No. 95-111

Q2 Shunting Service

Gracefield

24 May 1995

Abstract

On Wednesday, 24 May 1995 at about 0820 hours Q2 Shunt operated by New Zealand Rail Limited was shunting at Gracefield yard. During a propelling movement to attempt to catch and hook onto a moving wagon, the Rail Operator riding on the leading wagon fell under the Shunt and was killed instantly. Causal factors were unauthorised shunting procedures, wagon drawbar condition, limited experience of staff and effectiveness of compliance monitoring. Safety deficiencies addressed in the report are the suitability of and compliance with instructions covering loose shunting. Safety issues addressed in the report are the suitability of and compliance with procedures for wagon inspection and repair, and the training and certification of Operating staff.

Transport Accident Investigation Commission

Rail Accident Report No. 95-111

Train type and number:	Gracefield Yard Shunt Q2
Date and time:	24 May 1995, 0820 hours
Location:	Gracefield
Type of accident:	Fall under a moving train
Persons on board:	Shunting Crew: 2
Injuries:	Shunting Crew: 1 Fatal 1 Nil
Nature of damage:	Nil
Information sources:	Transport Accident Investigation Commission field investigation
Investigator in Charge:	R E Howe

1. Factual Information

1.1 On 24 May 1995 Q2 was a rostered New Zealand Rail Limited (NZRL) shunting service out of Wellington serving the Gracefield yard. It was crewed by one Locomotive Engineer (LE) and one Rail Operator (RO).

1.2 The shunt service had left Wellington at approximately 0530 hours arriving at Gracefield at approximately 0620 hours with the locomotive leading (south end). To facilitate shunting the locomotive ran around the train and re-attached at the north end. The crew took a break during which the RO attended to paperwork associated with the shunting requirements.

1.3 At 0730 hours the crew commenced breaking up the shunt and placing the wagons brought out from Wellington to their respective destinations.

1.4 A plan of the accident scene, including the general layout of the track work at Gracefield yard defining these destinations, is shown in Figure 1.

1.5 Prior to commencing the movement which preceded the accident, the shunt service was at the north end of the yard with the locomotive on the train road (refer Figure 1). The LE's driving position was on the east side, ie, on the left hand side in the direction of the proposed movement.

1.6 Shunting movements were under the control of the RO. Prior to initiating the movement he was last seen by an employee of Wellington Box (a NZRL subsidiary), looking between the last two wagons on the north end of the loop, then walking northwards between the loop and train road towards his train. The witness required shunting assistance later in the day and had stopped the RO between the loop and train road to ask him to arrange this.

1.7 There were no further witnesses to the RO's actions prior to the accident.

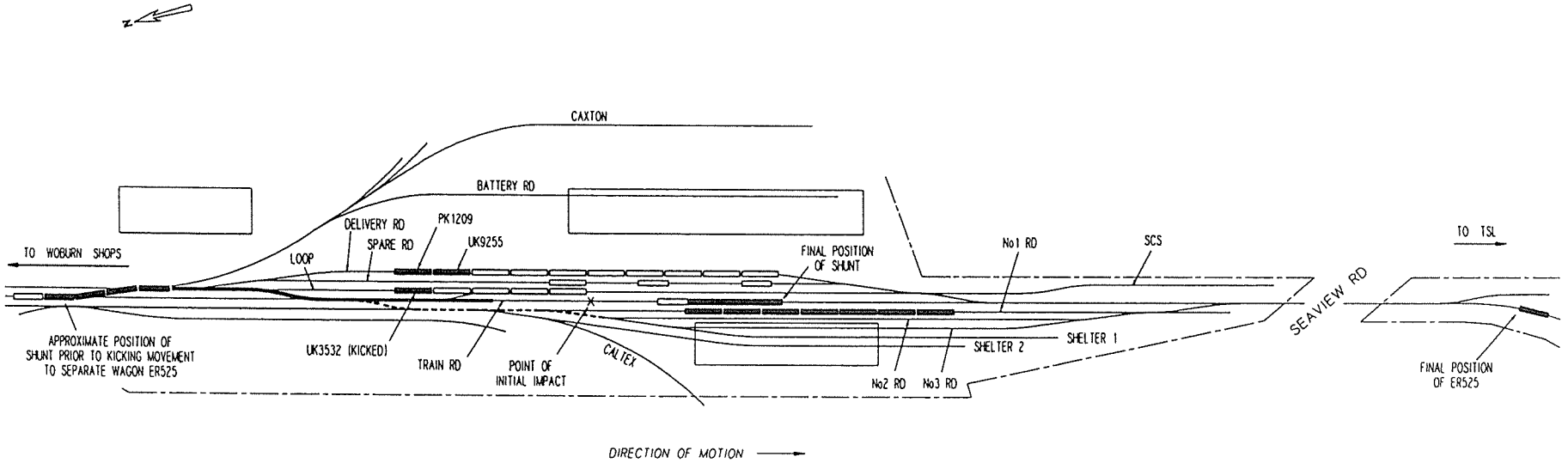
1.8 The LE received a radio command from the RO regarding the proposed shunting movement. Gracefield yard is operated under audio shunting procedures (ASP) which are based on maintaining contact between the LE and ground shunting staff by radio. In all the movements that follow it is not necessary or always possible for the LE to see or know where he is going although it is a code requirement that the shunter controlling the movement will advise him of the nature of the intended shunting. The LE follows explicit commands from the shunting staff with respect to direction and action.

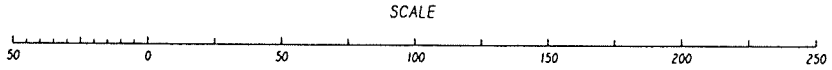
1.9 On the command 'Kick' the LE proceeded to propel his train south along the route pre-set by the RO, ready to carry out a standard kicking movement to the leading wagon ER525. "Kick" was an NZRL shunting term and defined by the LE as "come quickly towards a signal and be prepared to stop quickly". The purpose of kicking is to separate the unattached leading wagon being propelled and let it roll under momentum to its desired location in a controlled manner whilst stopping the train well short of that location with consequent saving in shunting time when compared with placing the wagon. "Kicking" and "Slipping" (the separation of wagons while travelling in a forward direction) are collectively referred to as "loose shunting".

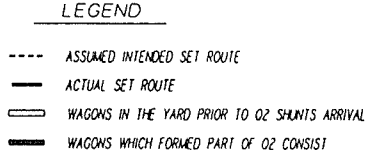
1.10 The LE increased the power to notch 6 and approximately four or five seconds later received the command 'Stop'. He accordingly braked and came to rest.

1.11 The LE estimated his speed at kicking at 18 km/hr to 20 km/hr.

1.12 Approximately five seconds from the stop command the LE received an instruction to go in chase of the detached wagon, including the message "The road was set wrong, we're going to have to go







GENERAL LAYOUT PLAN

Figure 1

95-111

and catch it". In the LE's words "You could tell the anxiety in his voice" which, to the LE, meant 'come forward in haste'.

1.13 The LE accelerated the train from rest and after approximately 10 to 15 seconds received the command 'Ease up'. He slowed the train to approximately 10 km/hr and felt the contact with the wagon being chased.

1.14 The LE then received an instruction "We've missed it, come at it again, come forward again".

1.15 He again accelerated the train and some 5 to 10 seconds later received a further 'ease up' command. This was the last command received from the RO.

1.16 The LE estimated his speed reduced to approximately 10 km/hr following the second ease up command and he continued at this speed for some 10 seconds whilst attempting to contact the RO by radio after not hearing any further command.

1.17 On receiving no response to his question "Have we caught it?" he applied the brakes and stopped the train.

1.18 Before dismounting the LE looked out of his window and saw Wagon ER525 approximately 50m ahead of the train and moving at "quite a speed". Wagon ER525 came to rest on the train road approximately 390m from the point of fall and 60m beyond the Seaview Road level crossing. The handbrake was in the off position.

1.19 The LE's concern was for the RO and he dismounted and proceeded southwards down his train and found evidence that the train had run over the RO. The rear of the train had come to rest on the train road approximately 78m from the point at which the RO was assumed to have fallen.

1.20 The LE was in shock but was able to climb back into the locomotive and advise Train Control of the accident. He then walked to the Box Company office on the east side of the yard to find the exact location of the accident and he rang Train Control again with this information.

1.21 The site was attended and secured by the Police.

Weather

1.22 The weather on the day was overcast and cool, but it was not raining at the time of the accident.

Train information

1.23 On 24 May 1995 Q2 Shunt on departure from Wellington consisted of locomotive DSG 3059 and the following wagons (in order); IB393, UK2585, UK3532, UK6022, UK11326, UK11361, UK5622, PK3363, PK1060, UCA59, UCA170, UCA210, UCA264, EST10, ZP14796, ER525, PK1029, UK9255.

1.24 Reversal of the train order at Woburn meant that on arrival at Gracefield and run around of the locomotive to facilitate shunting the consist was re-established with the locomotive at the north end prior to commencement of shunting. Shunting operations at Gracefield are restricted to a maximum speed of 25 km/hr.

1.25 Following wagon placement between 0730 hours and 0815 hours the consist prior to the last loose shunting movement was DSG 3059, PK1060, EST10, ZP14796, ER525. Following the kicking of ER525 the RO was trying to reconnect ZP14796 and ER525.

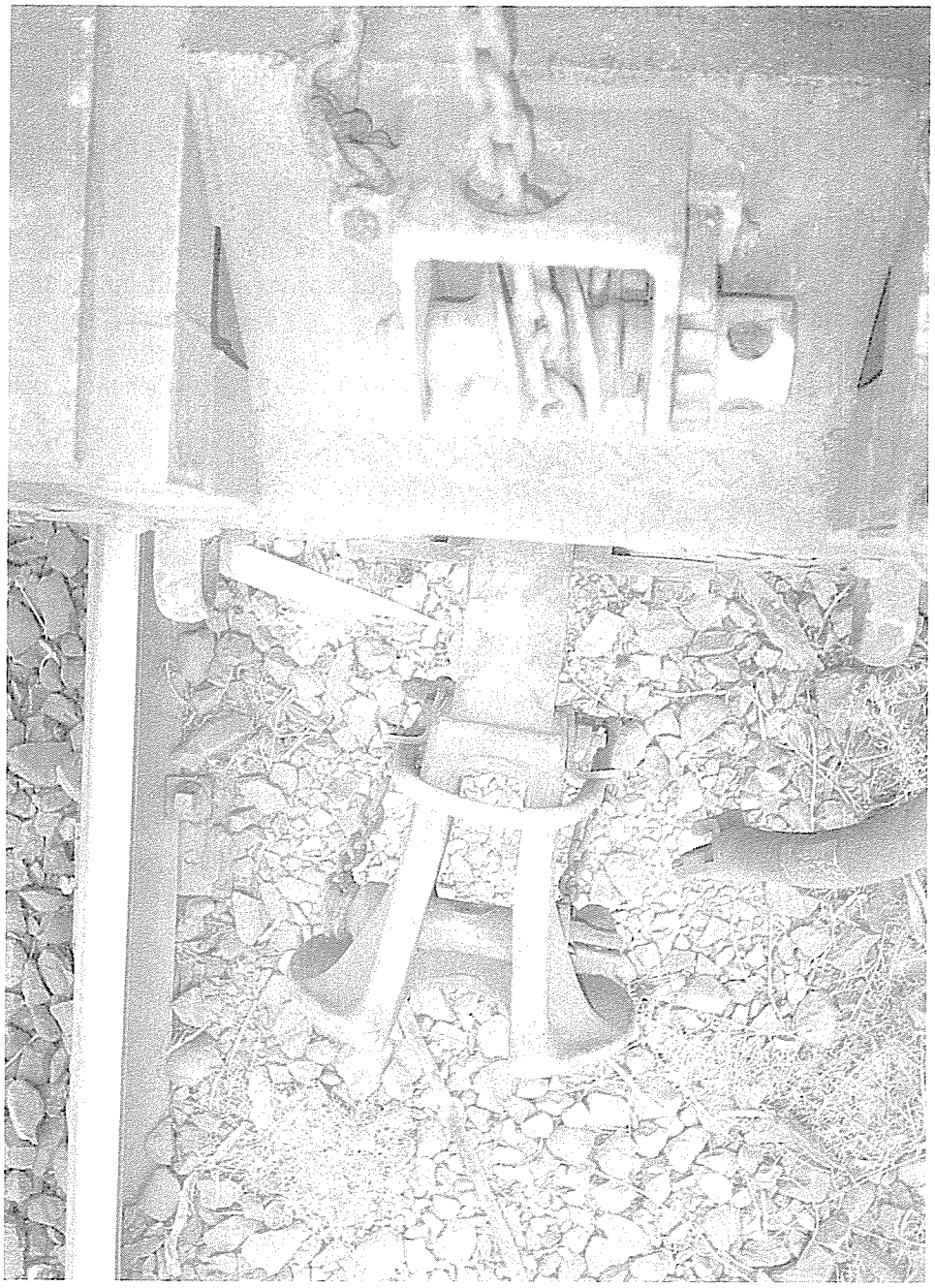


Figure 2
Bent drawbar on wagon ER525

Wagon details

1.26 Wagon ZP14796 did not display a current Certificate of Inspection and there was no record that one had been issued. The last certificate, attached to the wagon, was issued 3 December 1994 which meant that re-certification was due 3 March 1995. The wagon passed out of Mount Maunganui Depot on 15 May 1995 following repairs due to "bad ordering" of "doors/curtains/windows." It should have been inspected and displayed a new certificate on the wagon at that time. A Light Inspection had been carried out on 3 May 1995.

1.27 Following the accident the buffer on the opposite end to the handbrake on ZP14796 was measured under load and recorded as 700mm above rail level. (This was the buffer which the RO was attempting to connect to ER525.) The relevant code of practice in effect on 24th May 1995 (No M9-3, Drawgear on rolling stock) defined a minimum draw bar height allowed in service of 725mm measured in tare condition. The drawbar was in the central position following the accident.

1.28 The footstep of ZP14796 had been painted with white enamel paint at some time in the past. No record of painting date was available.

1.29 The normal brake dust and associated deposit on the leading end of Wagon ZP14796 showed recent trails of finger marks indicative of someone trying to obtain a handhold. The wagon ZP 14796 handrails were all in good condition and painted with white paint.

1.30 Wagon ER525 had a current Certificate of Inspection issued 1 May 1995.

1.31 Following the accident the buffer on the opposite end to the handbrake on ER525 was measured under load and recorded as 710mm above rail level. This was the buffer to which the RO was trying to attach ZP14796. Due to a bent drawbar the buffer head was offset 35 mm to the left (in direction of the propelling train movement) and pointed downwards by 30 mm from its theoretical position. In addition the drawbar was offset 10 mm to the left from the central position in the direction of travel following the accident.

1.32 At the time of the accident the requirements for drawgear were laid down in NZRL code CSN06 "GENERAL SAFETY AND MAINTENANCE STANDARDS FOR ROLLING STOCK", which included the following:

"06.9 DRAWGEAR

9.3 Drawbars should not be bent and the distance from the centre line of the drawbar to rail level shall not be less than the following dimensions."

Although 9.3 does not define "bent" there is general agreement amongst NZRL mechanical engineering staff that the bend in the drawbar of ER525 was such that it should have been withdrawn from service for repair i.e. "bad ordered" (Figure 2). The Depot Manager's Field Inspection Form for ER525 following the accident classed the buffer as "unserviceable".

Personnel details

1.33 The LE was currently certified for the duties being carried out at Gracefield. He had been working Q4 shunt the two days prior to the accident. His recreational and sleep patterns were normal. His health was good and he was not under medication.

1.34 The RO was a qualified LE Grade 2. He had joined as a locomotive trainee in 1979 and became LE Grade 2 in November 1985. In March 1987 he was certified as a Train Operator as part of the phasing out of guards. His latest re-certification as an LE was on 13 July 1994 with an expiry

date of 13 July 1995. Although his annual certificate was marked as expired July 1995, his certification had been extended with all others to December 1995 as part of NZRL's structured introduction of biennial re-certification of Operations staff to replace annual re-certification: biennial re-certification commenced February 1995. On 19 December 1994 he had been redesignated Rail Operator and on 20 January 1995 he had been certified for shunting duties at Gracefield. On 8 May 1995 he was assessed on, and passed, a compliance check associated with defined key tasks included in his duties.

1.35 The RO was properly attired for his duties, including safety boots with no noticeable tread wear and a standard high visibility vest. His behaviour on the day of the accident was described as normal by the LE and his disposition as "happy, he was his usual self". He showed no signs of ill health.

Control of shunting

1.36 Shunting operations at Gracefield were covered by NZRL's Rules and Regulations, the Operating Code, and the Gracefield Local Instructions. The relevant parts pertaining to this accident are:

1.36.1 Rule 129(b):

"(b) Kicking or Slipping

The kicking or slipping of vehicles may be performed only by employees experienced in shunting and adequate steps must be taken to prevent collisions between vehicles or the fouling of other lines."

1.36.2 Rail Operating Code:

Section 5.0 Coupling (inter alia)

"5.1 Coupling On or Cutting Off

Observe these simple rules:-

- Face the way the rake is going.
- Take a firm grip with the hand not required to lift the hook.
- Keep your feet clear of frogs, switches, and check rails at all times.
- Do not straddle the rail - keep your feet outside of it.

- When coupling or uncoupling make sure the rake is stationary and that the wagons will not be moved while the job is being done.

- Never attempt to use your foot to try and move a buffer."

1.36.3 Rail Operating Code:

Section 4.0 Safety:

"4.1 Personal Safety

The personal safety of members engaged in shunting duties is of the utmost importance. You should always remember the following:

NEVER attempt to couple or uncouple moving wagons; and never attempt to move wagons that are being coupled."

1.36.4 Gracefield Local Instructions: (inter alia)

"2. Shunting: Gracefield - Woburn:

All shunting carried out by the Gracefield - Woburn Shunting Service will be as follows:

2.1 Loose shunting will NOT be permitted in private sidings.

2.2 Loose shunting will NOT be permitted into sorting roads where wagons are already standing.

2.3 Loose shunting WILL be permitted when wagons are being worked into empty sorting roads provided one member of the shunting gang is in position to catch brakes.

NOTE: Loose shunting being the existing practice of kicking and slipping wagons.

5. Manning

Gracefield Shunts will consist of:-

- One Locomotive Engineer
- One Senior Shunter
- One Shunter

Until full introduction of ASP two Locomotive Engineers will be utilised."

1.37 NZRL re-issued the Local Instruction covering Gracefield on 13 July 1995 following the accident. It included the following instructions, inter alia:

"2. Shunting: Gracefield - Woburn:

All shunting carried out by Q2 Shunting Service will be as follows:-

2.1 Loose shunting will NOT be permitted in private sidings.

2.2 Loose shunting will NOT be permitted into sorting roads where wagons are already standing.

2.3 Loose shunting WILL be permitted when wagons are being worked into sorting roads PROVIDED AN ADDITIONAL QUALIFIED PERSON IS AVAILABLE TO CATCH WAGON BRAKES.

NOTE: Loose shunting being the existing practice of kicking and slipping wagons.

5. Manning

Q2 Shunts will consist of:

- One Locomotive Engineer
- One Rail Operator"

Shunting training

1.38 As part of his progression to LE Grade 2 the RO would have received some basic shunting training covering movement of locomotives and oil tankers in a locomotive depot.

1.39 In 1987 he attended a five-day training course associated with LE's taking over some guard duties as guards were phased out. This course covered:

"Day 1	Introduction
	Preparation of Train loading lists
	Marshalling Restrictions
	Traffic monitoring system (TMS) duties
	Rules for shunting staff
	Wagon markings
	Hand brakes
	Bond chains, Tarpaulins, twist locks, etc.
Day 2	Brake Test - what to look for
	Correct use of radios
	Recap on previous day
	Questions and Answers
	Films
Days 3 & 4	Practical Field Exercises
	Switch In - Switch Out
	Operation of Local Control Panel
	Shunting switchlocked sidings
	Woods Sleeper locks
	Woods Keys
	Barrier Controls
Day 5	Familiarisation Local Knowledge
	Revision
	Assessment Exercise"

1.40 As part of his attachment to the Wellington roster as a Grade 2 LE up to December 1994 the RO would have spent approximately 20 percent of his roster on shifts involving shunting duties and thus approximately 10 percent of his time as second man to the train driver and actively involved on these duties. Shunting duties would have generally been simple placing or lifting of wagons with no requirement for kicking. The operator has stated "this is entirely consistent with the normal day to day operations at Gracefield" although this is not borne out by the Local Instructions in effect until 27 November 1995 or by the way staff at Gracefield described operations between December 1994 and May 1995.

1.41 The next formal training the RO received was a half day Yard Induction in early December 1994 when placed in the Gracefield gang. This was basically a walk around the area in which he would work, in this case Gracefield and associated stations, with a Supervisor, Training and Operating Practices (S.T.O.P) accompanying him to point out hazards and local sidings and their features. The S.T.O.P stated he had discussed the Local Instruction then in force with the RO and this included discussion on "loose shunting".

1.42 All other training received by the RO was "on the job" between 5 December 1994, the date he was attached to the Gracefield gang, and 20 January 1995 when he was certified. This covered approximately 206 hours, the equivalent of 24 single shifts, over four weeks. (The RO took three weeks leave during this period.) During this period the S.T.O.P was unable to visit the site and assess the RO's progress and discuss this with staff at Gracefield due to other commitments and the interruption due to Christmas holidays. From 7 March 1995, the date at which the last staff left Gracefield, yard shunting requirements were supplied from Wellington by means of Shunt Q2 manned by one LE and one RO. The RO was in sole charge of shunting at Gracefield on his shift.

1.43 NZRL's shunting training has traditionally been based on shunting schools of one week duration, followed by a period of on-the-job training. In the past on-the-job training was usually achieved by attachment to a three man gang, and progression from third man to second man to chargehand was based on a proving period in each position. This would be a matter of weeks or months in each position depending on individual ability and the size and complexity of the operations. It is still current practice to achieve on-the-job training by attachment, but in the case of the RO he was attached to a formalised Gracefield establishment of two, one Senior Shunter and one Train Examiner, Operations (TXO). For approximately one and a half weeks he worked a single shift under the supervision of the Senior Shunter with the TXO assisting for part of the shift. This was followed by approximately two and a half weeks working with another RO under training, both under the supervision of the Senior Shunter, before certification on the 20th January. Following certification the RO worked a further week under the Senior Shunter before he was withdrawn from Gracefield and a further five weeks on single shift with the TXO also present during part of the shift before the TXO was also withdrawn from Gracefield. (The TXO was an experienced shunter with Senior Shunter skill equivalence.)

1.44 In 1994 the shunting schools were discontinued and a one week Yard Introductory Course was introduced. This was introduced because of the introduction of ASP shunting. This was the only formal shunting training run by NZRL. It was developed to train new employees in the traditional duties carried out by yard staff with particular relevance to ASP operations which, when followed by on-the-job training to defined conditions and standards, would allow certification as to competence of the full course content and a pass mark in the category "shunting duties".

1.45 The syllabus contained a list of key skills/knowledge based on the course which were required to be attached to the employee's certification. The course syllabus and the skills listed did not specifically refer to loose shunting and unless instructors chose to include this it was not part of the course or part of the certification check list.

1.46 The RO did not attend the Yard Introductory Course as it was considered the experience and knowledge covered by his certificate as an LE with Train Operator skills covered the course syllabus.

1.47 The operator has advised "Formal training (for kicking of wagons) is currently contained, and used where necessary, in the Yard Introductory Course". A perusal of the Yard Introductory Course syllabus applicable as at 24th May 1995 revealed no reference to kick shunting. The only indirect reference was on Page 41 under the broad heading "Practical training in the yard using a T/R or Locomotive". Following 17 bullet points of specifics to include is a non-bullet point sentence "Practical yard shunting by rolling vehicles off into empty roads". No other reference could be found within the syllabus.

Certification

1.48 Certification of the RO in "Shunting duties" at "Gracefield" (the words quoted define the formal level of certification on the RO's certificate) on 20 January 1995 was by means of a Staff 23 Form. This was the standard NZRL form for initial certification of any employee with a new qualification. The form does not list details of the specific skills making up the qualification or the key tasks that must be applied or demonstrated to gain it. This is in contrast to the recently revised assessment sheets for re-certification of yard operating staff and for compliance checks. These do list key tasks involved in shunting that must be applied or demonstrated. However none of the 21 key tasks listed on these sheets related to loose shunting.

1.49 The RO was not required to apply or demonstrate his loose shunting skills during his initial certification check. The S.T.O.P who certified him ran over the Local Instructions with the RO and recalled discussing with him that although they allowed loose shunting, loose shunting was not part of the RO's job.

1.50 The compliance check carried out on the RO on 8 May 1995 did not fit the general pattern for such tests. The examiner was a Grade 1 LE acting in a Supervisor Training position who joined the company as a Traffic Operator at East Town. He held this position for two years and it included shunting duties. Shortly after commencing his acting period he had chosen various localities, jobs, and people for compliance tests to help him assimilate the nature and scope of his acting duties quickly. The compliance check for the RO was pre-arranged. During the four hour check the RO was not required to demonstrate any loose shunting skills because the understanding of training staff was that there was no need for the RO to use this method of shunting.

Gracefield staff and shunt manning

1.51 Up until 1994 Gracefield had a staff establishment of three:

One TXO
One Senior Shunter
One Shunter

These staff were based at Gracefield. A shunt locomotive was stabled at Gracefield and locomotive crews were supplied from Wellington to rostered needs. The TXO was not part of the shunt gang.

1.52 On 10 June 1994 Gracefield staff establishment was formalised at two with the shunter's position being abolished. At the time the applicable "Notice to Staff" included, inter alia, *"There is scope to operate the yard shunt with one person on the ground supplemented with assistance from the Train Examiner, Operations during the busier period."*

1.53 On 7 October 1994 NZRL issued proposals for alterations to the shunting and manning levels of the Wellington suburban shunting services, including Q2. This was based on the removal of the shunt locomotive from Gracefield and operating Q2 as the Gracefield shunt on a roster system from Wellington.

1.54 Manning was to be one LE and one RO with both staff based at Wellington. Although not specifically defined in the proposal this abolished the positions of Senior Shunter and Train Examiner, Operations at Gracefield. The proposed implementation date was 20 November 1994 subject to appointments and training. The proposed staff changes were discussed and understood by the staff and unions.

1.55 The change was not effected until 14 February 1995 following the training of the two RO's required to operate the early and late shift worked by Q2.

Seaview road level crossing

1.56 This level crossing is protected by flashing lights and bells and barriers. On main line level crossings activation is by approaching trains some distance from the crossing to allow uninterrupted and protected rail passage. However, such an arrangement is not practicable close to a busy shunting yard.

1.57 The lights and bells and barriers at Seaview Road level crossing were normally operated manually before shunting movements were made over the crossing. Automatic activation only occurred when a rail vehicle was approximately six metres from the edge of the road. This would start the alarm with a further five seconds delay to clear traffic before the barrier arms started to fall.

2. Analysis

The accident

2.1 Comparison of the consist, the position of the wagons in the yard after the accident, and the approximate train position as established by the LE prior to the kicking movement indicated the likely last movement prior to kicking ER525 was placing PK1209 and UK9255 to the Delivery Road and pulling out to clear the loop to delivery points. The setting of the route as detailed in Figure 1 meant the train would have been straddling the loop to train road crossover with the locomotive on the train road prior to commencing the kicking of ER525 as shown in Figure 1.

2.2 A survey of route setting following the accident indicated the route was set for the movement to the train road. This had required some resetting of roads after pulling out from the Delivery Road, in particular the loop to Delivery Road points had been reset for normal and the loop to train road crossover was in the reverse position as required. However two turnouts, the train road to No. 1 road facing and the No. 1 road to the No. 2 and 3 ladder facing were not set to the normal route for temporary placement of workshop wagons, ie, to No. 2 or No. 3 road. Normal practice at Gracefield was to position wagons for Woburn on No. 2 or No. 3 road. Following the usual requirement to propel wagons from No. 1 road to TSL on the south side of Seaview Road, the locomotive then returned via the south end ladder to No. 2 or No. 3 road ready to propel any wagons to Woburn Shops north of Gracefield as the last shunting movement at the end of the shift. Assuming the RO's intent was to set up a route to No. 2 or No. 3 road it is considered that having reset the loop to Delivery Road points and then walking south to check and set the rest of his route, he may have been distracted by his observance of the buffer condition between Wagons UK3532 (previously kicked to the north end of the loop) and the rake of empty wagons on to which it had been kicked. The buffers on these wagons were displaced laterally and the hook had not caught on. He was seen looking at these buffers before walking north. It was at this point that the discussion with the Wellington Box employee took place, following which the RO continued walking north towards his train.

2.3 The distance from the assumed position of the locomotive on the commencement of the kicking movement, based on the L.E's recollection, and the final position of the locomotive was 280 m. This conflicts with the recollections of the Wellington Box employee who recalled the rake straddling the south end loop to train road crossover as the R.O walked towards it. This would have placed the train some 60m south of the position shown in Fig 1, ie a distance of 220m travelled during the kicking and chasing sequence. A time/distance/speed analysis of the LE's recollection of events leading up to the accident indicated a distance of 225 m was covered from the command "kick". This correlation is considered sufficiently close to allow confidence in any assumptions made as to events from the commencement of the kicking movement to the accident despite the doubts as to initial train position.

2.4 The final position of the RO with respect to the train movement, marks on the footstep of Wagon ZP14796, and the marks on the leading end of wagon ZP14796 indicate that the RO was riding on the footstep of ZP14796 when the accident occurred. This footstep was on the right hand side of the wagon in direction of movement, ie, the opposite side to the LE's driving position.

2.5 There is no evidence as to when the hook between ZP14796 and ER525 was lifted by the RO. This may have been at rest before commencing the kicking movement if the hook was free, or may have been after the movement commenced, thus bringing the buffers together and freeing the hook. If the former, it is considered cut-off was achieved on the straight track between the train road to loop - loop to train road crossovers on the route set for the kicking movement. If the latter, it is possible cut-off was achieved on the curved track through the loop to train road crossovers which could have affected drawbar position when attempts to catch on to ER525 were made.

2.6 The bent drawbar on ER525 would have decreased the probability of ZP14796 catching the hook during the chasing movement. Both buffers were low by similar amounts which would not have had an adverse affect on attempts to catch on.

2.7 The nominal width of the hook on ZP14796 was 30 mm at entry. The nominal width of the throat it was entering on ER525 was 90 mm. The 35 mm lateral offset of the bent drawbar to the left would have been sufficient to create an interference fit when attempts to catch the hook were made.

2.8 The first attempt to catch ER525 failed and it is likely the RO saw the misalignment and realised the drawbar on ZP14796 needed to be moved to the left, ie, away from him, to enable connection.

2.9 The marks on the footstep and on the end of Wagon ZP14796 indicate that his action on the second attempt to catch ER525 was probably to turn inwards with his back to the direction of travel, holding on to the handrail with his left hand, with his left foot on the footstep whilst attempting to move the drawbar over with his right foot. Based on the timing of commands given to the LE he may have been holding his radio handpiece in his right hand. It is assumed that while attempting to kick the drawbar away from him his left foot slipped from the footstep and he fell.

2.10 The Gracefield Local Instructions dated 4 June 1991 related to the staffing level applicable at that time. It had not been updated to reflect the Gracefield staffing and shunt manning changes which were implemented during 1994 and early 1995. The instruction was not appropriate to a "one man on the ground" shunting crew such as that operating at Gracefield on the day of the accident. In essence, the Local Instruction did not allow loose shunting with a "one man on the ground" shunting crew as it was not possible for an RO to control the kicking movement and catch the brake. Notwithstanding this, it was quite clear in expressing the key message that loose shunting could only be carried out with someone in position to catch the brakes.

2.11 The re-issue of the Local Instructions on 13 July 1995 made it clear that the RO at Gracefield was required to have the skills to loose shunt although the chance to exercise those skills would be limited by the availability of an additional qualified person. The operator has advised that the RO was certified "for ASP shunting and with one man on the ground". His certification did not make this clear. The operator has also advised that "It had been identified prior to training that he would not be formally trained or specifically tested on the skills required for loose shunting because he would not be required to perform this task at Gracefield". This is in apparent conflict with the reissue of the Gracefield Local Instruction on 13th July 1995 which allowed loose shunting under controlled conditions and defined the appointed Rail Operator, by inference, as a qualified person.

2.12 Rule 129(b) is not specific as to the meaning of "experienced". The background of the RO as an LE doing limited shunting as second man until December 1994 and then on-the-job local familiarisation training until the 7 March 1995 did not necessarily qualify him as experienced.

2.13 Once the kicking movement was made to the wrong road without a qualified person in position to catch brakes the RO was faced with a potentially dangerous situation as the wagon was proceeding towards Seaview Road level crossing at "quite a speed" (the LE's description).

2.14 The RO was aware of the method of operation of the level crossing protection and this would no doubt have influenced his thinking in deciding to give chase to the wagon and attempt to catch the hook.

2.15 In addition all staff at Gracefield were aware of the descending grade towards Seaview Road (the average grade was 1 in 600) which would have increased the normal wagon stopping distance.

2.16 In attempting to catch wagon ER525 by riding on the leading end of ZP14796 the RO was not contravening any specific NZRL code requirement. The code refers to "coupling or uncoupling" when stating a rake should be "stationary" and that it should never be attempted on "moving wagons". As NZRL's accepted practices allowed for lifting and attaching hooks ("cut-off" and "catch on") between moving wagons at a slow pace the current reference to "coupling and uncoupling" was assumed to refer specifically to brake hoses. Discussion with NZRL staff indicated agreement with this assumption. The operators definitions with respect to shunting terms and their application to code requirements requires urgent review to avoid misinterpretation and specifically to prohibit the inherently dangerous action carried out by the RO. This is in hand and reflected in this report Section 5, Safety Actions.

Wagon aspects

2.17 ER525 had last been in the Depot on 1 May 1995 at which time minor repairs had been carried out and tests and services undertaken before a Certificate of Inspection was issued. There is no way of determining whether the bent drawbar had been in that condition on 1 May 1995

2.18 Visual examination of the wagon when uncoupled gave an immediate indication of the nature and severity of the deformation. This would not have been so obvious if the wagon had been coupled when the Certificate of Inspection examination was made. It is not unusual for wagons to be coupled when examinations are made.

2.19 The NZRL code covering drawgear condition was revised in July 1995. The re-issue had no requirements relating to bent drawbars. The operator is taking steps to address this omission and to define limits of bend in buffers as detailed in this report Section 5, Safety Actions.

2.20 The painting of the footstep on ZP14796 reflected a recent relatively widespread NZRL practice of painting footsteps, handbrake levers, handrails and hand grips to make them stand out and be seen easily by Operating staff. This came into effect without formalisation and despite specific requirements in wagon upgrade or major repair specifications not to paint footstep tread surfaces and the detailed painting and lettering and stencilling diagrams for specific wagons which restrict painting of surfaces such as the top of footsteps and the top surface of handbrakes. The operator has taken steps to correct this situation as detailed in the this report Section 5, Safety Actions.

2.21 The paintwork on the footstep of ZP14796 was relatively new and had not worn through on the raised grip providers (Figure 3). It is difficult to assess what effect, if any, this may have had on the RO's footing.

2.22 The sequence of events leading up to the accident i.e. an unauthorised and incorrectly routed kicking movement, pursuing a wagon at speed from the leading end of a propelling movement, and the likely action of attempting to move a buffer with the foot, make it relevant to consider the training and certification of the RO in some detail.

Training

2.23 At the time of his attachment to the Gracefield gang the RO had received limited shunting training and had not received any training associated with loose shunting. It is unlikely that he would have been involved in any loose shunting while operating as an LE; most of his shunting experience would have been associated with placing wagons to, and picking wagons up from, mainline sidings. This apparent lack of training and experience on arrival at Gracefield was reflected in the opinion of the Gracefield staff with whom he was placed. This opinion was also supported by the second redesignated LE attached to the Gracefield gang as an RO in mid December 1995 who stated that in the course of his 18 years' service as an LE he was given no instruction on shunting prior to his arrival at Gracefield (he would have attended the same courses as the RO, including the Train Operators course outlined in clause 1.39)

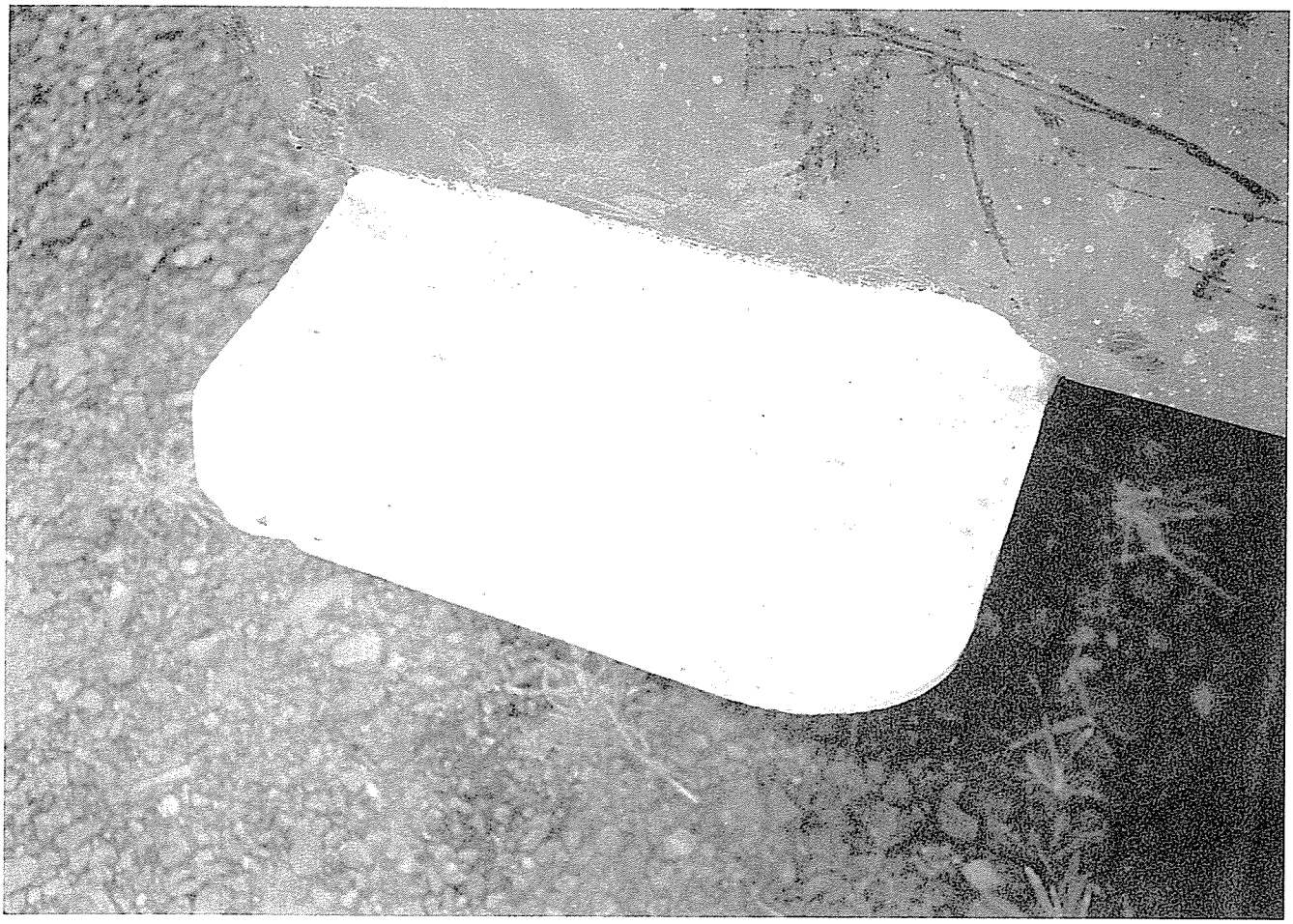


Figure 3
Painted footstep on ZP14796

2.24 The understanding of the Manager Training and Operating Practices and his Supervisor was that the RO did not need training for his shunting duties because he had been through the Train Operators Course in 1987. They saw their role as certifying that the RO could apply his skills on appointment to the position of RO to the particular operating environment of Gracefield. This local certification is standard practice when qualified operating staff are moved to a new locality. In reaching this understanding they were aware that the RO did not possess loose shunting skills and considered such skills were not necessary at Gracefield since under "one man on the ground" operation there would be no loose shunting. This conflicts with the Local Instruction in effect at the time of the accident and the Local Instruction covering "one man on the ground" operation issued 13 July 1995 following the accident.

2.25 The perception of the Terminal Manager, the RO's controlling officer who placed him at Gracefield, was that the RO had been placed there for Gracefield staff to train him on the operation of Gracefield yard. He stated he did not expect Gracefield staff to train the RO with respect to shunting but did expect that in the course of his period with them they would keep an eye on his progress, correct wrong actions and in general pass on their knowledge to the RO.

2.26 The Acting Senior Shunter and the TXO based at Gracefield said they were unclear as to what was expected of them with respect to the RO's attachment at the time of his placement. They stated they had no prior knowledge of his arrival with the gang and no specific instructions as to what was expected of them. They assumed that they were to train the RO in the operation of Gracefield yard and this was confirmed during several site visits by the Terminal Manager during the time of the attachment prior to certification. Their response to any lack of skill and experience shown by the RO was to correct wrong actions and to pass on tips from their own knowledge i.e. meeting the Terminal Manager's expectations.

2.27 It is relevant that during the RO's period of attachment at Gracefield, Gracefield was manned as a "two man on the ground" shunting yard and staff at Gracefield stated kick shunting was carried out as standard practice on an almost hourly basis. Statements further indicated that during this period kicking movements were made with a man on the brakes (i.e. in position on the ground or riding the wagon kicked in such a way as to be able to apply the handbrake when necessary), or by kicking onto a road with wagons placed and braked to hold, or by kicking a wagon with the handbrake partly applied and that the RO observed and carried out such kicking movements . The latter two methods of kicking were not recognised or covered by code or instructions but are understood to have been relatively common shunting staff practice.

2.28 The RO's on-the-job training was therefore in an environment where kicking was permitted and commonplace and where long established practices developed by experienced staff were carried out as if they were "accepted" practices and not detected or corrected by supervision or compliance monitoring.

2.29 It is considered the traditional method of acquiring skills in loose shunting by progression through positions in a shunt gang would have achieved the desired end result of only employees "experienced in shunting" (Rule 129(b)) carrying out kicking and slipping movements.

2.30 The lack of formal training in loose shunting skills, the limited period to absorb these skills on-the-job, and the lack of any formal assessment of those skills in operation raises doubts as to the readiness of the RO to be left in sole charge where loose shunting was permitted under controlled conditions. These doubts are based on the Local Instructions and apply despite the reported discussion between the S.T.O.P and the RO during certification at which time the S.T.O.P "discussed with the RO that loose shunting was not part of his job".

Certification

2.31 NZRL has a comprehensive and controlled certification system covering operating staff. The recent reissue of re-certification and compliance forms indicated that this system is under constant review and is intended to cover skills in detail.

2.32 Currently this detail is not reflected in initial certification by means of a Staff 23 Form. There was no way of telling from the RO's certification in "shunting duties" at "Gracefield" as to what those specific duties were and what skills needed to be applied or demonstrated to be certified. In the event there appear to have been different perceptions as to what part loose shunting played in those duties. It is considered the specific skill details defined with regard to re-certification and compliance testing should be reflected in initial certification and that initial certification and subsequent re-certification and compliance testing should include loose shunting skills where those skills form part of the expected and permitted duties.

Human factors

2.33 The RO was a solidly built big framed man whose interests included active sports. Reports indicated he adapted well to the physical demands of shunting at a speed related to his size. Although he was slow on his feet, the report also indicated his natural style was to think and act quickly, with a high level of confidence. This confidence was sometimes seen by others as misplaced, as reflected during a discussion in the Wellington yard with the supervisor who had introduced him to Gracefield and who had eventually certified him. This took place in early January (approximately two weeks before his certification). On asking when he was to be certified, and on being told he was not yet ready, the RO responded he was "ready to go".

2.34 The shunt crew took a break of approximately sixty minutes following reattachment of the locomotive on the north end upon arrival at Gracefield. The operator considers it would have been unlikely that more than about fifteen minutes would have been needed to action the "paper work". Time management and the delay in breaking up Q2 shunt on that day may have been a contributory factor in the sequence of events leading up to the accident. However investigation revealed the method of operation used on the morning of the accident (kick shunting) was not unique to that morning, indeed it was a regular feature of shunting at Gracefield. A further factor in the possible effect of time management was the Gracefield shunting staffs mutually agreed practice of not shunting in the dark due to their concern at the level of lighting available in Gracefield Yard. Sunrise on the 24th May 1995 was approximately 0730 hours, ie, when the break terminated and shunting recommenced. The operator is looking into the possible relevance of this to overall time management considerations.

3. Findings

3.1 The LE was operating the shunt normally in response to the RO's commands and was certified for the duties concerned.

3.2 The RO was carrying out an unauthorised shunting movement, in that there was no additional qualified person to catch wagon brakes, prior to the accident.

3.3 The route for the intended kicking movement was incorrectly set by the RO.

3.4 The RO's actions following his realisation of the wrongly set route were apparently affected by his concern regarding the potential hazard of the wagon running down onto Seaview Road level crossing.

3.5 In pursuing the wagon from the leading end of a relatively high speed propelling movement he took up a dangerous position which was not specifically prohibited by NZRL code requirements.

3.6 The drawbar on wagon ER525 was bent to such a degree that an interference fit was possible when attempting to catch the hook.

3.7 It is probable that the RO was attempting the prohibited action of trying to move the drawbar on wagon ER525 with his foot when he slipped from the footstep.

3.8 The paint on the footstep on wagon ZP14796 may have adversely affected the RO's foothold on the footstep.

3.9 The time management adopted by the Gracefield shunting gang may have been a contributing factor to the sequence of events leading up to the accident.

3.10 The lack of a current Certificate of Inspection for wagon ZP14796 did not contribute to the accident.

3.11 The low height of the buffers on the matching ends of ZP14796 and ER525 did not contribute to the accident.

3.12 The Gracefield Local Instruction permitted loose shunting under controlled conditions as part of the accepted way of operating the yard.

3.13 The RO was certified for "shunting duties" at "Gracefield" although he had not been formally trained or specifically tested in the skills required for loose shunting.

3.14 It is not known whether the kick shunting movement was initiated by the RO as a deliberate non-compliance in order to speed up his job or as a mistaken understanding of what was acceptable based upon the training and certification he had received.

3.15 The RO had observed or made kicking movements frequently during his on-the-job training period, not always with a qualified person available to catch wagon brakes.

3.16 The RO had initiated two kicking movements between 0730 hours and 0800 hours on the morning of 24 May 1995 prior to the accident.

3.17 It is likely the RO had initiated kicking movements frequently without a qualified person in position to catch the wagon brakes during his period in sole charge at Gracefield from 7 March 1995 to 24 May 1995.

3.18 Supervision and compliance monitoring following the training and certification of the newly appointed and relatively inexperienced RO failed to detect or correct his reported common use of kick shunting, including non-compliant procedures.

3.19 Kicking of wagons is an authorised and standard practice in clearly defined circumstances although no formal provisions exist for training or certifying staff in the procedures required and the restrictions applicable.

3.20 Experienced shunting staff have adopted their own methods of kick shunting which do not necessarily comply with the defined Code and Local Instruction requirements.

3.21 The general level of compliance monitoring with regard to kick shunting procedures does not appear to have identified or actioned the apparent common use of non-compliant procedures.

3.22 Unmonitored on-the-job learning without formal training in the particular conditions, procedures and skills required to carry out loose shunting may have resulted in the relatively inexperienced RO assuming the established practices of experienced staff were accepted procedures.

4. Safety Recommendations

4.1 NZRL have a strongly structured approach to the training, certification and compliance testing of operating staff generally well suited to operational needs.

4.2 As evidenced by the changes at Gracefield , the traditional structure of three man shunting gangs where loose shunting was an every day occurrence is progressively giving way to "one man on the ground" crewing where loose shunting is still permitted on the infrequent occasions when an additional qualified person is available to catch wagon brakes. The skills and experience required by the staff concerned have not changed but the ability to exercise them will be decreased. It is also possible that the temptation to carry out non-compliant loose shunting may increase.

4.3 In the particular and relatively recent application of the training, certification and compliance system to LEs re-deployed on to ground operating duties involving shunting skills, assumptions as to general shunt knowledge have not always been supported by experience shown on the job.

4.4 It is therefore recommended that the Managing Director of Tranz Rail Limited::

4.4.1 Urgently review the adequacy of the existing Local Instruction covering shunting at Gracefield to ensure it clearly defines under what circumstances, if any, loose shunting is allowed with a two man gang. (036/95)

4.4.2 Review the adequacy of Local Instructions covering shunting for all localities, with particular regard to loose shunting. (037/95)

4.4.3 Carry out specific training and educational programmes to make all yard operational staff fully aware of the requirements for loose shunting and institute a system to ensure compliance. (038/95)

4.5 The operator, Tranz Rail Limited, made the following response to the Final Safety Recommendations:

Clause 4.3
Tranz Rail questions the continual reference to inexperience of the staff. The process started when the points were incorrectly set. It was followed by a non-compliance and the employee was aware of the instruction. The next and most critical action was chasing a wagon at speed while riding on the front. The employee had sufficient experience riding on wagons and locomotives to know the dangers associated with this.

5. Safety Actions

5.1 On 13 July 1995 NZRL revised the Local Instruction covering Gracefield operations to reflect the manning levels introduced from 14 February 1995 while still permitting loose shunting under controlled conditions. On 27 November 1995 the operator reissued the Local Instruction for Gracefield amended to the effect that "Loose shunting will NOT be permitted in sidings and marshalling roads in the Gracefield - Woburn area".

5.2 The operator is currently reviewing Section 5 of the Operating Code. As a result of liaison during the course of this investigation this review will include a revised list of definitions of shunting terms which will include clear differentiation of the following common terms:

Catch on
Cut off
Couple
Uncouple

The review will also include provision of a code requirement which will prohibit attempting to catch on when riding on a vehicle.

5.3 As a result of liaison during the course of the investigation the Mechanical Code is being amended to include a requirement to detect and set limits for bent drawbars and to clarify the intent of the code to measure drawbar heights under tare conditions.

5.4 The operator has issued instructions to prevent the painting of footsteps and the top surfaces of handbrake levers and to "bad order" any wagons found in this condition to have the paint burnt off. Full painting of handrails and handgrips will continue as in the past and a reminder instruction has been issued to all mechanical depots to confirm the practice.

5.5 The identification of loose shunting has been addressed and amended in the detailed mastery test associated with recertification and compliance tests.

13 December 1995

M F Dunphy
Chief Commissioner

Glossary Of Railway Terms

ASP	Audio Shunting Procedures.
Catch on	To attach vehicles by dropping the hook.
Consist	The locomotive(s) and vehicles making up a train.
Couple	To connect brake hoses ready for use.
Cut off	To lift the hook between vehicles.
Kicking	To separate wagon(s) by accelerating the movement a short distance in the direction that is being operated with the hook lifted.
Leading en	The front end of a locomotive or vehicle in direction of travel.
Loose shunting	Kicking or slipping.
Operator	New Zealand Rail Limited, now known as Tranz Rail Limited.
Propelling	Pushing a rake of vehicles.
Rake	A group of vehicles.
Run about	The action of detaching a locomotive from its train and reattaching it at the opposite end.
Slipping	Separating wagon(s) by pulling them, lifting the hook and accelerating the locomotive forward. After the locomotive clears, points are reversed and the following wagon(s) proceed to another road.
Uncouple	To disconnect brake hoses.