washout (photograph courtesy of Tranz Rail)

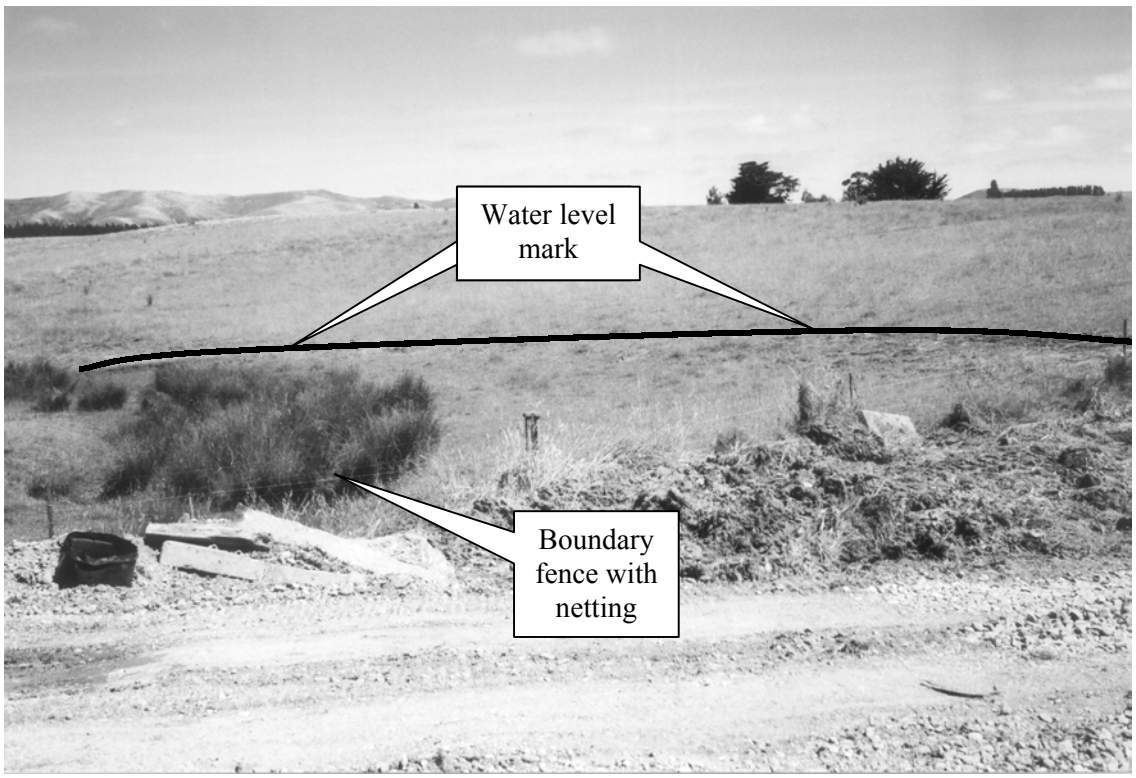

Figure 11
The depression on the western side of the access road showing the water level mark

4.2.7 The water banked up against the access road formation then flowed with some force over the top, taking with it clay and shingle as it flowed firstly across the access road then down into the culvert beneath the track formation. This debris settled in the culvert and impeded the flow of water. Tranz Rail had not been able to advise when the culvert was last cleaned out, but regular visual inspections had been undertaken prior to the washout and the culvert had not been obstructed at those times.

4.2.8 The area between the culverts rapidly filled with water, which then spread along the track formation for a distance of about 40 m north and 150 m south, and beyond the access road into the field for about 40 m. The track formation south of the culvert was later found to have been washed out in 4 places over a distance of about 100 m.

4.2.9 Another culvert, about 260 m further north at the 118.16 km, was also washed out by the run off from the rain. Although neither of the culverts had been considered as trouble spots, the culvert at the 118.16 km had previously washed out in 1986.

4.3 The locomotive engineer

4.3.1 The locomotive engineer had 41 years experience and held a held a current grade 1 certificate. His shift had started at 1905 on Friday 18 January following a rostered day off-duty.

4.3.2 Although it was raining when Train 720 departed from Christchurch, the locomotive engineer said it was not heavy. It was still raining when he arrived at Tormore but was light enough that he didn't require his wet weather protective clothing when he left the locomotive cab to uncouple his train.

4.3.3 The locomotive engineer was sitting in the driver's position on the eastern side of the locomotive when he left Tormore to go to assist Train 735, and noticed nothing unusual regarding water levels of the stream which ran along his side of the track formation, adjacent to the washout site. Train 735 was crewed by 2 locomotive engineers and when he arrived at the

disabled train one of them coupled his locomotive to the train. It was raining at the time but not hard and this crew member had not been wearing wet weather protective gear either as he undertook this task.

4.3.4 On the journey back to Tormore the crew of Train 735 rode in the cab of the locomotive of Train 720 with the locomotive engineer. No concerns about the water levels were raised although, by then, it had started to rain harder.

4.3.5 En route to Tormore they heard over the train control radio, the track maintainer for the area advise the train controller that he was "concerned enough to go and run the section." The locomotive engineer of Train 735 thought that the rain must have been heavier where the track maintainer was than where his train was at that time. From the radio conversation he thought that the track maintainer was going to look at known trouble spots rather than where he was.

4.3.6 Following the derailment, the locomotive engineer recalled how surprised he had been at the water damage, given the amount of rain that had fallen, and felt that the water may have originated from another source rather than just rainfall runoff. On his first trip north through the area, to assist Train 735, he had slowed down to have a look at the stream at Mina but noticed that it was running normally with no sign of rising water. When he next travelled north through the area about 40 minutes later, after having assisted Train 735 back to Tormore, he ran in to the washouts.

4.3.7 A farmer, who had arrived onsite about 15 minutes after the derailment, remarked to the locomotive engineer that he thought the water had come from a farm dam which had burst further up the valley. Tranz Rail track staff who attended the scene found no evidence of a burst dam on farms they visited nor on site suggesting a large volume of water had travelled down from the surrounding farms and contributed to the washouts.

4.4 The track maintainer

4.4.1 The track maintainer said that heavy rain showers had occurred in the area during the night and 2 local rain gauges to which he had access had recorded levels of 97 and 118 mm respectively during a 2-hour period.

4.4.2 The rain had been such that it had disturbed the track maintainer's sleep and given him concerns for the condition of the track. He contacted a fellow track worker and together they went to inspect known trouble spots in their area. In the Essential Features List there was a reference to potential large land movements and slumps between 101.00 km and 101.600 km (the Ethelton slip), which required that an inspection be undertaken during heavy rain, and this was the site he gave priority to.

4.4.3 The track maintainer was aware that Train 735 was at Tormore waiting to proceed south so he gave instructions to train control that it was not to do so until he had run the section ahead of it. He also learned that Train 720 was proceeding north from Tormore but, because the locomotive engineer had previously been through the area while assisting Train 735, he was happy for it to continue north, but that the locomotive engineer should be cautious.

4.4.4 Before the track maintainer reached the Ethelton slip, he heard on the train control radio that Train 720 had run into a washout at the 117.80 km. After it was confirmed that the locomotive engineer was unhurt, he continued with his inspection to Ethelton as planned. This inspection found a washout at the Ethelton slip and train services throughout the area were suspended until a full inspection could be done at daylight.

4.5 Locomotive event recorder

4.5.1 The locomotive event recorder was downloaded and supplied for analysis.

Analysis 11

1. When the locomotive of Train 720 had travelled through the area to assist Train 735, the locomotive engineer had been on the opposite side to where the water build-up was occurring and, as such, his assessment of the situation based on the level of the stream beside him was justified. As the locomotive rounded the right hand curve, the headlight would have swept across the farm paddock and probably would not have highlighted the water lying in the depression. The locomotive engineer's visibility would also have been further restricted by the rain and by the access road that ran between the railway line and the farm paddock where the water was backing up.

2. While returning to Tormore with Train 735 attached, the locomotive engineer would still have been on the opposite side to the water building in the depression. Although there were 2 more people with him in the cab at this time, their visibility would probably have been restricted, not only by the rain and the access road, but also because the locomotive was running in reverse. Because of this it is not surprising that the rising water was not sighted on either of these trips across the culvert.

3. It was likely that the water had been building up behind the access road for some time, having been flowing into the depression while the culvert under the access road was blocked. The water line formed by debris indicated that a significant lake had developed before the water reached the top of the access road and flowed over and into the culvert between the access road and the track formation. The pipe under the track formation was unable to cope with the volume and pressure of water, which then flowed over the access road formation and quickly filled the gap between the culverts. The water travelled in both directions before it breached the formation and washed the ballast out in 4 places over a distance of 200 m. However, there was nothing to suggest that the culvert pipe that had been installed to replace the original timber beams was not of sufficient size to cope with water flows under normal conditions. The culvert probably became blocked by debris from the access road being washed into the culvert and impeding the water flow.

4. The locomotive engineer's perception that the water may have come from another source was understandable, given that he did not think that the rain had been particularly heavy and that he had not seen any evidence of it building during his earlier trips through the area. His judgement of the rainfall at the time had been confirmed by the fact that none of the locomotive crew members had considered it necessary to resort to protective wet weather clothing while coupling and uncoupling the locomotives during the assistance sequence.

5. Tranz Rail had investigated the possibility that the water had come from a burst dam but they had been unable to find any evidence to support this. Therefore, it was most likely that the water had gradually built up behind the access road as a result of the blocked culvert and reached its peak during a localised torrential downpour, probably while the locomotive engineer of Train 720 was not in the area to witness it.

6. That there had been torrential rain in the area was not in doubt and was confirmed by rain gauge readings. Localised storms were not unusual and the decision of local track staff to undertake a special inspection of a known potential trouble spot in such conditions and ahead of Train 735 almost certainly avoided a potential washout and derailment involving that train. While it may have been prudent to have held Train 720 also until after a special inspection had been run ahead of it, the locomotive engineer had already been through the section twice in the prevailing conditions in a relatively short time and there were no known trouble spots in the area. The length gangers decision to allow the train to proceed was probably justified, and freed him to concentrate his efforts on inspecting the known potential trouble spot site at Ethelton Gorge.

7. The value of local staff was highlighted by the fact that they responded to the localised heavy rainfall and in so doing avoided a potential derailment to Train 735. Had there not been staff at Mina, the extreme weather conditions would probably have gone unnoticed, with the nearest staff being at either Kaikoura or Christchurch, where the weather conditions in both places were such that it was unlikely that special inspections would have been initiated.

8. The locomotive engineer of Train 720 was travelling cautiously when he later travelled back through the site and encountered the washouts and this probably averted a more serious situation, both in injuries and damage. Analysis of the event recorder output for Train 720 showed that the train was travelling about 49 km/h as it approached the washout site.

5 Analysis Summary

5.1 The 3 incidents all involved events caused by the forces of nature. It is unlikely that the natural events could have been prevented. However, the interaction between the trains and the slip and washouts would probably have been prevented had appropriate special inspections been carried out.

5.2 A review of the common features associated with these 3 accidents showed:

- all happened as a direct result of inclement weather
- although no serious injuries resulted from the accidents there was the potential in each case for more serious and life threatening injuries to have been sustained
- only one of the derailments occurred on a known and identified trouble spot
- in only one occurrence was a special inspection initiated by local track staff
- in 2 occurrences the length of time between inspections and the running of the first train through the area was excessive
- in 2 occurrences inadequate relief arrangements to cover staff on leave were identified

5.3 Arising from these common factors are the following safety issues:

- the need for adequate relief procedures to cover leave programmes to ensure track staff are available for track or special inspections and emergency situations at all times
- more effective procedures for the implementation and management of special inspections when required to counter the effects of inclement weather or other
- the need to manage special or track inspections to better match the running of trains

The safety recommendations recorded in Section 8 of this report address these issues.

6 Findings

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

02-101, express freight train 929, Rangitata, 4 January 2002

6.1 The major cause of this accident was the washout of about 100 m of track formation by the Rangitata River while it was in flood after it had breached existing flood protection groynes.

6.2 The washout was caused by a river flow that was not unusually high and which the groynes, had they been maintained to an acceptable standard, could reasonably have been expected to protect the track formation.

6.3 The washout occurred in an area that was identified in the Essential Features list and known to be a potential trouble spot.

6.4 Tranz Rail were aware of the poor condition of the flood protection groynes but little work had been done in upgrading them or returning them to an acceptable standard.

6.5 The cautious approach by the locomotive engineer of Train 929 as his train approached the Rangitata River Bridge probably lessened the severity of the impact.

6.6 There was no formalised procedure in place between the Regional Council and Tranz Rail for the monitoring and reporting of water levels in the Rangitata River.

6.7 The peak flow reported by the Regional Council at 0800 was at the upriver gauge site and Tranz Rail staff were unaware that the high river level was due at the Rangitata River bridge between 1230 and 1330.

6.8 TC2's decision to request the senior track maintainer from Timaru to undertake a special inspection of the site was sound and ensured that an inspection was undertaken before the passage of Train 901. However, given that the water level was still rising, the time between the special inspection and the arrival of Train 901 in the area was excessive.

6.9 The inadequacy of relief arrangements to cover the absence of the length ganger at Ashburton was highlighted by the events leading up to this accident. However, even if staff had been on duty at Ashburton it is doubtful that they would have instigated a special inspection based on the weather conditions at the time.

6.10 There was no communication between the senior track maintainer and the track and structures manager during or after the special inspection. Decisions by the track and structures manager regarding the action to be taken was based on his previous experience and regular river level reports from the local farmer.

6.11 After the initial special inspection, no Tranz Rail staff attended the site, with the exception of the locomotive engineers of passing trains, until after the accident nearly 13 hours later.

6.12 The procedures for implementing and lifting speed restrictions, and the notification of such restrictions to locomotive engineers, were not adhered to.

6.13 No attempt was made by TC3 to contact the senior track maintainer at Timaru to confirm the special inspection before Train 902 travelled through the area. Train 902 should not have been dispatched from Hinds without this special inspection being made.

02-102, express freight train 841, Buller Gorge, 3 January 2002

6.14 The major contributing cause to this accident was the slip that blocked the Westport -Stillwater Line.

6.15 The slip was caused by heavy local rain in the vicinity of the Buller Gorge.

6.16 The location of the slip was not identified as a potential trouble spot in the Essential Features list although some sites within the Buller Gorge were. There had been no previous problems at the site.

6.17 The inadequacy of relief arrangements to cover the absence of the length gangers at Westport and Reefton was highlighted by the fact that staff had to be called back from leave to provide assistance to the locomotive engineer. However, even if staff had been on duty at these places it is possible the localised rain may not have reached them, in which case they would not have instigated a special inspection.

6.18 An inspection for the resumption of services was carried out on the morning of 3 January and did find some storm damage from the previous day, which was repaired. Nevertheless, in response to the notification of adverse weather during the evening of 3 January, a special inspection should have been undertaken.

02-103, express freight train 720, Mina, 19 January 2002

6.19 The washouts were caused by the inability of the culvert pipe beneath the access road to cope with the flow of water from the adjacent field. As a result the water flowed over the access road and flooded the culvert under the track formation.

6.20 Once flooded, the culvert under the track formation was unable to cope with its own flow. The water rose against the formation and flowed both north and south until it breached it in several places.

6.21 The special inspection procedures in place for inclement weather avoided a potential derailment of Train 735.

6.22 The decision to allow Train 720 to proceed without a track inspection being done was understandable given that the train had twice passed through the area recently. However, had the train been held pending such an inspection, the washouts would probably have been found and the derailment avoided.

6.23 The cautious approach by the locomotive engineer of Train 720 as it approached the washout site probably minimised both the risk of injury to him and the extent of damage to the train.

7 Safety Actions

7.1 On 28 March 2002 Tranz Rail advised relating to the Rangitata Bridge and track formation in part as follows:

> Tranz Rail has taken the following interim steps at this site:
>
> - A temporary speed restriction has been implemented at the site pending reassessment after completion of permanent track repairs
> - Revised Adverse Weather Condition instructions have been implemented as discussed and agreed with the Land Transport Safety Authority. A copy of these procedures is attached as Appendix 1. [see appendix 1 of this report]
>
> Tranz Rail has commissioned and received an expert report on the incident including an assessment of the inspection process, river protection works and other relevant matters.
> Recommendations from this report are being evaluated and include:
>
> - Design and implement suitable river protection works before end of year,
> - Investigate an arrangement with Regional Council to inspect and manage protection works and other matters including formalising early warning advice from existing flow gauge sites,

- Review inspection procedures during adverse weather and/or high river flows,
- Strengthen inspection procedures and reporting processes around routine structure and track inspections.

Tranz Rail believe that a direct link to the river flow gauge at the Rangitata Gorge is not necessary as the existing early warning process did work but was not supported by solid communication protocols.

7.2 On 2 October 2002 Tranz Rail advised as follows:

The following safety actions have been completed by Tranz Rail or are in progress following the derailment of train 929 at Rangitata on 4 January 2002:

The initial investigation.
Tranz Rail initiated an internal investigation that was kept independent from the Engineering Design office or the Regional Infrastructure office. Mr Don Davis (a senior and respected former Tranz Rail engineer) and Graham Levy of Beca Carter Hollings & Ferner (Beca), conducted the investigation using Mr Levy's expertise in river behaviour, particularly Canterbury braided rivers.

Rangitata remedial work
The initial investigation indicated that the immediate post incident remedial work should be supplemented by additional, designed works before the end of the end of the year.

Tranz Rail engaged Beca to:
Advise on the temporary remedial work that had been carried out. - Beca confirmed that though not suitable for the long term, the temporary work was suitable for the length of time it would take to design and construct further works (approximately until December 2002).
Carry out a full physical survey of the river & design long term remedial works. - Beca has completed this work. The remedial work has been programmed in stages and stage 1 work will be complete by December 2002.

A national survey of similar sites is being conducted (see below). Once this is complete, the National Infrastructure Asset Manager will review the priority of the Rangitata site against the national list and may elect at that time to bring forward the remaining stages of work ultimately required at this site.

National erosion study
The Rangitata site is not unique in the Tranz Rail network and it was possible similar situations could exist elsewhere. Tranz Rail therefore engaged Beca to plan and carry out a National survey of all sites on the network where a similar incident could potentially occur.

It was agreed that a full network inspection was unreasonable and unnecessary & that a desk exercise would be carried out by Beca to identify potential sites and rank them to create a list of sites to be visited. The process involved extensive research including:
Bridge list
Bridge database
Essential features list
Faults list
Incident list
Risk Register
Renewals plan
Scour rating
Interviews - internal (Head office and bridge inspectors)
Interviews – external (Regional Councils and Transit)

Sites identified were both bridge sites and non-bridge sites. These were short listed using a wide range of parameters. A pro forma site visit inspection sheet was developed covering all issues needing inspection.

A sample of these sites has been visited using a team of Beca and Tranz Rail technical staff and the inspection system tested and validated. The programme of site visits will be continued in October and November when longer days will increase the efficiency and thoroughness of each site visits.

Planned Erosion Study
At the conclusion of the field visit -
A decision will be made as to the need to visit sites not short-listed (the plan allows for some of these to be visited to validate the decision not to include them)
Sites needing remedial work will be prioritised, action plans developed, costed and a programme prepared. It is possible the programme will span 3 to 5 years.
Any lessons learned will be incorporated into the inspection or design process

Benchmarking
The Tranz Rail inspection and response processes have been developed over many years and it was appropriate to review these in line with the initial report. Tranz Rail engaged Beca to benchmark Tranz Rail design philosophy and inspection practice against other groups primarily Transit & Local Body RCA. A number of useful comparisons were made and these will be presented to the Structures Technical committee before the end of the year for them to consider and adopt if appropriate.

River controlling authorities
The National Manager Infrastructure is working with Beca to set up protocols with various Regional Councils to increase the level of reporting to Tranz Rail and ways to improve Tranz Rail response to such information.

Reports received as a result of the investigations
Rangitata River Incident – River Investigation
Tranz Rail Bridge Erosion Study – Risk Identification Benchmarking
Tranz Rail Bridge Erosion Study – Draft Interim Report
Tranz Rail Bridge Erosion Study – Draft Interim Report 2 Maps showing proposed sites
Tranz Rail Bridge Erosion Study – Draft Interim Report Appendix F data sheets
Sample audit

Reports yet to receive
Final Draft audit report – Due 15/12/02
Final audit report – Due 15/02/03
Tranz Rail programme of works – Due 15/4/02

Conclusion
Tranz Rail viewed this incident seriously and as well as investigating the multiple circumstances that lead to the event, it has widened the research to incorporate other processes and sites. External experts have carried out this work in detail using sound engineering methodology & lead. While the process is not yet complete the findings so far are a valuable addition to Tranz Rail's existing knowledge and systems and will be incorporated where appropriate into codes, standards and practices.

8 Safety Recommendations

8.1 On 8 May 2002 the Commission recommended to the Managing Director of Tranz Rail that he:

> take immediate steps to institute an inspection/protection regime at the south abutment of Bridge 57 over the Rangitata River which:
>
> recognises the current lack of designed engineering works to protect against relatively low return period floods;
>
> recognises the vulnerability of the protective work and the rail embankment to both full flow and falling river levels;
>
> is linked to the river flow gauge at the Rangitata Gorge to give advance warnings;
>
> requires either:
>
> - patrols immediately ahead of all trains during and immediately following defined river flows; or
> - a sufficiently low speed restriction to assist LE's to stop clear of visible hazards; or
> - the piloting of all trains during, and immediately following, defined river flows; or
> - a combination of the above. (017/02)

8.2 On 7 June 2002 the Managing Director of Tranz Rail responded in part:

> Thank you for your letter dated 8 May 2002. Tranz Rail accept safety recommendation 017/02. As advised in our letter dated 28 March 2002, we have implemented a new inspection and speed restriction regime for adverse weather conditions…

8.3 On 21 January 2003 the Commission recommended to the Managing Director of Tranz Rail that he:

> introduce procedures into the leave programmes for track staff, including length gangers and track maintainers, to ensure adequate qualified staff remain on duty or on call to meet operating contingencies during holiday periods and that the names of such staff are advised to train control (054/02)

8.4 On 4 February 2003 the Managing Director of Tranz Rail responded in part:

> **054/02** – Tranz Rail accept this recommendation. A specific holiday period contingency plan and Call Out list process has been developed and used by Transfield Services over the most recent summer holiday period. Call out lists are located with the 155 Call Centre and are updated weekly.
>
> The 155 call out system covers the need (see preliminary report clause 2.9.3) for the Call Out list of appropriate staff to be distributed and up to date at all times.

8.5 On 21 January 2003 the Commission recommended to the Managing Director of Tranz Rail that he:

> include within existing special track inspection procedures a requirement that such inspections are carried out immediately before the passage of the next train through the affected area (055/02)

8.6 On 4 February 2003, the Managing Director of Tranz Rail responded:

> **055/02** – Tranz Rail accept this recommendation. The requirements of Bulletin No. 167 "Adverse Weather Conditions" demonstrate this recommendation has been implemented.
>
> In addition an engineering project to review erosion potential at bridge sites and to review inspection processes and benchmark them against external comparable organisations was initiated after the incident. This project is now well advanced. Completion of the inspection process review and subsequent confirmation/ amendment of inspection processes is expected by end June 2003.

Approved for publication 29 January 2003

Hon. W P Jeffries
Chief Commissioner

Appendix 1

WELLINGTON

BULLETIN NO. 167
(Semi permanent)

TRANZ RAIL
13 March, 2002

NOTE: Where a paragraph is marked with a vertical line and the print is italic this indicates either it is a new instruction or if it was a previous change a further change has been made.

Adverse Weather Conditions

Adverse Weather Conditions refers to an unusual weather condition where there is a liklihood of damage to the line due to storm, flooding or other cause that **could result in significant risk to the integrity of the track network.**

These can arise from:

- local weather effects eg. storms
- distant weather effects eg. rain in a distant river catchment causing high flows some distance downstream.

Advice Of Adverse Weather Conditions can reach Train Control from a number of sources:

- Local rail infrastructure maintenance staff.
- Locomotive Engineers
- Other local Tranz Rail staff
- Members of the public
- Weather information services
- Territorial authorities (District / Regional Councils etc)

When advised of a possible Adverse Weather Condition Train Control must confer with the local Track & Structures Manager and local Ganger who will advise if it is necessary to declare an Adverse Weather Condition and, if so, the portion of track to be included:

On Declaration Of An Adverse Weather Condition Train Control Must:

- Stop all trains in the affected area.
- Arrange for a special inspection of the affected area.
- After clearance from Infrastructure staff, restrict train speed through the affected area to a maximum of 40 km/h or such slower speed as advised by infrastructure maintenance staff.
- Endorse the train control diagram if the Track & Structures Manager and/ or Ganger have determined additional inspections are to take place before subsequent trains are permitted to travel over the affected area.

The Adverse Weather Condition will be lifted when the unusual conditions have abated and an inspection has confirmed that the track is safe for normal speed running.

The clearance time must be endorsed on the train control diagram.

Network Controller

Recent railway occurrence reports published by the Transport Accident Investigation Commission (most recent at top of list)

02-112	passenger fell from the Rail Forest Express, Tunnel 29, Nihotupu Tramline, Waitakere, Saturday 4 May 2002
02-104	express freight and passenger trains, derailments or near derailments due to heat buckles, various localities, 21 December 2001 to 28 January 2002
02-113	passenger express Train 700 TranzCoastal and petrol tanker, near collision Vickerman Street level crossing, near Blenheim, 25 April 2002
02-107	express freight Train 530, collision with stationary shunt locomotive, New Plymouth, 29 January 2002
01-111	passenger EMU Train 2621, door incident, Ava, 15 August 2001
01-107	passenger baggage car Train 201, broken wheel, Otaihanga, 6 June 2001
01-112	Shunt 84, runaway wagon, Stillwater, 13 September 2001
01-113	DC4185 light locomotive and private car, collision, Egmont Tanneries private level crossing 164.14 km Stratford, 19 September 2001
01-109	passenger EMU Train 8203, doors open on EMU, Tawa, 16 July 2001
01-108	express freight Train 842, derailment, Otira Tunnel, 7 July 2001
01-106	express passenger Train 600 Bay Express and maintenance plant, collision, Muri, 6 May 2001
01-104	express freight Train 547 and express freight Train 531, collision, Mokoia, 7 March 2001
01-102	express freight Trains 237 and 144, derailment and collision on double-line track, Paerata-Pukekohe, 23 February 2001
00-123	Train 3130 and Train 3134, collision, Ellerslie, 28 December 2000
01-101	passenger express Train 901 Southerner and stock truck and trailer unit, collision, Makikihi Beach Road level crossing between Timaru and Oamaru, 8 January 2001
00-118	express freight and express passenger trains, derailments or near derailments due to heat buckles, various localities, 5 December 2000 to 2 March 2001

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