Report 00-105

Lyttelton shunting service

derailment

Woolston

27 April 2000

Abstract

At approximately 1100 on Thursday, 27 April 2000, the Lyttelton shunt was operating in Woolston yard when wagon LPA 5218 loaded with scrap metal derailed due to the track condition. The wagon overturned and fell on the rail operator who had been riding on the shunt. His injuries were fatal.

The safety issues identified included actioning of identified track gauge exceedances and the factors which contributed to the wagon overturning. Two safety recommendations were made to Tranz Rail Limited, to address these issues.

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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.

Transport Accident Investigation Commission
P O Box 10-323, Wellington, New Zealand
Phone +64 4 473 3112 Fax +64 4 499 1510
E-mail: reports@taic.org.nz Web site: www.taic.org.nz

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Abbreviations

km/h	kilometres per hour
lb	pound
m	metre(s)
mm	millimetre(s)
POD	point of derailment
TO	turnout
T & SM	Track and Structures Manager
Tranz Rail	Tranz Rail Limited
yd	yard (linear)

Data Summary

Train type:	Lyttelton shunting service
Date and time:	27 April 2000, about 1100
Location:	Woolston
Type of occurrence:	derailment
Persons on board:	crew: 2
Injuries:	1 (fatal)
Damage:	minor
Operator:	Tranz Rail Limited (Tranz Rail)
Investigator-in-charge:	R E Howe

1. Factual Information

1.1 Narrative

1.1.1 On Thursday, 27 April 2000, the Lyttelton shunt was working Woolston yard, which was part of its authorised area of operation. The remote-controlled locomotive DSG 3033 was under the control of a remote-control operator, and a rail operator completed the 2-person crew.

1.1.2 At about 1100 the shunt was required to place 2 wagons carrying scrap metal to different sidings. Figure 1 is a site plan of the area concerned.

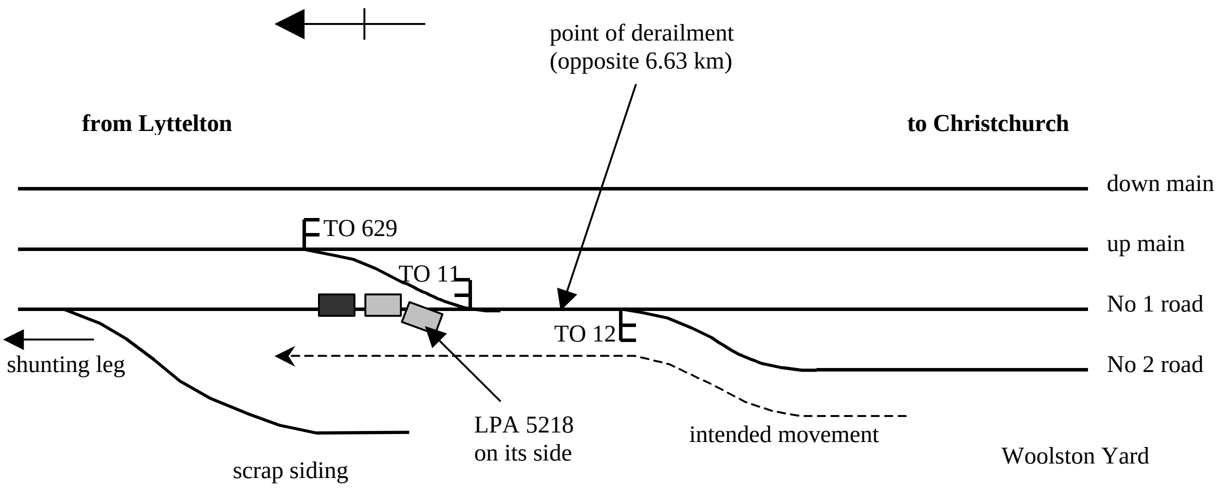

Figure 1
Site plan
(not to scale)

The proposed sequence of movements to achieve the placement was:

- DSG 3033 propel wagon LPA 598 south on No. 2 road to connect to LPA 5218, which was standing on No. 2 road
- the locomotive and 2 wagons pull forward through turnout (TO) 12 to continue down No. 1 road clear of TO 11
- the rear wagon (LPA 5218) to be cut off and left on No. 1 road while LPA 598 was pulled forward and then propelled into the scrap siding
- the locomotive to then run around LPA 5218 and propel it down the shunting leg to its desired location.

Shunt details

1.1.3 The remote-control operator stated that when coupling up to LPA 5218 it was about 100 m south of TO 12. The rail operator was on the ground to do the coupling, with the remote-control operator in the rear left refuge on DSG 3033.

1.1.4 The rail operator then gave a radio message to the remote-contol operator “okay to go forward”. The remote-control operator knew the rail operator was between the 2 wagons on the left-hand side, and saw him mount the shunt before he pulled out. He was not sure which wagon he mounted but believed it was the rear of the leading wagon, LPA 598.

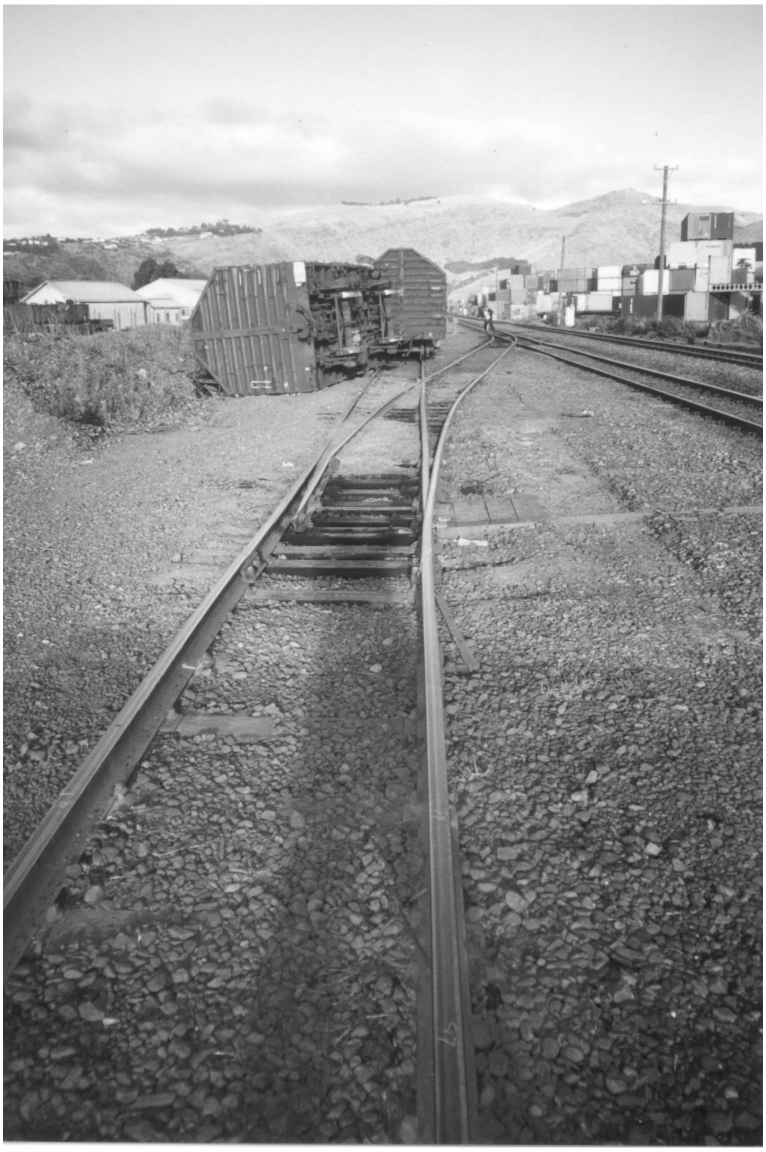

Figure 2
A view of the derailment site from the POD

1.1.5 The remote-contol operator moved the shunt off with the throttle in notch one and estimated the shunt speed as "walking pace" as he negotiated TO 12 and TO 11. He did not feel or hear anything unusual. He turned to check his rake as he passed a gravel pile some 22 m past TO 11 points and saw the trailing wagon leaning over and about "1 m to 1.5 m above ground level". He immediately applied the brakes and the shunt came to a stop with the rear of the locomotive (the remote-contol operator's position) 35 m from the point of derailment (POD) and the trailing wagon overturned. He did not recall seeing the rail operator when he made this check, but in his interview recalled seeing the high visibility markings which were part of the shunt jacket worn by the rail operator. Figure 2 is a view of the derailment site from the POD.

1.1.6 The rail operator had been riding on the left side of the shunt, and was fatally injured during the derailment and subsequent overturning. His body was found trapped under the leading end of the overturned wagon, 23 m from the POD and outside the left rail.

1.2 Site evidence

Derailment markings

1.2.1 The following derailment markings were recorded at the site:

- The POD occurred where a left-hand wheel came off the rail and fell inside, 3 m past TO 12 points.
- A right-hand wheel had subsequently risen up and crossed the rail to the outside, 4 m past the POD.
- Derailed wheels had followed the outside of the curved rails from TO 11 towards TO 629 to a point 11.7 m from the POD.
- At 11.7 m from the POD the right-hand derailed wheel had crossed back over the right-hand curved rail
- The left-hand wheel continued to ride on the inside of the left-hand curved rail to a point 22.3 m from the POD.
- The leading axle of wagon LPA 5218 came to rest 23.5 m from the POD.

1.2.2 There was heavy damage to the left-hand open switch on TO 11, and to the right-hand points boxing adjacent to TO 11.

1.2.3 Figure 3 shows the relationship of track damage to the final position of the shunt.

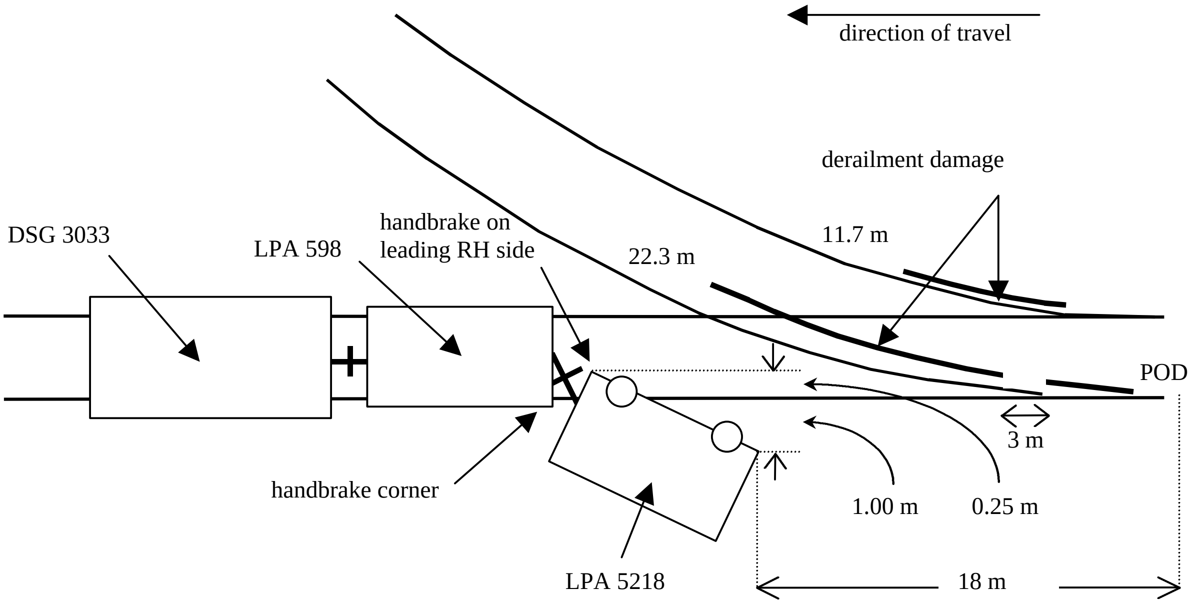

Figure 3
Position of the shunt following derailment
(not to scale)

Rolling stock

1.2.4 Inspection following the derailment found wagons LPA 598 and LPA 5218 were connected by both brake pipe and coupling. The trailing wheels of LPA 598 were clear of the rails, with the weight held by the coupling.

1.2.5 The position of the hand brake on LPA wagons is shown on Figure 3. Each hand brake corner was equipped with a handrail. The diagonally opposite corner to the hand brake was equipped with a footstep and hoop handrail. The other 2 corners of each wagon had a hoop footstep and variable height handrails.

1.2.6 An inspection of wagon LPA 5218 following the derailment found it was to Tranz Rail's standards and there were no unusual features which could have contributed to the incident. The back-to-back wheel measurement on wheelset 1 was 997 mm and the leading right-hand wheel flange had a reading of 18, indicating a 25 mm flange thickness. The leading left-hand wheel had an overall width of 114 mm. The significance of these dimensions to derailment due to spread gauge is shown in Figure 4.

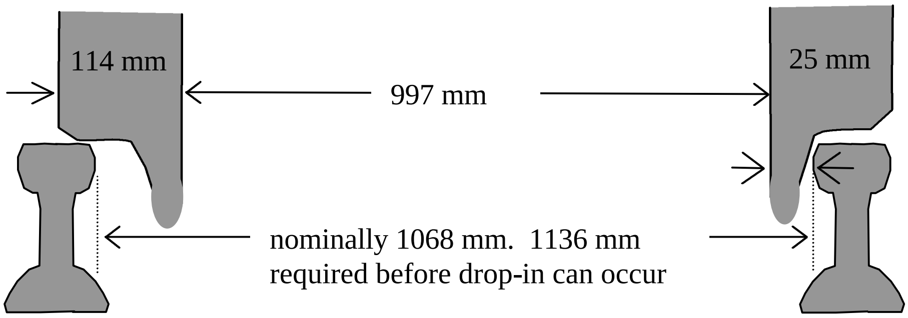

Figure 4
Conditions for a spread gauge derailment
(not to scale)

Track condition at POD

1.2.7 The fifteen sleepers between TO 12 and TO 11 were covered in ballast to sleeper top (refer Figure 2) and their conditions could not be assessed visually. The track was dug out and the sleepers and their fastening condition prior to and at the POD were assessed as follows:

Sleeper 1 (at TO 12 points)	fair condition	fastenings tight	gauge 1083 mm
Sleeper 2	fair condition	fastenings tight	gauge 1083 mm
Sleeper 3	fair condition	fastenings tight	gauge 1081 mm
Sleeper 4	poor condition	broken at both rail seatings, fastenings ineffective	gauge 1081 mm
Sleeper 5	poor condition	fastenings ineffective	gauge 1091 mm
Sleeper 6 (just before POD)	poor condition	broken at both rail seatings, fastenings ineffective	gauge 1097 mm

Derailment damage affected assessment beyond sleeper 6, although, in general, sleepers were fair. Fastening integrity, particularly just past the POD, was variable. A 3-man gang with bars was able to move the left rail out 5 mm laterally and the right rail out 11 mm laterally at the POD following the derailment. Although this was an indication of rail movement there was evidence that the left-hand rail had rolled during the derailment about 2 m past the POD, making such post-derailment movement easier.

1.2.8 Figure 5 shows sleepers 4, 5 and 6 after removal.

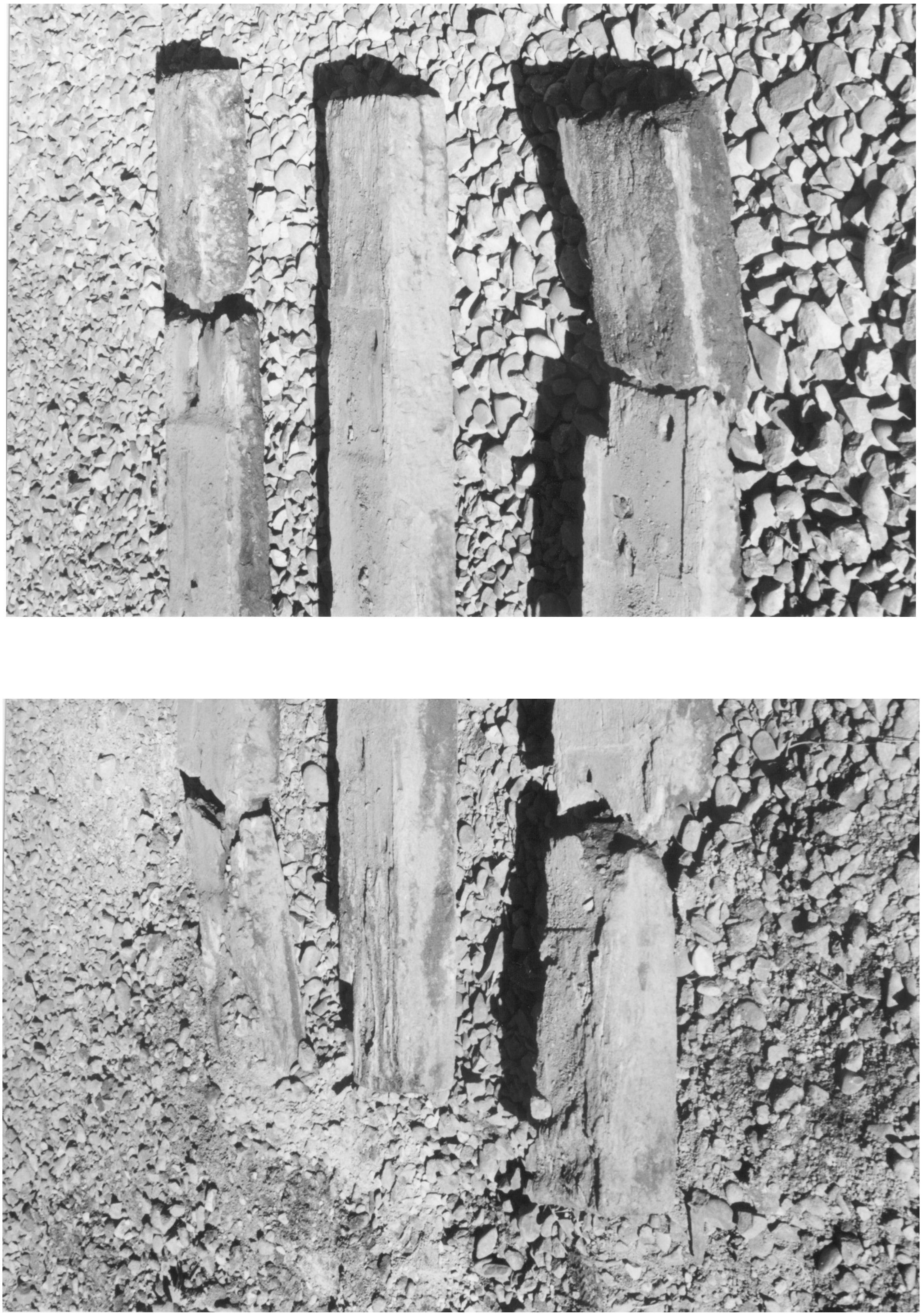

Figure 5
The ends of sleepers 4, 5 and 6 (bottom to top)

1.3 Track details

1.3.1 Turnouts 11 and 12 and the track between them were in 91 lb/yd heavyweight rail.

1.3.2 The straight track between the 2 turnouts was supported by jarrah hardwood sleepers with bed-plates and hardwood screws. The sleepers had not been crossbored. [1]

1.4 Track inspection history

1.4.1 In December 1999, some 4 months before the accident, the Tranz Rail track inspection regime was changed. Inspections related to this accident were made in each regime. The code tables summarising minimum inspection requirements for yards before the change on 17 December and after were:

Before 17 December 1999

INSPECTION TYPE	CODE CLAUSE	FREQUENCY	INSPECTION RESPONSIBILITY
Length Gangers inspections	P.26	Each 6 or 8 weeks. Refer clause P.27	Gangers
Track & Structures Managers Inspections	P.28	Each 12 months	Track & Structures Managers
Line Inspectors Inspections	P.29	Two per year	Line Inspectors

In addition main line patrols were made by approved staff either once or twice per week.

After 17 December 1999

INSPECTION TYPE	CODE CLAUSE	MAXIMUM FREQUENCY	INSPECTION RESPONSIBILITY
Engineering Inspections	P.29	Once every 12 months	Regional Manager
Track Inspection, including essential features list *	P.21	Once or twice per week as per P.21	Track Inspector
Yard Inspections	P.21	Once every 30 days **	Track Inspector

* Equivalent of the previous patrol requirements.
** Changed to 60 days by amendment of 28/02/2000.

1.4.2 As related to inspection of No. 1 road at Woolston this inspection regime change had the following effect.

Requirements prior to 17 December 1999

- 6-weekly ganger inspection
- 6-monthly Line Inspector inspection
- annual Track and Structures Manager (T&SM) inspection

[1] The 4 holes in each bedplate allowed the 2 screw fastenings to be replaced in opposite corners when fastenings became loose, a maintenance procedure termed crossboring which effectively doubled the sleeper life.

Requirements after 17 December 1999

- Track Inspector inspections at 30-days intervals (changed to 60-day intervals on 28 February 2000)
- annual engineering inspection

1.4.3 The last Line Inspector inspection of Woolston yard to the old code requirements had been made by the then acting Line Inspector in August 1999. Arising from this inspection the Track Inspection Diary included an entry "track between TO 629 and 12 resleeper" which was listed as a priority 1. Tranz Rail advised the priorities allocated were a guide to gangers and were not required to be actioned within a specific period.

1.4.4 The acting Line Inspector advised that the turnouts in Woolston yard had been rationalised and renumbered in late 1999, and that the entry in August 1999 referred to the curved track between TO 629 and what is now TO 11 (see Figure 1). He advised this inspection did not detect any problem with the straight between TO 11 and TO 12. None of the work detailed in this diary entry had been carried out prior to the derailment.

1.4.5 The acting Line Inspector who carried out the inspection detailed in section 1.4.3 was appointed Track Inspector and carried out yard inspections at Woolston on 16 February 2000 and 5 March 2000. Non-conforming track conditions identified did not include the track between TO 11 and TO 12. The last ganger's inspection was at the end of December 1999, and again did not identify any problem in the TO 11 to TO 12 area.

1.4.6 As well as inspections as detailed Tranz Rail operated an EM80 track recording car. The requirements for EM80 car inspections were laid down in code supplement CSP/50 as follows:

> 2. FREQUENCY OF OPERATION
>
> The car will make recording runs of the North and South Islands as follows:
>
> Lines with regular Passenger Services - twice/year
> Class A and B freight lines - twice/year
> Class C freight lines - once/year
>
> These are minimum requirements. The programme for recording runs will be set by Manager, Track Maintenance. More than this number of runs is acceptable.

There was no requirement in this code to record yards. Traditionally such main line recording runs had included loops, which were classified as main lines. However, over the previous few years a practice had developed of recording arrival and departure roads and other main yard tracks. As part of this practice No. 1 road at Woolston, classified as a siding and not an arrival or departure road, had been recorded twice in the 7 months prior to the accident. The practice has been recently (effective 18 May 2001) covered by a Code amendment as detailed in Section 4.4.

1.4.7 A north to south EM80 run was made in September 1999 through the area where the derailment occurred (from No. 1 road through the curved leg of TO 12) and a gauge of 1096 mm was recorded. The length ganger was on board during the run and received the exception report immediately following the run.

1.4.8 A further north to south run on 28 February 2000 straight through No. 1 road recorded 1093 mm gauge, followed by a 1097 mm gauge reading during a south to north run the same day following the same route as the shunt. The acting length ganger was not on board during these runs. The exception report for the yard, including the 1097 gauge fault highlighted with other class 1** (referred to as "class 1 star") gauge and twist faults by the T&SM following the run, was forwarded to the length ganger. The class 1** faults were not specifically drawn to the gangers' attention, except by the highlighting. The ganger filed the report for later action, but did not refer to it at the time, and was unaware of the particular gauge reading and its priority until after the accident. The ganger advised he had higher priority main line work to attend. He was generally able to tackle priority yard work every 3 months. He stated dynamic gauge around 1096 mm was not uncommon in yards.

1.5 Track standards

1.5.1 Tranz Rail gauge tolerances applicable to No. 1 road at Woolston were defined in code P.46 of Tranz Rail Code T003. For a speed category rating of 4 (maximum speed 25 km/h as in a yard) the lower limit was 1086 mm and the upper limit 1092 mm, with the comment "allow for any push on rail fastenings".

1.5.2 Action for maintenance tolerances was defined in code P.45, which included:

> (a) The maintenance tolerances for field measurements are shown in P.46 for the various track geometry and line speed categories.
>
> 1. Track that is at or beyond the "Upper Limit" must be corrected without delay unless appropriate speed restrictions are imposed.
>
> 2. Track that is between "Lower" and "Upper" limits is to be programmed for corrective action, in conjunction with the T&SM.

1.5.3 Tranz Rail advised the relevant intervention levels covering EM80 gauge readings when recording yards were in CSP/36, "EM80 track evaluation car exceedance limits". This defined 1092 mm as a class 2 fault, 1094 mm as a class 1 fault and 1097 as a class 1** fault, the same as low speed main lines. Because of the dynamic effect of the car on the track these levels were greater than the static gauge tolerances defined in 1.5.1.

1.5.4 The requirements for actioning EM80 exceedance limits were detailed in P.91 of Code T003 which included the following requirements:

PRIORITY	DESCRIPTION	ACTION TO BE TAKEN
Class 1**	Beyond absolute minimum	To fix immediately. If not fixed within 24 hours impose Temporary Speed Restriction - if considered necessary.
Class 1	Beyond acceptable limits but below maximum	To be fixed within four weeks. If not fixed within four weeks impose Temporary Speed Restriction – if considered necessary.
Class 2	Marginally beyond acceptable limits	T&SM to evaluate and forward supplementary list to Ganger at a later stage, directing action to be taken.

> (a) Gangers, in conjunction with T&SM must ensure the appropriate action is taken (Refer CSP/38).
>
> Until corrected, Gangers (or other competent track staff) must check the condition of Class 1** exceedances. This would normally be during inspections and is a check to ensure that the track is still suitable for the passage of trains under any operating restriction that may be put in place. Class 1 exceedances are to be checked during normal routine inspections. The exceedances sheet is to be used as an aid to inspections and must be made available to any relieving ganger.

(b) T&SM must ensure the length Ganger receives the EM80 exceedance reports for attention, promptly after the run. When only loops are being recorded by the EM80 it is not necessary for Area track staff to be on board during recording. However for any unattended run, it is important that T&SM ensure that arrangements are made with the car operator for the Ganger to receive the exceedance reports as soon as practicable after the run.

(c) T&SM must take the following action on recorded defects:

(i) Priority 1** Exceedances should be individually checked on site by the T&SM within one week of the run to ensure proper corrective action has been taken.

Where the number of exceedances is so excessive the T&SM could not check all exceedances the following must apply:

A representative sample of each type of exceedance must be checked on site, over the length.

The T&SM must advise the [Regional Manager, Track and Structures] in writing that he has checked the Priority 1** exceedances as above. He must certify that exceedances have been corrected, with exceptions listed and appropriate speed restrictions placed if considered necessary.

(ii) Priority 1 Exceedances should be individually checked on site by the T&SM. Where the number of exceedances is so excessive the T&SM could not check all exceedances the following must apply:

A representative sample of each new type of exceedance must be checked on site over the length. T&SM's must review exceedances during their first general inspection after the EM80 run, of any Gang length.

The T&SM must advise the [Regional Manager, Track and Structures] in writing that he has checked Priority 1 exceedances as above. He must certify that exceedances have been corrected, with exceptions listed and appropriate speed restrictions placed if considered necessary.

(iii) T&SM should view exceedance reports and compare with past recordings to identify trends for appropriate action.

(d) Repeated exceedances must be given special attention by the Ganger and T&SM. Where the remedial work has proved ineffective the T&SM must report to RM T&S and request approval for special work or technical advice.

1.5.5 Code P.91 (c) required the T&SM to take action on recorded defects on the main line. The T&SM advised he did not individually check 1** yard exceedances generally, and had not checked the exceedance found on 28 February 2000 between TO 11 and TO 12. He made a quarterly report to the Regional Manager Track and Structures (M 120 report) in accordance with code P.91 (c). The report for the January to March quarter was signed by him on 26 April 2000 (the day before the accident) and forwarded to the Regional Manager. It stated that "all faults were treated except top faults in sealed level crossings and track structures". However, when interviewed the T&SM stated his report related to EM80 exceedances in the main line, and it was not his practice to inspect yard defects or include them in his reports. He commented on the general decrease in spread gauge yard derailments over recent years due to a deliberate programme targeting curved closures in yard turnouts.

1.6 Wagon history

1.6.1 The Tranz Rail wagon control computer system showed no moves for wagon LPA 5218 prior to 11 February 1999. The wagon had a birth date in the wagon register of 1 January 1996. Checks showed the wagon had not been weighbilled prior to that date, or during 1997 or 1998. Tranz Rail attributed this unusual record to moving without weighbills, a practice not uncommon for wagons involved in scrap metal traffic.

1.6.2 Records showed this wagon had been idle for some time at Gracefield prior to 1999. In February 1999 it was requested back into service, and was given a special check inspection and released for traffic on 17 February 1999. During October 1999 to April 2000 it was operating in the South Island. Inspections were up to date and a post-derailment inspection showed the wagon to have been in good order prior to the derailment. It was subsequently scrapped, due to the damage sustained.

1.7 Wagon loading

1.7.1 LPA 5218 was loaded with scrap metal. The wagon had been weighed over the Weedons weigh bridge prior to the derailment with the following individual wheel weights recorded (as an average of 4 readings per wheel).

leading left wheel	5971 kg
leading right wheel	4383 kg
trailing left wheel	6484 kg
trailing right wheel	5206 kg
	22044 kg

The weighbridge alert level for uneven loads occurred when an axle was out of balance by 30%, calculated by comparing the difference between the wheel loadings with the average wheel loading.

1.8 Personnel

1.8.1 The rail operator had 30 years service. He held appropriate and current certification for the shunt duties involved, and his compliance monitoring record was to Tranz Rail code requirements.

1.8.2 The remote-contol operator had 35 years service, 20 of which involved shunting. He had been certified in remote-contol operations since 1996 and been classified Team Leader for 13 months. He held current certification for the upgraded Cattron remote-contol used to control the shunting operations concerned.

1.8.3 The length ganger was an experienced track man with 20 years railway service. He had been ganger of the length since 1990.

1.8.4 The Track Inspector had been ganger at Kaikoura for some years before acting as Line Inspector for 6 months prior to his appointment as Track Inspector in 1999.

1.8.5 The T&SM was a senior experienced manager. After 14 years service as a technical engineering staff member he had been in track supervisory and management roles for 19 years.

2. Analysis

2.1 The derailment

2.1.1 Derailment markings and track condition indicated the leading axle of LPA 5218 derailed due to gauge spread when the left wheel dropped inside the rail. Gauge spread had been accentuated by the shunt's approach to the weakened straight track from a left-hand curve, which imposed lateral forces on the right rail on the straight. Sleepers 4, 5 and 6 did not supply any lateral restraint, and rail movement permitted the drop-in. About 4 m past the POD the improved sleeper condition and fastening integrity forced the right wheel to mount the rail.

2.2 Wagon overturning

2.2.1 The remote-contol operator's recollection of braking showed that the shunt stopped in approximately 10 m, allowing for reaction time. This related to a speed of approximately 10 km/h, and is consistent with the remote-contol operator's speed estimation.

2.2.2 Damage to the left points rail of TO 11 was consistent with a heavy wheel impact, with no markings for 3 m, indicating the impact caused the left wheel to float. At the same time the right wheel was outside the right curved rail and bearing heavily on the ground. This clockwise rotation of the leading end of the wagon was reversed when the right wheel mounted the rail and lost contact with the ground as the left wheel dug in heavily on the outside of the left curved rail. Turnout rails are fastened and braced to resist lateral movement and there would have been little give in the rail at the pivot point. The resulting anticlockwise rotation of the leading end of the wagon, assisted by the lateral component of the draw bar pull as the shunt and Wagon LPA 5218 continued to diverge, reached a point where the centre of gravity of the wagon moved outside the left-hand wheel pivot point and the weight of the wagon completed the overturning.

2.2.3 The wagon was heavier on the left side than the right side as follows:

left side	12455 kg
right side	9889 kg

This out of balance was made up of a 15% out of balance in the leading axle and 11% in the trailing axle, compared to the 30% permitted in an axle before a weigh bridge alert. For a uniformly distributed load a rotation of about 18^o, equivalent to a wheel height difference of 360 mm, would have placed the weight component outside the pivot point and thus contribute to overturning. For the wagon as loaded a rotation of 16^o, equivalent to a height difference of 310 mm, achieved the same effect. However, for a scrap metal load, the load in LPA 5218 could be described as reasonably uniformly distributed. Although the asymmetrical loading did have an effect on overturning, its contribution is not considered to have been major.

2.2.4 Wagon LPA 5218 overturned due to a combination of a rotation due to dynamic interaction with the turnout, lateral draw bar pull, and the presence of a fixed pivot point provided by the turnout structure. This overturning was assisted by the asymmetrical loading of the wagon, but may still have occurred irrespective of such asymmetrical loading.

2.2.5 The rail operator was probably riding on the hand brake on the left trailing end of LPA 598. The sequence of events from the derailment until the wagon fell on the rail operator was not witnessed. His body was found 23 m from the POD, with the hand brake he had probably been riding on coming to rest about 26 m from the POD. It is likely that he was dislodged from wagon LPA 598 as LPA 5218 rotated anticlockwise and LPA 598 responded to the transmitted coupling forces.

2.3 Track gauge

2.3.1 Track in yards is surfaced to rail foot level to provide footing for shunting staff. Woolston was a standard yard in this respect (Figure 2).

2.3.2 This surfacing hid sleepers and rail fastenings and prevented visual identification of poor materials. This had always been a hurdle to be overcome when inspecting yards to ensure standards were maintained.

2.3.3 Traditional methods of ensuring standards were maintained in yards were based on regular manual inspections involving static gauge measurements against an upper limit of 1092 mm. It is likely the static gauge was at or near this upper limit based on the 1093 mm gauge measured by the EM80 car on a straight run at low speed, with little related dynamic effect.

2.3.4 Inspection had been carried out to code requirements. Despite the change in inspection regime and its associated disruption, the transition had been effectively controlled in terms of frequency and type of inspection.

2.3.5 The failure of foot inspections to identify the weak section of track was not surprising. Gauge is randomly checked, with more attention given to curved track than straight. With no visual indication present, the fact that this short section of straight track was not checked does not indicate a less than satisfactory inspection regime. However, the inherent risk associated with such short lengths of straight between turnouts has been highlighted by this accident, and Tranz Rail safety actions have recognised this factor.

2.3.6 The part played by the EM80 recording which identified wide gauge is more complicated. Tranz Rail code did not require EM80 runs in yards. However, as a response to a series of derailments on Arrival and Departure roads (classed as main line derailments) it had become accepted practice over the last few years to record important yard routes, although it was apparent that the formal system of actioning exceedances developed for main lines was not being uniformly applied to yard exceedances.

2.3.7 In light of the lack of defined procedures for operating the EM80 car in yards, the ganger's action in filing his report for later action was understandable. He had main line priorities which he felt took precedence over yards. The T&SM's actions in highlighting and forwarding the exceedances without site inspection and report is also understandable. There was no formal requirement to do so, and again he considered main lines took precedence.

2.3.8 The option of applying a temporary speed restriction was not practicable in the yard situation. A maximum speed of 25 km/h applied, and any lower speed would have been operationally difficult to maintain and would have had little practical effect on decreasing the risk of derailment.

2.3.9 It is regrettable that despite proactive action in using the EM80 car in yards, its ability to highlight a weak area was not utilised. The 1096 mm class 1 fault identified in September 1999 involved a curved turnout route and associated lateral forces transmitted to the straight track to cause gauge widening. The 1093 mm (straight road) and 1097 mm (curved road) readings in February confirmed significant lateral movement of the rail at low speed to the class 1** exceedance level. Experienced interpretation of the EM80 outputs should have alerted staff to the significance, and initiated appropriate action despite the lack of formal procedures.

2.3.10 Derailment in yards due to spread gauge, while not common, do occur. However, they seldom lead to vehicles overturning, the cause of the fatality in this particular derailment. The reason for overturning has been identified (section 2.2.4). The most important conclusion from the derailment and resulting overturning is the risk associated with wide gauge on straight track at turnout points, and particularly between back-to-back turnouts, which can turn a relatively low risk spread gauge derailment into a high risk wagon rollover.

3. Findings

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

3.1 The shunt was being operated appropriately at the time of the derailment.

3.2 The derailment was caused by spread gauge between the rails allowing a wheel to drop in.

3.3 The proximity of the turnout, and to a lesser extent the particular wagon loading, caused derailed wagon LPA 5218 to overturn.

3.4 The rail operator was probably appropriately positioned for shunting operations but was dislodged by the wagon movement, and underneath the wagon when it overturned.

3.5 The track had been inspected to Tranz Rail code frequency.

3.6 The failure of these inspections to identify the particular sleeper condition and associated gauge which caused the derailment was not surprising given the spot check nature of such inspections and the priority given to main line and curved track.

3.7 The use of the EM80 car to measure dynamic gauge in yards was not a formal Tranz Rail requirement, but was accepted practice at all levels.

3.8 The EM80 identified a gauge problem in September 1999 and February 2000, but no action was taken to correct or protect the exceedance identified.

3.9 The only formal action requirement related to main lines and loops, leaving it open to individual staff to determine what, if any, action was taken in any given time span for yard exceedances.

3.10 The desirable action of recording important yard tracks using the EM80 requires formalising, with guidelines and procedures regarding interpretation and action required to maintain safety in yards.

3.11 Despite the lack of formal procedures governing the use of the EM80 in yards, the particular readings associated with the length of track concerned in December and February should have alerted staff to poor sleeper/fastening conditions and prompted site inspection and action.

4. Safety Actions

4.1 Following the accident Tranz Rail introduced a system-wide check of gauge on straight track prior to facing points in yards, with action where appropriate.

4.2 Tranz Rail advised that the track standards referred to in 1.5.1 to 1.5.4 had been changed in a new handbook, “T200, Infrastructure Engineering Handbook” issued in October 2000, to ensure correlation of all limits.

4.3 Following a number of recent shunting accidents Tranz Rail commissioned an independent report prior to the Commission of Enquiry into Rail Safety in late 2000. Following on from recommendations in this report Tranz Rail have introduced a “no-ride” shunting procedure in part of the system intended to minimise, and if possible eliminate, the need for staff to ride on moving wagons. The new procedure relies on a mix of:

- the use of dedicated wagons equipped with refuges to protect staff, similar to refuges installed on shunting locomotives
- revised shunting procedures to minimise propelling movements

- the increased use of motor vehicles by shunting staff
- increased shunting from the ground.

Tranz Rail intend to develop this concept with staff and unions with the aim of introducing it throughout the whole system by the end of 2001.

4.4 Tranz Rail has issued Significant Information Notice SIN017, effective date 18 May 2001, which stated:

> **INTRODUCTION**
>
> The EM.80 track evaluation car tests the track geometry throughout New Zealand. The frequency of testing varies according to the classification of a line.
>
> **CHANGES**
>
> Track Supplement CSP 50; Section 2 on page 2 is hereby replaced as follows:
>
> **2. FREQUENCY OF OPERATION**
>
> The car will make recording runs of the North and South Islands as follows:

Lines with regular passenger services	twice/year
Class A and B freight lines	twice/year
Class C freight lines and all loops	once/year
Main arrival/departure roads within yards and/or terminals	as below

> Arrival and departure roads within Yards and terminals shall be tested, where physically possible.
>
> These roads are tested using Speed Category 5, contained in Track Supplements; Section 36 Effective date: 23 January 2001.
>
> The above frequencies are minimum requirements and testing more than that specified is acceptable, including other roads in yards and terminals. The programme for recording runs is set by Mechanisation Manager.

5. Safety Recommendations

5.1 On 27 July 2000 the Commission recommended to the managing director of Tranz Rail that he:

5.1.1 limit the use of four-wheel wagons to the carriage of homogeneous loads where the likelihood of asymmetrical loading is minimal, and give consideration to an early phasing out of all four-wheel revenue wagons. (038/00)

5.2 On 8 August 2000 the managing director of Tranz Rail replied:

5.2.1 Tranz Rail intends to adopt safety recommendation 038/00. It is our intention to phase out the carrying of scrap in four-wheeled wagons by the end of December 2000.

5.3 On 20 April 2001 the Commission recommended to the managing director of Tranz Rail that he:

5.3.1 introduce code procedures for the use of the EM80 recording car on important yard roads covering:

- tracks to be inspected
- exceedances applicable
- classification and actioning of defects. (005/01)

5.4 On 21 May 2001 the managing director of Tranz Rail replied:

5.4.1 Tranz Rail accept this recommendation. Please note a standing instruction to this effect has been placed in effect as of May 2001 and will replace the previous standing instruction in the Track Code.

5.5 The Code amendment was made by SIN017 as detailed in section 4.4.

Approved for publication 16 May 2001

Hon. W P Jeffries
Chief Commissioner