Report 98-105

Train 235

derailment

Ngaruawahia

14 March 1998

Abstract

On Saturday, 14 March 1998, at about 1802 hours a displaced stack of platform containers on Train 235, a Westfield to Wellington express freight train, struck a through-truss bridge at Ngaruawahia. As a result of the collision the train parted, six wagons were derailed, and major damage to the bridge occurred when five wagons and various loads concertinaed.

The cause of the collision was the movement of inadequately restrained stacked platform containers. Safety issues identified were:

- the serviceability and uniformity of integral interlocking devices fitted to platform containers;
- the standards for transporting stacked platform containers internationally; and
- the understanding of and compliance with requirements for transporting stacked platform containers by rail.

Three safety recommendations were made to address these issues.

The Commission investigated this incident because of the potential for loads which have moved in transit to endanger other trains and third parties adjacent to the track.

Transport Accident Investigation Commission

Rail Incident Report 98-105

Train type and number:	Express freight 235
Date and time:	14 March 1998, 1802 hours
Location:	Ngaruawahia at 560 km North Island Main Trunk
Type of occurrence:	Platform containers struck bridge
Persons on board:	Crew: 1
Injuries	Nil
Damage:	Major damage to Bridge 267 North Island Main Trunk, the six derailed wagons and various loads
Investigator-in-Charge:	R E Howe

1. Factual Information

1.1 Narrative

1.1.1 At 1600 hours on Saturday 14 March 1998 Train 235, a rostered southbound Tranz Rail Limited (Tranz Rail) express freight, departed Westfield for Wellington.

1.1.2 The train consist was locomotives DFT 7049, DX 5037 and 36 wagons with an all-up weight of 1222 t and a length of 632 m. The train was crewed by a locomotive engineer (LE).

1.1.3 At approximately 1802 hours the train changed from double line to single line at the north end of Ngaruawahia to cross Bridge 267, a single line through-truss bridge spanning the Waikato River.

1.1.4 Shortly after the front of the train had crossed the bridge the LE noticed that the train had lost all air pressure and the train brakes had been automatically applied. The LE suspected a burst hose but when he walked down his train he found the train had parted, with the rear portion of the train derailed into the bridge structure at the northern entry to Bridge 267, (see Figures 1 and 2).

1.1.5 As a result of the damage to the bridge the North Island Main Trunk (NIMT) was closed for seven days while temporary repairs were carried out to enable rail traffic to resume at restricted speed.

1.2 Witness reports

1.2.1 A truck driver travelling north on State Highway 1 approximately one kilometre north of Bridge 267 passed southbound Train 235 on the adjacent parallel railway.

1.2.2 His attention was drawn to a wagon near the middle of the train loaded with stacked container bases. He stated the orange bases were stacked about six high and the front of all but the bottom one had moved uniformly approximately 1.5 m towards him (the left hand side of the train in the direction of travel). His observation was made approximately one minute before Train 235 reached the bridge.

1.2.3 A motorist was stopped on the east side of Old Taupiri Road level crossing by the flashing lights and bells warning of the approach of Train 235. The crossing is approximately 60 m north of the entry to Bridge 267.

1.2.4 The motorist looked to his right as Train 235 approached and saw "reddish-brown flat steel things ... about six high ... with some loose ones sticking out at the front". He noted other stacks in front of the loose stack which "were all okay". His recollection of the loose stack was that the two bottom ones were together and had moved towards him at the front, but were still in position at the back. The ones above had also moved at the front but not as much as those below.

1.2.5 The motorist looked to his left as the train passed and saw the displaced front end of the two bottom steel bases hit the left hand side of the bridge and "swing around blocking everything else" following which "the ones on top went forward and everything just piled up behind".

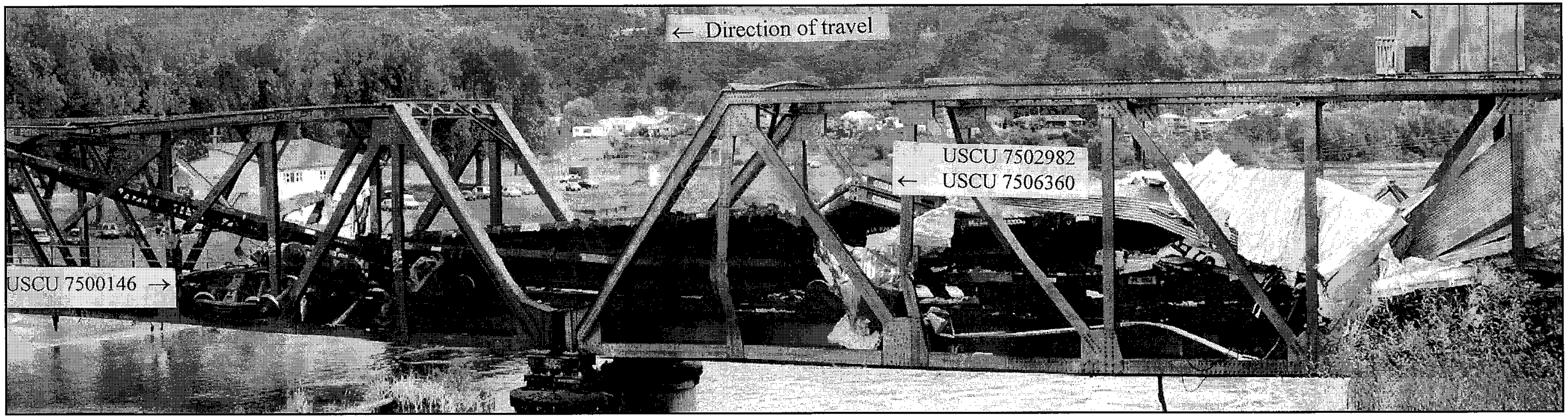


Figure 1
General view of the derailment scene from the east

Figure 2
General view looking south at the north entry to the bridge

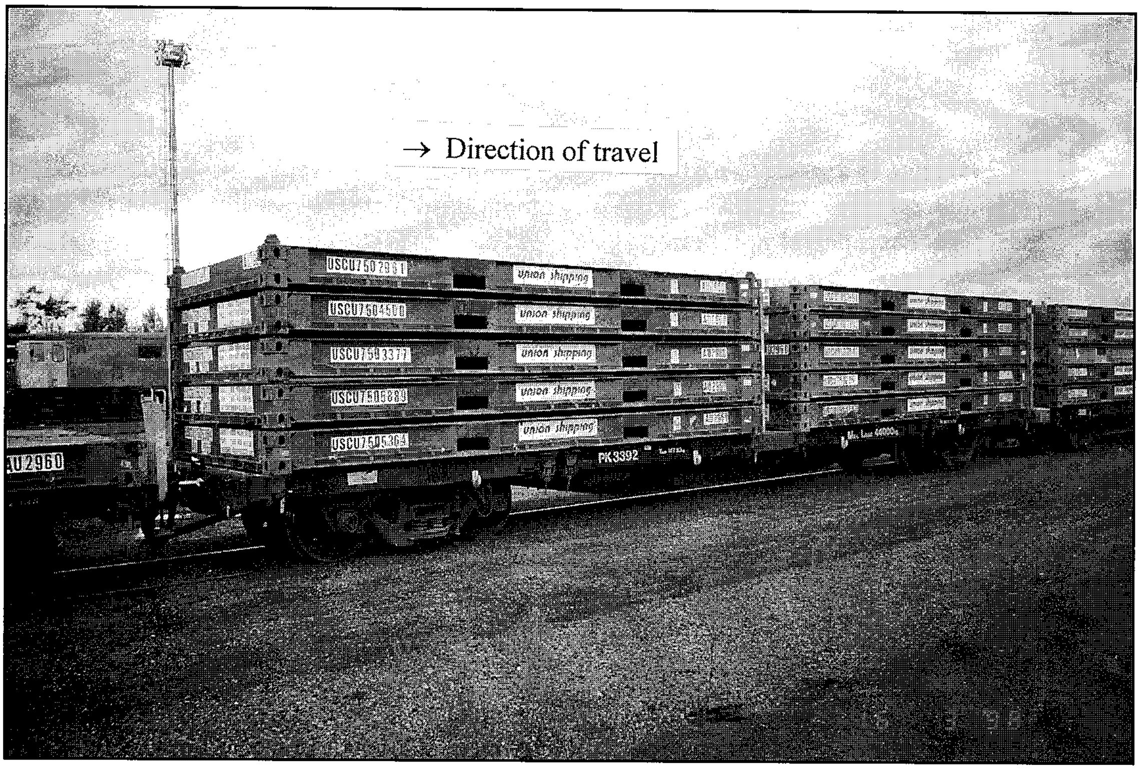


Figure 3
General view of the three stacks preceding the stack which collided.
PK3478 and the bottom of stack 4 at left

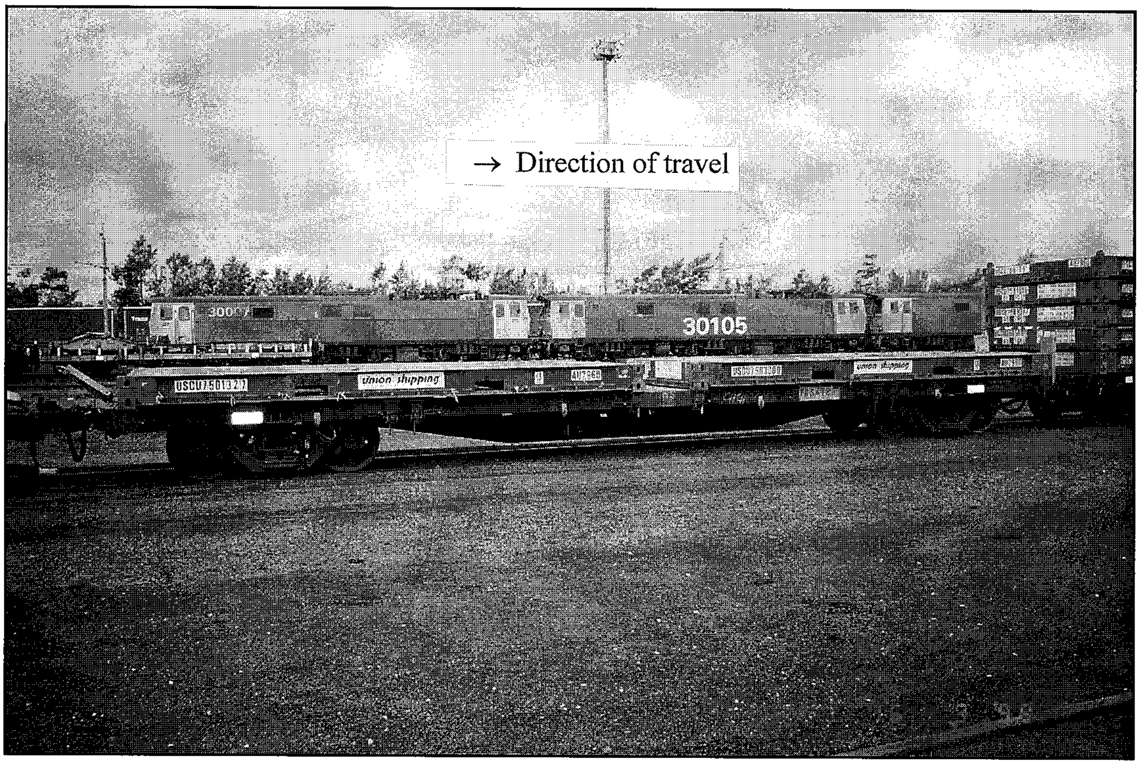


Figure 4
PK3478 showing the bottom bases in position following the incident.
Both stacks were five high prior to the collision, similar to PK3392 at right

1.3 Site information

1.3.1 Train 235

1.3.1.1 Train 235 came to a stop approximately 640 m south of the impact point. Eighteen wagons were still attached to the train with the second and third from the rear derailed to the right hand side. There was a gap of approximately 300 m back to the derailed wagons on Bridge 267.

1.3.1.2 Of the remaining 18 wagons, four had derailed and were part of the tangled mass of wagons and loads at the entry to Bridge 267. The final 14 wagons remained on the track.

1.3.1.3 Wagons 17 and 18 on the front portion of the train had been loaded with empty containers. These containers were found to be part of the tangled wreckage on the bridge.

1.3.1.4 Wagons 14, 15 and 16 on the front portion of the train were loaded with platform containers. Platform containers (also known as flatdecks, bases and bolsters) are a standard container type defined in Australian/New Zealand Standard AS/NZS 3711.8:1993 as "a loadable platform having no superstructure whatever but having the same length and width as the base of series 1 containers, and equipped with top and bottom corner fittings, located in plan view as on other series 1 containers, so that some securing and lifting devices used on other series 1 containers of the same length can also be used on platforms". For simplicity they are referred to as bases henceforth.

1.3.1.5 Figure 3 shows wagons 14 and 15 (UK8509 and PK3392 respectively) following the incident loaded with three stacks of bases five high.

1.3.1.6 Figure 4 shows wagon 16 (PK3478) following the incident with only one base left from each stack. These bases were fastened by four twistlocks to the wagon and had not moved.

1.3.1.7 The manifest for Train 235 showed that PK3478 had been loaded with two stacks of five bases prior to the incident.

1.3.1.8 Comparison of the manifest with the bases still in place on PK3478 showed the individually identified bases were loaded onto PK3478 in the configuration shown in Figure 5:

SCXU 8938436	USCU 7504199
SCPU 8928688	USCU 7503736
USCU 7502982	USCU 7502405
USCU 7506360	USCU 7500146
USCU 7503000	USCU 7501327

←

Direction of Travel

Figure 5
Bases on PK 3478

1.3.1.9 Each of the bases was 2440 mm wide. The USCU 750 series bases were 340 mm deep and the SCXU and SCPU series bases 330 mm deep.

1.3.1.10 The normal stack width was 2460 mm making allowance for stacking tolerances and attachments.

1.3.1.11 The overall stack height, on the 870 mm deck-height wagons, was approximately 2600 mm above rail level depending on stacking details.

1.3.2 The damaged bases

1.3.2.1 Following the incident eight bases were recovered from Bridge 267 at the locations defined below:

SCXU 8938436 SCPU 8928688	wrapped around the top cross member of the first through-truss span (Figure 6).
USCU 7502982 USCU 7506360	joined together, inside the bridge and slightly skewed, at the south end of the first through-truss span (Figure 1).
USCU 7504199 USCU 7503736 USCU 7502405	under the containers and debris which had not entered the bridge and across the end diagonals at the entrance to the first through-truss span. USCU 7504199 and USCU 7503736 were joined.
USCU 7500146	inside the bridge at the north end of the second through-truss span, at right angles to the track and protruding through the bridge sides (Figure 1).

1.3.2.2 Inspection of the bases recovered from the bridge showed signs of welding on some corner castings, with USCU 7503736 having a broken portion of steel angle welded to it.

1.3.2.3 On Wednesday 18 March 1998 an undamaged length of steel angle (Figure 7 and Figure 8) was found approximately 2 km north of Bridge 267 at 561.96 km NIMT. The dimensions of the steel angle and the pattern of welding along its length indicated that it may have been used for restraining bases on wagon PK3478 on 14 March.

1.3.2.4 Some days after the incident a fractured piece of steel angle was found amongst the debris dumped following site clearance. Its size and weld patterns indicated that it may also have been used to restrain bases on wagon PK3478.

1.3.3 Track inspection

1.3.3.1 An inspection of the track and structures close to the line north of Ngaruawahia showed no signs of any impact or unusual features to indicate any earlier collision associated with Train 235 and its load.

Figure 6
The two "Sea Container" bases wrapped around the top cross member at the entry to the first though-truss span

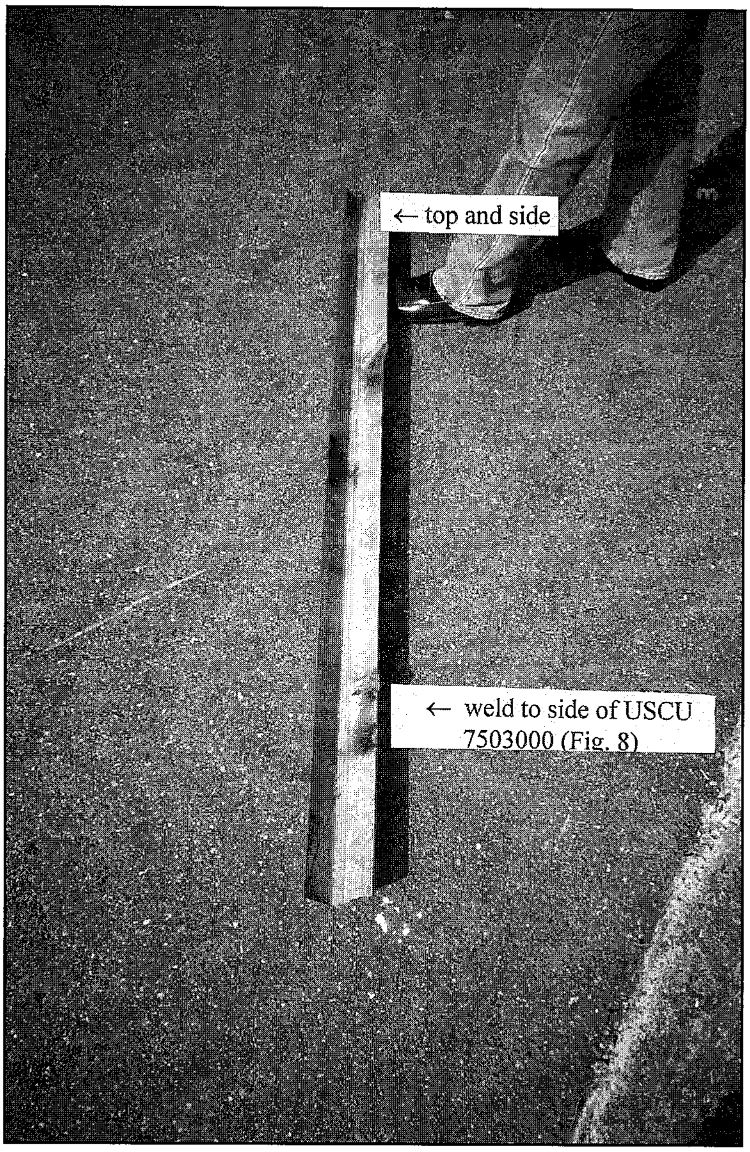


Figure 7
Length of steel angle found 2 km of the derailment site

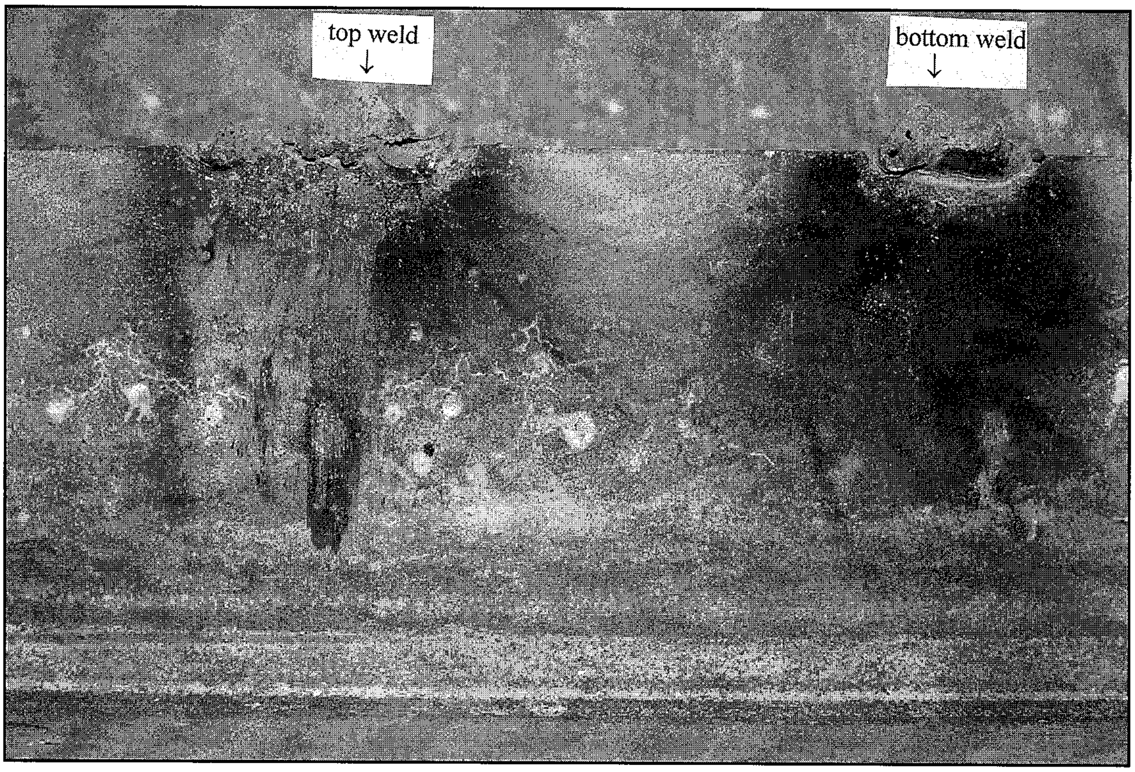


Figure 8
Close up of the welds which were to the side of USCS 7503000 (base 1)

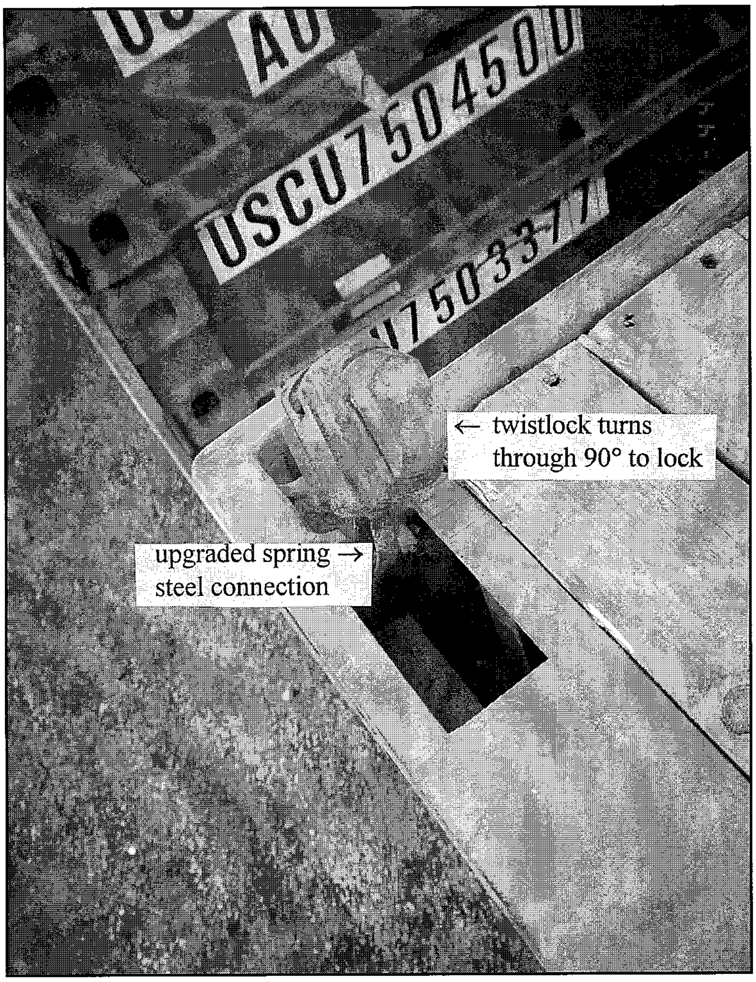


Figure 9
Retractable pivoted twistlock in the partly raised position. (Note the upgraded spring steel connection detail to replace the defective casting detail typified in Figure 14.)

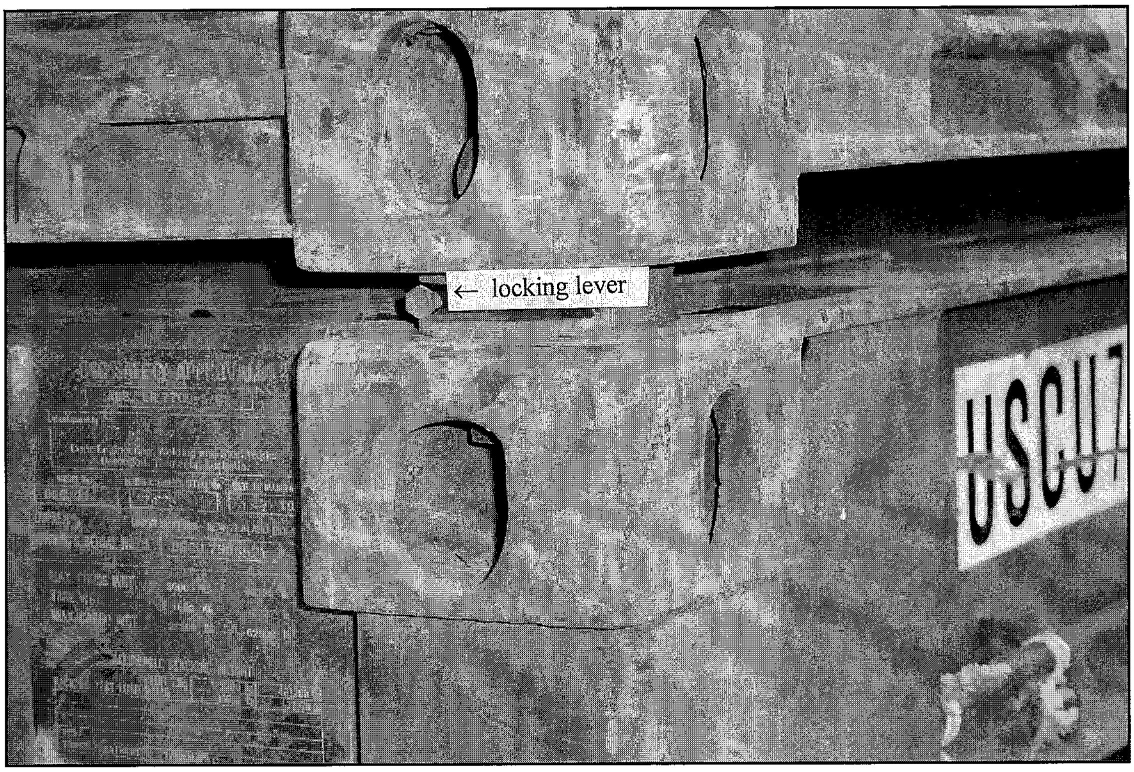


Figure 10
Twistlock locked in place

1.3.4 Integral interlocking of stacked bases

1.3.4.1 The bases making up the five stacks on Train 235 comprised two types distinguished by the different integral interlocking systems for connecting them together for transit and handling.

Type 1. The USCU 750 series bases (referred to henceforth as "Doric" bases, see 1.6.1) made up 22 of the 25 bases being transported. These bases included a built-in twistlock at each corner on the top (Figure 9). When stacked for transit these twistlocks were intended to be raised and rotated through 90 degrees to lock the bases together (Figure 10).

Type 2. The bases with prefix SCXU or SCPU (commonly referred to as "Sea Container" bases) made up the remaining three being transported. These included retractable locators on two of the four corners to locate stacked containers (Figure 11), and a built-in ring and bolt system at each corner to connect the bases for transit (Figure 12). The bases had detailed instructions attached regarding the use of the ring and bolt system.

1.3.4.2 The undamaged stacks on wagons UK8509 and PK3392 were inspected to determine the condition and application of the integral interlocking devices. The results of this inspection are summarised in Table 1.

Table 1

Terminology Stack 1 refers to the leading stack of bases on Train 235. Each of the five stacks were five bases high and are numbered bottom to top. Interface 1 is between base 1 and base 2.

Stack 1 (UK 8509, refer Figure 13)

Interface No.	Connection details
4	All twistlocks were missing.
3	Base 3 was a "Sea Container" base with no twistlocks. Both locators were retracted.
2	All twistlocks were missing.
1	Four twistlocks were present, raised, but not locked. (Base 1 was a modified "Doric" base with spring steel twistlock pin connectors, refer Figure 9).

Stack 2 (leading end of PK 3392)

Interface No.	Connection details
4	All twistlocks were missing
3	Four twistlocks were present and raised, of which two were locked. (Base 3 was a modified "Doric" base)
2	Four twistlocks were present and locked.
1	Two out of four twistlocks were present, raised but not locked.

"Sea Container" base details

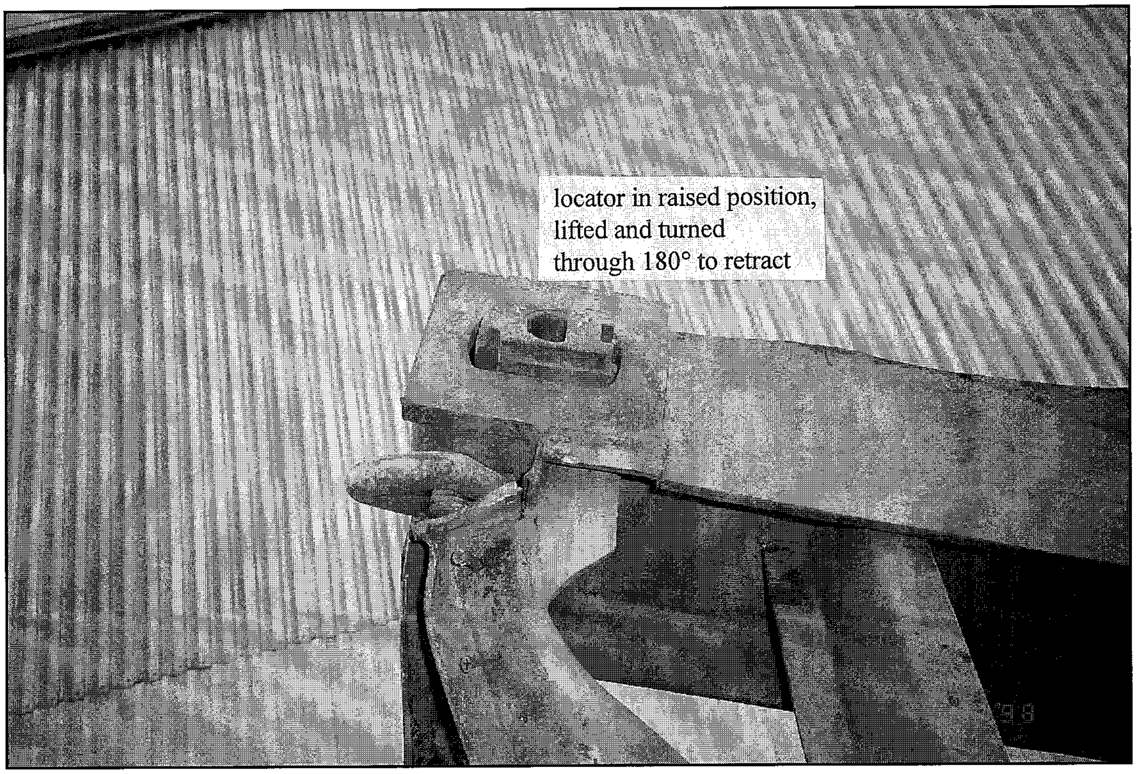


Figure 11
Retractable locator. Two locators on each base located at opposite corners

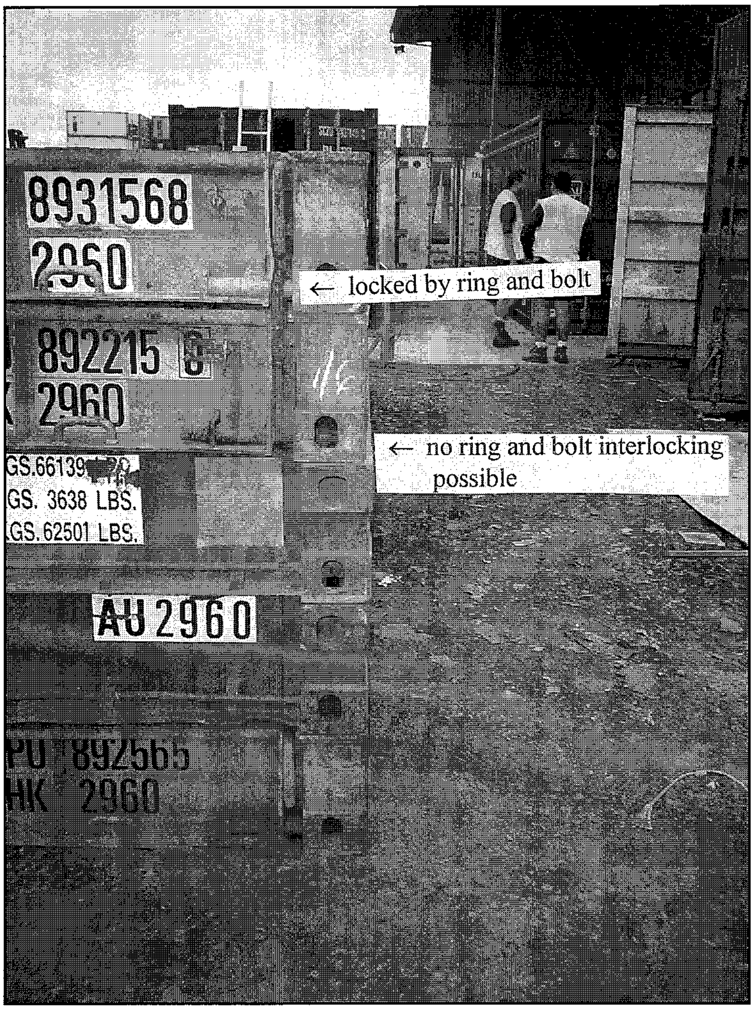


Figure 12
Method of locking "Sea Container" bases using a ring and bolt at each corner (these bases were not involved in the incident)

Stack 3 (trailing end of PK 3392)

4	Three out of four twistlocks were present and locked.
3	Four out of four twistlocks were present and locked.
2	Four twistlocks were present, three of which were locked and one retracted. (Base 2 was a modified "Doric" base).
1	Three out of four twistlocks were present and locked.

1.3.4.3 The bases which had formed the two damaged stacks on PK3478 were also inspected with the results summarised in Table 2.

Table 2

Stack 4 (leading end of PK3478 and reported as moved prior to the collision)

4	Bases 4 and 5 were "Sea Container" bases. The two locators on base 4 were raised. The ring and bolt locking was not applied.
3	No twistlocks and pins were present (but the right rear corner was damaged and missing as a result of the incident).
2	The two trailing twistlocks were missing. The two leading twistlocks were present and raised, but only one was locked.
1	All twistlocks were missing (a fresh casting break at the left rear may have occurred at impact but if so the twistlock was not locked).

Stack 5 (trailing end of PK3478)

4	Four twistlocks were present and raised, but only two were locked. (Base 4 was a modified "Doric" base).
3	All twistlocks were missing.
2	All twistlocks were missing.
1	All twistlocks were missing.

1.3.5 Steel angles welded at corners

1.3.5.1 All three undamaged stacks were restrained at diagonally opposite corners by lengths of steel angle welded to the bases. A detailed visual inspection of all base/steel angle interfaces showed:

- the six lengths of steel angle welded to the leading right side and trailing left side of the three stacks had angle leg lengths varying from 30 to 100 mm

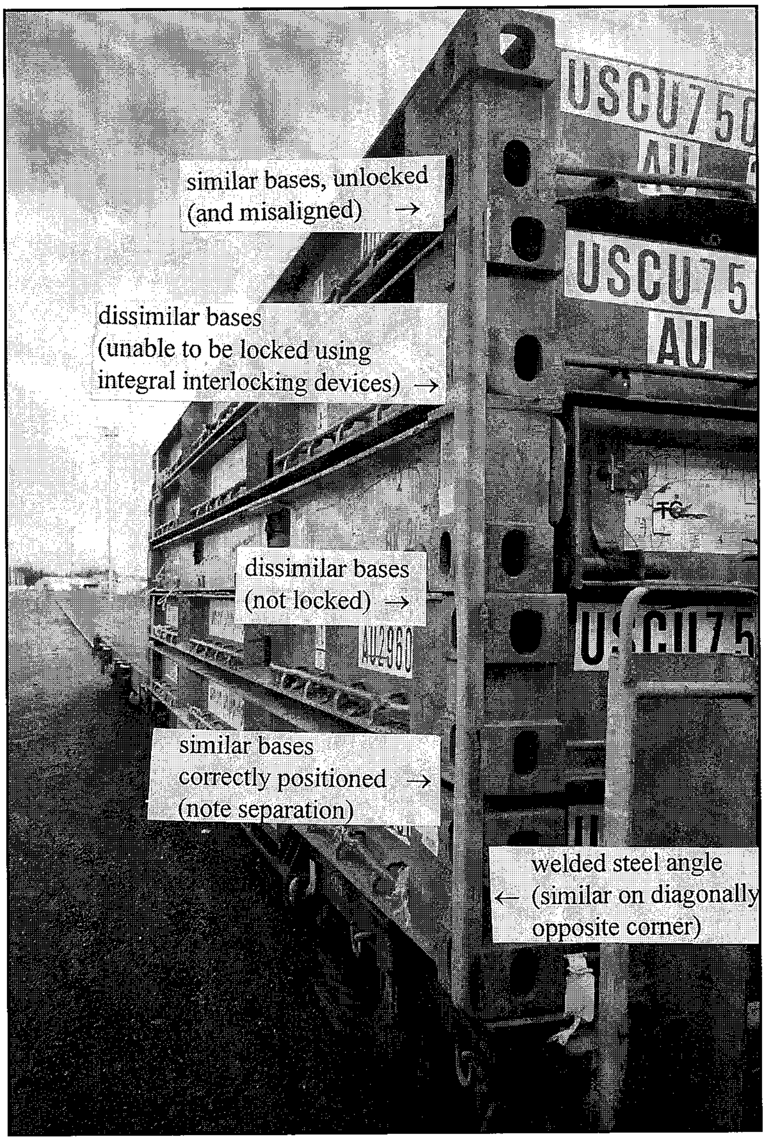


Figure 13
The trailing left corner of stack 1 on UK8509

- the shorter angle leg lengths (30 to 60 mm) did not overlap the holes in the corner castings and allowed a possible full length weld on the corner casting
- the longer angle leg lengths (80 and 100 mm) overlapped the holes in the corner casting and only short welds were possible above and below the holes
- the bases were not uniformly stacked which meant that the steel angle did not sit flush with all of the bases
- the gap between the lengths of angle and the bases varied from flush to 16 mm and welding had been carried out with gaps of up to 6 mm
- the paint on the bases had not been removed prior to welding, and the scorching and burning of the paint was evident by soot markings on the lengths of angle and scorch marks around the welds on the bases
- the surfaces of the base and steel angle had not been prepared for welding
- there was significant lack of fusion between the bases and the steel angle in many instances
- the length available for welding had not been fully utilised
- the "Sea Container" bases did not have a top corner casting and the weld length which could be applied was therefore limited
- the burning paint had produced bubbles of gas which caused porosity in the welds
- the total length of the welds on stacks 1, 2 and 3 were approximately 1650 mm, 1150 mm and 1650 mm respectively and the pattern varied on each stack
- the steel angle on the left trailing corner of stack 1 showed distortion at level 2.

1.3.5.2 A similar inspection of the base/steel angle interfaces on the two failed stacks showed:

- the 80 mm x 60 mm length of steel angle found on the track side north of the derailment site had been welded to the leading right side of stack 4
- the trailing left side of stack 4 had been welded although no corresponding length of steel angle was found
- the leading left side of stack 5 had been welded although no corresponding length of steel angle was found
- the trailing right side of stack 5 had been welded using a length of 80 mm x 60 mm steel angle (a remnant was attached)
- the total length of the welds on stacks 4 and 5 were approximately 540 mm and 850 mm respectively and the pattern varied on each stack.

1.3.5.3 The length of steel angle that was found by the track was laboratory inspected to determine the quality of the welds and the effective weld length. Examination of the portion of the fractured welds remaining on the recovered length of steel angle showed high porosity with an assessed average weld effectiveness of approximately 30%. The leg length of the welds indicated a relatively good fit had existed between the steel angle and the stacked bases on this corner compared with other welded corners. The recovered steel angle showed distortion in the vicinity of the weld to the middle base.

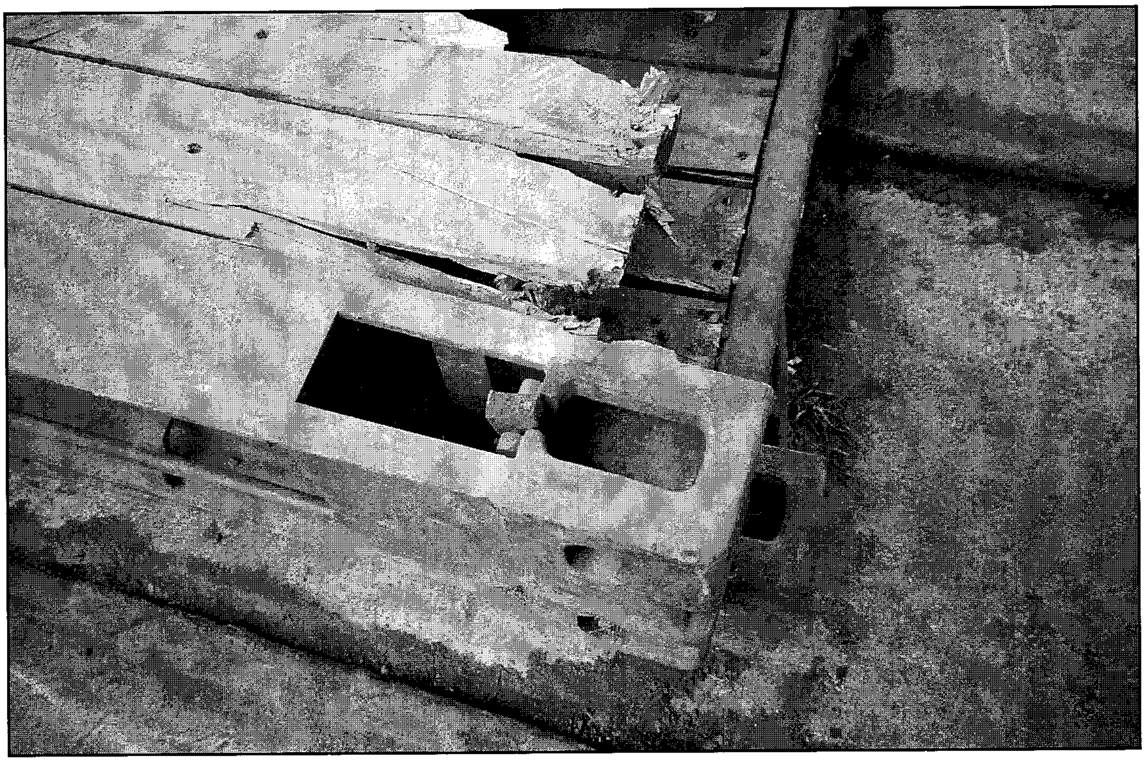


Figure 14
A typical "Doric" base twistlock casting failure (USCU 7502982)

1.3.5.4 The "Doric" corner casting, the Corten[1] steel angle and a sample of welding wire reported as having been used when assembling the stacks were laboratory assessed to determine weldability.

1.3.6 Damage to Bridge 267

1.3.6.1 The collision and resulting derailment caused major damage to structural members of Bridge 267.

1.3.6.2 The left side end diagonal at truss entry showed signs of a heavy impact at 1700 mm above rail level and heavy abrasion, including the removal of bolt heads, from 760 mm above rail level. This abrasion covered the full width of the member from 1475 mm above rail level.

1.3.6.3 The clear width across the track between end diagonals at truss entry was 4.3 m.

1.3.7 Train event recorder

1.3.7.1 The event recorder was extracted from DFT 7049 for downloading and analysis.

1.4 History of the load

1.4.1 The 25 container bases were owned by Union Shipping New Zealand Limited (USNZ) and leased to Australia-New Zealand Direct Line Management Services NZ Limited (ANZDL). ANZDL had entered into a contract with Specialised Container Services (Auckland) Limited (SCS) for SCS to provide a depot service including storage, handling, survey, repair and wash. SCS had been instructed by ANZDL not to repair or replace twistlocks.

1.4.2 SCS had received the bases and consolidated them into stacks of five for dispatch from their rail siding at Otahuhu on 14 March 1998.

1.4.3 The bases had been stacked and welded at opposite corners using lengths of 4 mm thick Corten steel angle chosen from a rack of variable sizes of angle leg lengths held for general container repairs.

1.4.4 Two SCS repairers had welded the five stacks, one a qualified welder and the other unqualified.

1.4.5 The qualified welder had satisfactorily completed the requirements of New Zealand Standard 4711 for test code GD (semi-automatic, gas shielded bare wire - flat plate position) and held a valid certificate until 25 June 1998. He had been in the container industry for approximately 12 years. He stated he had welded steel angles on to base stacks "a few times" during this period. He had been at SCS for one and a half years and stated that he recalled being instructed by the Operations Manager to weld steel angles on opposite corners of stacked bases some months prior to March 1998.

1.4.6 The unqualified welder had been with SCS for two and a half years and had been welding for two years. The SCS Depot Manager and Operations Manager were aware of the lack of qualification but had authorised the repairer to carry out welding.

1.4.7 The bases had been checked prior to dispatch by an SCS staff member who was a qualified Institute of International Container Lessors Limited (IICL) inspector (refer 1.8.1.).

[1] Corten is a trade name for a corrosion resistant steel.

1.4.8 The three wagons loaded with bases formed part of a rake of approximately 25 wagons picked up by the Tranz Rail shunt at approximately 1200 hours on 14 March. The shunt staff could not recall noticing stacked bases as part of the pick-up.

1.4.9 A senior shunter in the shunt crew stated he was familiar with five high stacks of bases and recalled occasionally picking them up from various localities. He stated he was not aware of any integral interlocking systems and understood such loads would require strops or chains. He stated that his knowledge of twistlocks was limited to those that fastened containers to wagons.

1.4.10 A Tranz Rail Operations Controller carried out the train examination on Train 235 at Westfield prior to its departure. He held a current certification for train examiner's duties.

1.4.11 He stated he recalled seeing the bases on the train and that they had "a metal strip on the sides of them that made the nests secure". He said he checked that the twist locks were secured to the wagons.

1.4.12 The Operations Controller could not remember seeing bases secured in this manner before. His memory was of bases with steel band strapping holding them down and he stated his thoughts on 14 March were how clean and functional the steel angles welded on to corner castings were in comparison with the old bands.

1.4.13 He stated he was not aware of any code or other requirements relating to stacking of bases and did not know how they were being locked, although he thought they were self-locking.

1.5 Background to welded steel angles

1.5.1 SCS and ANZDL staff recalled the first and only other time welded stacks of bases had been railed out of the SCS yard in the two years of SCS operation had occurred in January 1998. SCS staff stated this was as a result of wagons loaded with bases which Tranz Rail had returned to the SCS yard as unfit to travel. Annotated manifest records supplied by SCS showed this occurred between 14 January and 18 January 1998.

1.5.2 The SCS Operations Manager stated that during a discussion with ANZDL logistics representative by telephone relating to the returned wagons and how to address the problem, he was told "just weld them together". The ANZDL representative confirmed this discussion and stated that his comment "just weld them together" was "in line with knowledge that a written instruction was already in place and that welding was the norm". His awareness that bases were being welded was based on information he had gained from the ANZDL Australian representative regarding a Melbourne accident "in the latter part of last year". He stated he was also aware of bases coming in from Suva that were welded together, although he had not seen any welded bases.

1.5.3 The SCS Operations Manager also recalled a separate occasion involving welding of bases which occurred between January and March 1998. In this case it involved bases being consigned by road. He stated he was called to the office telephone from the yard to take a call from the ANZDL Port Manager who required him to weld bases together which were in SCS yard. They were welded in a similar manner to those associated with the 14 March incident and consigned. The ANZDL Port Manager had no recollection of these events. However he stated he was aware of stacks he had seen entering New Zealand from Australia which had been welded. He also understood the practice had started following an incident at Melbourne where banded bases had moved progressively on one another ("lozenged") during road transit. The Commission's inquiries failed to obtain any information on that incident.

1.5.4 Inquiries did show that at about that time welding trials had been carried out in Australia due to problems with the use of flat band steel strapping which allowed loads to move in transit. The trials were said to have involved the direct welding of the corners of the bases together without the use of steel angles. This was supported by reports of bases secured in this manner seen in New Zealand.

1.5.5 During the investigation further evidence of welded bases within New Zealand came to light. This related to three 24 foot bases (not equipped with integral interlocking devices) which had arrived in New Zealand in late 1997 welded and banded and had been separated in Auckland early 1998.

1.5.6 No standards or detailed instructions for welding stacks of bases were issued by ANZDL or SCS. The SCS Operations Controller instructed the repairers to "weld angles to opposite corners". The repairers chose the steel angles to be used from the stock rack at the depot.

1.5.7 Tranz Rail and SCS staff on duty during 14 January to 18 January had varying recollections of events surrounding the rejected bases because of the lapse of time, but the most likely sequence of events established was:

- three wagons with stacked bases were uplifted from SCS on 14 January
- one wagon was noticed with the load "lozenged" in the yard, and the wagons were returned to SCS for resecuring
- when presented again on 15 January two of the wagons were accepted for transit but the third was again returned to SCS
- one of the accepted wagons was loaded with 10 "Sea Container" bases and these had been ring-bolted when presented on 15 January
- the wagon rejected for a second time on 15 January was loaded with a mix of "Doric" bases and "Sea Container" bases
- An Operations Controller saw and rejected the loads on 14 January and 15 January. He recalled that when presented for the second time on 15 January "blue plastic restrainers" had been added and there were no steel angles welded to the corners of the stacks. He considered the restrainers were ineffective for such loads and that was why they were returned again
- when the last wagon was presented for the third time on 16 January SCS reports indicated that opposite corners of the loads were restrained with lengths of steel angle welded to them and the wagon was uplifted by Tranz Rail
- Tranz Rail staff could not recall steel angles welded to the corners of the last wagon.

1.5.8 Four Tranz Rail operating staff from Westfield yard who were directly involved with shunting or train examination associated with load outs from SCS in January and March were interviewed during the course of the investigation. The purpose was not only to try to establish the specific events, but also to determine the overall knowledge of the staff of the requirements for rail transport of stacked bases. The results varied widely and showed:

- three were aware of previous but infrequent consignments of stacked bases from Westfield
- two considered the use of steel banding, strops or chains was the correct way to secure such stacks
- one considered welding the four corners was the correct method
- one was aware of the twistlock and ring bolt details and their intended use

- one believed the bases to be self-locking
- none were aware of specific requirements for securing stacked bases.

One staff member also referred to previous examples of bases with built-in twistlocks "coming open" in Westfield yard and stated that these had been reported to Tranz Rail management at the time. Tranz Rail advised it had no record of any such reports. Staff also commented on the difficulty of determining the condition and position of twistlocks above the second level in a stack.

1.6 Background to USCU 750 ("Doric") bases

1.6.1 The USCU 750 series are 750 bases built for USNZ by Doric Engineering, Tasmania in 1993 which are referred to in this report as "Doric" bases.

1.6.2 USNZ advised that shortly after the contract had been completed it was found that the twistlock pin castings were suffering an unusually high rate of failure. This was found to be caused by a material quality problem, and following USNZ and Doric Engineering negotiations a refurbishment programme commenced in 1994 with the aim of replacing the castings with a spring steel connector (Figure 14 shows a typical casting failure and Figure 9 a refurbished base with spring steel connectors).

1.6.3 The refurbishment programme halted in early 1995 due to contractual difficulties. At that stage approximately 200 of the 750 bases had been upgraded.

1.6.4 The programme recommenced in February 1998 with the intent of resubmitting all 750 container bases for checking and upgrading where required.

1.7 Road incident on 13 March 1998

1.7.1 During the course of the investigation the Commission became aware of a separate and unrelated incident which occurred on 13 March 1998. This involved bases which were being transported by road, falling from a truck and trailer unit near Rotorua. From the information available it appeared that three "Doric" bases which were stacked on top of two "Sea Container" bases fell from the trailer as the unit rounded a corner. The load was not chained.

1.8 Requirements for transport of stacked bases

1.8.1 The bases involved in the incident are classified as containers and covered by the International Convention for Safe Containers 1972 (CSC) and its amendments, to which New Zealand is a signatory. The New Zealand container industry currently conforms on a voluntary basis to most aspects of the CSC. This includes compliance with the IICL equipment inspection guidelines, including the use of IICL qualified inspectors.

1.8.2 Regulation 1 of the CSC requires all containers to have a Safety Approval Plate fixed to them. All the bases involved in the incident were fitted with such plates.

1.8.3 Regulation 2 covers maintenance and examination and allows an approved continuous examination programme (ACEP). USNZ were recorded by the New Zealand Maritime Safety Authority (MSA) as operating such a programme. Actioning of the programme was delegated to ANZDL who in turn contracted inspection, maintenance and repair of containers to SCS, although they retained the responsibility for deciding which repairs were carried out.

1.8.4 While the Convention is applicable to all modes of transport the particular importance of marine aspects of container transport is reflected in specific legislation and proposed rules and regulations relating to that mode.

1.8.5 The MSA advised that from a maritime safety perspective the current New Zealand legislation is included in the General Harbour (Ship, Cargo and Deck Safety) Regulations 1968 and its amendments. This is regarded by MSA as an interim document and they are currently drafting new rules to be issued under the Maritime Transport Act 1994. These rules, and accompanying regulations, will replace the current, and mainly voluntary, compliance regime.

1.8.6 From a rail and road transport perspective the Land Transport Safety Authority (LTSA) advised they have no rules or regulations issued under their statutory legislation covering the inspection and certification requirements for the inland transport of stacked bases.

1.8.7 The applicable standards for bases are laid down in Australian/New Zealand Standard AS/NZS 3711.8: 1993 and include:

> **7.3 Test No. 15 - Lifting of an interlocked pile by the top**
>
> **7.3.1 General**
>
> This test shall be carried out to prove the resistance of either a platform or a folded container connected to a interlocked pile when lifted from above using the features . . . provided, and with the lifting forces applied vertically.
>
> **7.3.2 Procedure**
>
> The container shall be connected by means of interlocking devices or by its integral interlocking devices (where fitted) to another container or to a test fixture which simulates a second container, so that the gross mass lifted by the container under test is $(2n - 1)T$, the mass being equally shared among the interlocking devices, where n is the largest number of interlocked units having a combined height of less than 2591 mm.
>
> The combined units shall be carefully lifted from all four top corners in such a way that no significant acceleration or deceleration forces are applied.
>
> **7.3.3 Requirements**
>
> On completion of the test, the container shall show neither permanent deformation nor abnormality which will render it unsuitable for use, and the dimensional requirements affecting handling, securing and interchange shall be satisfied.

1.8.8 The requirements for handling and securing freight containers are laid down in Australian/New Zealand Standards AS/NZS 3711.10: 1993, but make no specific mention of stacked bases.

1.8.9 Tranz Rail advised the requirements for the transport of stacked bases were set out in Section 12 of its Freight Handling Code (FHC) and Tranz Rail stated it considered the FHC read as a whole clearly indicated how bases should be locked together for transport. In coming to this conclusion Tranz Rail stated it regarded integral twistlocks, such as those built in to the "Doric" bases, as double twistlocks. Tranz Rail also advised that bases fitted with built-in systems effectively become a single container and travel as such internationally. For this reason it would have accepted a request for acceptance of the "Sea Container" ring and bolt system as it satisfied the fundamental requirement for load security.

1.8.10 The relevant portions of the FHC are attached as Appendix 1. Tranz Rail supplied SCS with a copy of Section 12 of the FHC in 1997. ANZDL did not carry out direct loading and was not supplied with a copy. There was no record of consignors or Tranz Rail staff questioning the application of the code to the carriage of bases five high.

1.8.11 Tranz Rail's "Mechanical Engineering Design Manual" included the following sections relating to containers and their transport by rail:

1.8.11.1 Section 10 "Intermodal Equipment". The scope of this section was defined as

> This section specifies the design and location requirements of securing devices and other special equipment required on freight rolling stock for the transport of containers and swap bodies in intermodal traffic. Also included are aspects of freight rolling stock design specific to this class of traffic.

1.8.11.2 Section 11 "Freight Containers and Swap-bodies"

The scope of this section was defined as:

> This section specifies the minimum requirements for the design and construction of various types of freight containers and swap bodies approved for transport by rail.

The only reference to bases was in Paragraph 11.4.14 which stated:

> **Platform and Platform-based Containers or Swap Bodies**
>
> Platform containers and swap bodies may be fitted with fixed, removable or collapsible sides and ends. Provision shall be made for storing and securing non-fixed sides and ends within the base outline when transported in the empty or partly loaded condition.
>
> All tests required by ISO 1496 Part 5[2] shall be performed as specified except Tests 1, 9, 10, 12 and 14. Test 9 "Transverse Rigidity", Test 10 "Longitudinal Rigidity" and Test 12 "Grappler Lift" are all optional. Test 1 "Stacking" and Test 14 "Stacking in Folded Condition" may be modified or eliminated from the specification provided suitable instructions are stencilled on the container.
>
> Forklift pockets areas shall be accordance with ISO 1496 modified to suit container width.

1.8.12 The Manual also included Section 15 "Loading and securing of loads". The scope of this section was defined as:

> This section specifies the basic principles and minimum requirements for the design and construction of equipment for the loading and securing of freight on or in general purpose freight rolling stock of all types not specially equipped for the carriage of specific types of loading as listed in Sections 10, 12 and 16[3].
>
> It includes the general conditions relating to dunnage and other systems used to locate, support and protect loading. It also specified minimum requirements for the strength and attachment of securing devices, systems and components.
>
> Instructions for loading staff are to be found in Tranz Link's 'Freight Handling Code'.

---

[2] ISO 1496 Part 5 equated to AS/NZS 3711.8:1993 (see 1.8.7)

[3] Section 12 and 16 applied to tank wagons and specially equipped freight rolling stock respectively.

Tranz Rail advised this section of the Design Manual was not intended to include the loading and securing of multiple stacked bases above the first base secured to any wagon and accordingly made no mention of the requirements for such freight.

1.8.13 Tranz Rail was asked to clarify the intent of the instruction "DO NOT STACK any other type of container" included in section 12.5 of the FHC referring to multiple stacked containers. The reply stated the intent was to prohibit stacking of containers which, when stacked, would exceed the weight or height restrictions noted earlier in the section.

2. Analysis

2.1 The collision

2.1.1 Witness reports and the damage to the bridge and bases indicated that the initial impact which triggered the derailment was the collision of the second and third bases of the leading stack of bases on wagon PK3478 (stack 4) with the left side end girder as they entered the truss.

2.1.2 The remains of the welds on the length of steel angle found at 561.96 km NIMT matched the remains of the welds on the bases making up the leading stack on PK3478. In particular the match with the first base, which remained locked on the wagon, showed the steel angle found had originated from the right leading corner of the stack.

2.1.3 The distortion of the steel angle from the right leading corner was consistent with lateral movement of the bases at level 3 between a "Doric" base and a "Sea Container" base above it before weld failure. The distortion was similar to the longitudinal distortion present at stack 1 level 2 (see 1.3.5.1) where again a "Sea Container" base was on top of a "Doric" base.

2.1.4 The position and orientation of the bases after the derailment did not fully support the witness recollection of bases 2 and 3 being the first to hit the bridge. Bases 2 and 3 were found inside the bridge whereas bases 4 and 5 did not enter the bridge but rode up the end girders and wrapped around the top cross member. This suggested bases 4 and 5 may have struck the bridge first. The behaviour of all components following such a collision is unpredictable. In view of the similar lack of restraint between the bases at interfaces 1 and 3 (Table 2) either scenario was possible.

2.1.5 Following the loss of the steel angle restraint at the right leading corner of the stack, bases 2 to 5 were free to rotate about the left trailing corner unless they had been effectively restrained at each interface. The steel angle welded at the left trailing corner may have restricted, but would not have prevented, such rotation.

2.1.6 Analysis of the restraint at each interface between the bases of the leading stack (Table 2) showed the bases were unrestrained at interfaces 1 and 3. Interface 2 was effective in providing restraint at the leading end and interface 4 effectively located bases 4 and 5.

2.1.7 Analysis of the output from the locomotive event recorder showed the speed of the train at impact was 60 km/h, the authorised speed through the turnouts from double line to single line and back to double line.

2.1.8 Track inspection, analysis of the event recorder output and staff reports showed no unusual track condition or train handling characteristics which could have influenced the security of the stacked bases.

2.2 Interlocking of stacks

2.2.1 The bottom base on each stack was correctly secured to the wagon.

2.2.2 Of the 20 interfaces between bases in the five stacks, seven had no effective integral interlocking, eight were effectively interlocked and five were either located or partly interlocked. The primary reason for the ineffective integral interlocking was the missing twistlocks on the "Doric" bases, although full use had not been made of the functional integral interlocking devices available.

2.2.3 The standard nature of all base corner castings meant that a "Sea Container" base stacked above a "Doric" base (stack 1 and stack 4 had such a configuration) could be locked in position by the "Doric" base twistlock system provided it was present and functional. Where a "Doric" base was stacked above a "Sea Container" base no integral locking was possible (stack 1 had such a configuration). Although it was possible to interlock "Doric" and "Sea Container" bases by selective stacking, the control required to achieve this and the possibility of other interlocking devices being encountered in a mix of bases indicated reliance on such a system was undesirable.

2.2.4 The only two "Sea Container" bases stacked together were on stack 4 (see 1.3.4.3). The ring and bolt locking had not been applied despite the clear instructions fixed to the bases.

2.2.5 The five stacks included 80 potential integral interlocking devices to secure the stacks. Only 38 were present and functional and of these only 22 had been correctly locked in position. It was apparent that the use of an alternative method of securement (welding) to overcome defective fastenings had resulted in a lack of attention to the use of those functional fittings present.

2.2.6 Although the transport of bases in stacks was not a common traffic on rail or road such loads had been transported by both modes.

2.2.7 The "Doric" base twistlock history had resulted in approximately 50% of all twistlocks missing or broken based on the sample of 22 bases involved in the incident. It is likely that correct integral interlocking of stacked "Doric" bases had not been possible for some years.

2.2.8 USNZ and ANZDL were aware of the twistlock problem and of the delayed solution which had been in hand to address it. SCS advised that they were aware of the high level of twistlock unservicability and had been specifically advised not to repair or replace twistlocks as part of their contract. Neither USNZ or ANZDL had taken any steps to issue instructions for transporting stacked bases with unserviceable twistlocks, despite the internationally accepted method of using double twistlocks for such connections (see para 2.5.3).

2.2.9 The bases were all certified under the Safety Approval Plate and ACEP system although many had sub-standard integral interlocking systems. There were no requirements for the interlocking system to be a part of the inspection and certification procedures in the IICL guidelines. This apparent gap in the inspection and certification process has serious safety implications where top lifting may be attempted. In addition the height and nature of the stacked bases are such that it is difficult for a rail or road operator presented with an interlocked stack for transport to check compliance with any standards set. The integral interlocking devices should be as much a part of inspection and certification as other structural aspects of containers. MSA have indicated that the proposed follow up to safety recommendations made to them will include attention to this issue.

2.3 Options to interlocking

2.3.1 Stacked "Doric" bases, either in similar stacks or mixed with "Sea Containers" bases, have been transported by road and rail within New Zealand and Australia since 1994. There is no clear picture of how these have been restrained for transport on rail wagons in New Zealand although there are indications that steel banding or strops have been the usual methods, and that loads restrained in this manner may have shifted in transit in the past.

2.3.2 The introduction of welded alternatives as an option to such banding appears to have developed in Australia and been seen in New Zealand over the last two years. Welding does not appear to have been a widespread practice.

2.3.3 Although only two separate consignments of stacked bases restrained by welded steel angles appear to have been sent out from the SCS yard by rail, reports indicated welding of bases may have been carried out occasionally prior to this at other container depots in New Zealand. Stacks of bases had been welded in Australia and elsewhere and some of these had been transported into New Zealand.

2.3.4 Although there appears to have been no specific barrier to welding bases directly together, or indirectly using angles, the use of welding as a method of restraint when the stacks were required to withstand the forces associated with marine, rail and road transport should have been designed and carried out to specific standards. The method of failure showed that there had been insufficient weld strength and the steel angle distortion showed this member was of insufficient strength. If there was any possibility of top lifting of a stack Australian/New Zealand Standard AS/NZS 3711.8:1993 required interlocking devices, or integral interlocking devices where fitted, to be used to satisfy Test 15.

2.3.5 Tranz Rail interpreted the FHC to mean that the use of double twistlocks was the only approved method of securing stacked bases on rail, and stated that it interpreted integral twistlocks as being double twistlocks. Tranz Rail also advised "A clear indicator as to how the bases should have been interconnected is the fact that they are built with integral connectors". However it was apparent that stacked "Doric" bases with a high level of unserviceable integral interlocking devices had been transported by rail without being secured with double twistlocks.

2.3.6 Reports indicated that the method of securing the loads was steel banding, with at least two examples of welding in 1998. Neither of these options met Tranz Rail's intended FHC standards. Although the appropriate FHC sections were held by, or accessible to, consignors and Tranz Rail staff dealing with such loads there was no evidence that either party consulted the code before banded or welded loads were forwarded by rail. Even if they had, the intent of the code with respect to transport of bases five high is not clear.

2.3.7 In view of the code's lack of any direct reference to stacking requirements for bases with or without integral interlocking devices it is not surprising that those concerned with the application of the code had differing views of its requirements and did not see fit to question its content.

2.4 Quality of welding

2.4.1 The quality of welding on all stacks on Train 235 was variable, with common problems of porosity due to burning paint and the fit between the steel angle and the base corner castings.

2.4.2 Based on an average 30% effectiveness, the length of weld restraining the displaced stack was 150 mm compared to 265 to 510 mm for the other four stacks. Examination of the fracture faces on the length of steel angle found prior to the site of the derailment showed failure was due to overload in the weld near the weld/base or weld/steel angle interface.

2.4.3 Laboratory assessment showed the "Doric" corner casting and the steel angle were weldable with the consumable reportedly used for the assembly of the stacks.

2.4.4 The SCS repairers were not qualified to carry out semi-automatic gas shielded bare wire welding in the vertical position.

2.5 Tranz Rail procedures

2.5.1 Tranz Rail's FHC did not explicitly refer to stacked bases, or refer to the integral interlocking devices associated with some bases. The only reference to multiple stacked containers (Section 12.5) defined height and weight limits and referred to Section 12.4 for "securing of containers on rail". Section 12.4 detailed the twistlock requirements for wagon to container and referred explicitly to the use of "double shipping twistlocks" for half-height containers.

2.5.2 Tranz Rail's 'Mechanical Engineering Design Manual' did not refer directly to stacked bases, or to the integral interlocking devices associated with some bases, except by reference to ISO 1496 Part 5. It is desirable that the role of, and any requirements for, variable integral interlocking devices should be clearly defined within the FHC and the Design Manual.

2.5.3 Tranz Rail's belief that the FHC clearly indicated how bases were to be locked was based on its interpretation that bases stacked five high were included in the "Half height" or "double stacked" requirements in Section 12.4 of the FHC. This interpretation required stacked bases to have four "double shipping twistlocks" in the fully locked position between each stack and Tranz Rail interpreted "Doric" integral twistlocks as being double twistlocks. Double twistlocks are described in AS/NZS 3711.10.1993, and neither the "Doric" integral interlocking twistlocks nor the "Sea Container" ring and bolt system complied with this description. Tranz Rail's revised instruction issued following the incident (see 4.4) separately defined requirements for integral interlocking devices. In the Commission's view the FHC in effect at the time of the incident gave no clear guidance to Tranz Rail staff or consignors as to the requirements for multiple stacked bases with integral interlocking devices. There is no evidence that double twistlocks have been the normal method of securing such loads where they have involved high levels of ineffective twistlocks or dissimilar bases. There are strong indications that banding had been used prior to the welding examples referred to.

2.5.4 Tranz Rail staff had varying appreciations of the presence of and requirements for integral interlocking devices for securing stacked bases, and the appropriateness of alternative ways to secure such loads.

2.5.5 Although the revised Tranz Rail Code issued after the incident clarified the requirements for connecting bases with integral twistlocks Tranz Rail staff could find it difficult to ensure compliance with this requirement above the second or third level in a stack.

2.6 Requirements for stacked bases

2.6.1 Current inspection and certification requirements for containers make little reference to stacked bases. The most specific requirement is the lifting test (see 1.8.7). Inspection and repair guidelines should include reference to integral interlocking devices to ensure that where present they are maintained to standard or else revert to the standards for bases with no integral interlocking devices. Systems of variable standards such as those on the "Doric" bases can lead to confusion as to the effectiveness of the security as appears may have happened in the road incident on 13 March 1998 (see 1.7).

2.6.2 The safety issues associated with this incident have implications across transport modes and outside the New Zealand transport environment. Safety recommendations made to the three safety authorities have been framed accordingly.

3. Findings

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

3.1 The derailment of Train 235 was caused by a collision between an insecure load on a wagon on the train and the left side end girder at the entry to the first through - truss span of Bridge 276.

3.2 The collision occurred because part of a load of five stacked bases had moved laterally following the failure of welded interfaces on a steel angle corner restraint.

3.3 The bottom base was correctly secured to the wagon and did not move before or following the collision.

3.4 Welded steel angles had been used previously to restrain stacks of bases before consigning them by rail and road.

3.5 Tranz Rail had not approved welding as a method of restraint for conveyance of stacked bases by rail.

3.6 The welding of stacks together had been introduced as one way of both overcoming the ineffectiveness of integral interlocking devices and accommodating bases with incompatible integral interlocking devices in a stack.

3.7 The quality of the welds on the stacks involved in the incident was variable and many welds showed high porosity and other defects resulting in low effectiveness.

3.8 The welders were not qualified for the type of welding used.

3.9 There was no clear understanding between USNZ, ANZDL and SCS as to their respective responsibilities under the ACEP inspection scheme, particularly with regard to the integral interlocking devices.

3.10 Reliance on missing or ineffective interlocking devices had the potential to result in insecure loads and was the likely cause of a recent road incident involving movement of stacked bases.

3.11 The international transport of bases meant that the incident had implications outside the New Zealand transport environment.

3.12 The IICL inspection and certification requirements for bases did not lay down any procedures for integral interlocking devices.

3.13 An internationally accepted solution to ineffective integral interlocking devices was available (double twistlocks).

3.14 Alternative methods introduced to overcome ineffective integral interlocking devices were variable and without standards or defined procedures.

3.15 The Tranz Rail requirements for the conveyance of multiple stacked containers were not specific with regard to the carriage of stacked bases with or without integral interlocking devices.

3.16 Tranz Rail staff had variable understandings of the requirements for securing stacked bases.

4. Safety Actions

4.1 SCS advised that all its welders are now appropriately qualified and certified.

4.2 USNZ advised that following the incident it had immediately taken steps to accelerate the "Doric" twistlock refurbishment programme. As at November 1998, USNZ advised that 562 of the 750 bases had been upgraded and completion of the programme was likely in early 1999 depending on the availability of bases.

4.3 Immediately following the incident ANZDL issued the following instruction to all of its depots:

> With immediate effect the following procedures are to be implemented when assembling ANZDL bases/flat rack into a nested configuration.
>
> 1. Only those bases with all 4 locking devices operational are to be nested.
>
> 2. Only bases with similar locking devices, that can be inter-connected to each other are to be included in the same nest.
>
> 3. The locking devices of all bases/flat racks received into your depot are to be surveyed, any SCXU/SCPU unit with a damaged locking device is to be repaired to a serviceable condition. Any USCU unit with a damaged locking device is to be reported to this office.
>
> 4. If there is any doubt as to the integrity of the bases locking mechanisms the unit is not to be included in any nesting program until repaired.

4.4 Immediately following the incident Tranz Rail issued revised instructions covering multiple stacked containers. These were brought to the attention of staff and customers by a Train Advice and a Significant Information Notice respectively. The revised instructions stated:

> 12.5 Multiple stacked containers (Revised Instruction)
>
> Flatrack containers (platform and collapsible types) when transported empty in stacks of two containers or more MUST comply with the following:
>
> * The combined height of the multiple stacked flatrack containers must not exceed 2.6 metres.
>
> * The base flatrack container in the stack must be secured to the wagon deck with four twistlocks up, locked and pinned/tied (as per instruction 9.2 on page 2).
>
> * Each flatrack container layer must be securely locked together by either:
>
>   * (i) Securing ALL FOUR twistlocks (built into the flatrack) in the fully locked position or:

* (ii) Securing the flatrack containers together by use of FOUR DOUBLE SHIPPING twistlocks in the fully locked position.

* Collapsible flatrack containers must only be transported with their end walls secured in the down (collapsed) position onto the platform deck, and additionally for the top flatrack container, ensure the ends are either pinned, chained or strapped to prevent the end walls from lifting in transit.

When initially issued following the incident the requirement for securing bases to the wagon deck was a minimum of three twistlocks. The general standard for containers was amended shortly thereafter and the requirement for four twistlocks was introduced. This change was unrelated to the incident.

4.5 The problem of ensuring compliance with the revised Tranz Rail requirements for fastening of integral twistlocks has been recognised. Tranz Rail advised that a proposal for a documented sign-off of such loads is currently under consideration. This procedure would be similar to that in use for hazardous freight and would require the consignor to sign-off that the load has been correctly secured and is ready to travel. Collapsible flat rack ends may also be included in the procedure. As with hazardous freight the documentation would be attached to the wagon for ready inspection enroute.

4.6 Tranz Rail advised it is aware of the issues associated with integral interlocking devices raised in 2.5.2 and is reviewing the suitability of the related documentation.

4.7 In view of the actions taken above no specific recommendations to the parties directly concerned were deemed necessary.

5. Safety Recommendations

5.1 On 24 April 1998 it was recommended to the Director of Land Transport Safety that the LTSA, MSA and Occupational Safety and Health (OSH):

5.1.1 Liaise as necessary to immediately bring to the attention of the relevant sectors of the New Zealand land and sea transport industry the need to be alert to sub-standard connection of stacks of bases and replace such connections with a system which complies with an appropriate standard, (015/98); and

5.1.2 Immediately bring the potential problem of sub-standard connections between stacked bases to the attention of appropriate Australian transport safety agencies. (016/98)

5.2 On 27 March 1998 the Director of Land Transport Safety had responded, as follows, to the preliminary safety recommendation of the same wording as the above final safety recommendation:

5.2.1 **015/98**
LTSA has faxed New Zealand relevant road and rail organisations to make them (a) aware of the danger in transporting insecure flat rack pods and (b) to seek assurances that no more of these pods are transported without proper restraints.

5.2.2 **016/98**
LTSA has discussed the issue with appropriate rail and road authorities in Australia, and your letter has been faxed to them under a cover note for their further consideration and action.

5.3 On 24 April 1998 it was recommended to the Director of Land Transport Safety that the LTSA, MSA and OSH:

5.3.1 Liaise as necessary to bring the problem of sub-standard connections between stacked bases to the attention of safety agencies in other countries where it is considered the use of dissimilar interlocking systems could result in similar sub-standard practises. (017/98)

5.4 On 7 May the Director of Land Transport Safety responded as follows:

5.4.1 **017/98**
LTSA will adopt this safety recommendation and contact the LTSA counterparts in the UK, USA and Canada.

5.5 On 24 April 1998 it was recommended to the Director of Maritime Safety that MSA, OSH and LTSA:

5.5.1 Liaise as necessary to immediately bring to the attention of the relevant sectors of the New Zealand land and sea transport industry the need to be alert to sub-standard connection of stacks of bases and replace such connections with a system which complies with an appropriate standard (018/98); and

5.5.2 Immediately bring the potential of sub-standard connections between stacked bases to the attention of appropriate Australian transport safety agencies. (019/98); and

5.5.3 Bring the problem of sub-standard connections between stacked bases to the attention of safety agencies in other countries where it is considered the use of dissimilar interlocking systems could result in similar sub-standard practises. (020/98)

5.6 On 2 April the Director of Maritime Safety had responded, as follows, to the preliminary safety recommendation of the same wording as the above final safety recommendation:

5.6.1 **018/98**
We will advise the shipping industry of our concern that flat top containers are being transported in this manner. We will also suggest to the Institute of International Containers Lessors Ltd that they include the inspection of the twist locks, and other securing arrangements for the purpose of stacking flat top containers, in the Guide for Container Equipment Inspection.

5.6.2 **019/98**
We will be making arrangements to inform and discuss the issues with the Australian Maritime Safety Authority.

5.6.3 **020/98**

We will inform and suggest to the Institute of International Container Lessors Ltd that they publicise the need to transport stacks of flat top containers in the manner for which they were designed and intended to be transported.

5.7 On 24 April 1998 it was recommended to the General Manager, Occupational Safety and Health that OSH, LTSA and MSA:

5.7.1 Liaise as necessary to immediately bring to the attention of the relevant sectors of the New Zealand land and sea transport industry the need to be alert to sub-standard connection of stacks of bases and replace such connections with a system which complies with an appropriate standard, (021/98); and

5.7.2 Immediately bring the potential problem of sub-standard connections between stacked bases to the attention of appropriate Australian transport safety agencies, (022/98); and

5.7.3 Bring the problem of sub-standard connections between stacked bases to the attention of safety agencies in other countries where it is considered the use of dissimilar interlocking systems could result in similar sub-standard practices. (023/98)

5.8 On 16 April the General Manager, Occupational Safety and Health had responded, as follows, to the preliminary safety recommendation of the same wording as the above final safety recommendation:

5.8.1 We will disseminate the information to relevant parties through our branch networks.

Our inspectors will also be instructed to carry out checks on interlocking of stacked bases during visits.

Approved for publication 25 November 1998

Hon. W P Jeffries
Chief Commissioner

SECTION 12 CONTAINERISED TRAFFIC

12.1 DOCUMENTATION

Refer to Section 7 (7.1) for details

12.2 GENERAL TRANSPORTATION

Three factors are significant:

- ➔ Weight
- ➔ Height
- ➔ Nature of Load

WEIGHT

BEFORE LOADING....

✔ check the GROSS WEIGHT on the documentation and ensure

- ➔ The container is not overloaded
- ➔ The line-haul unit will be loaded within its limits

For rail, see Section 12.3. Refer to Diagrams 12.5 to 12.9

DO...

✔ Load Containers onto the wagon directly **WITHOUT** dunnage.

✔ Ensure that **ALL** Tank Containers, and Containers carrying **LIVESTOCK** or **HAZARDOUS** substances have **ALL TWISTLOCKS UP, LOCKED and PINNED/TIED.**

For other loads, **THREE TWISTLOCKS UP, LOCKED and PINNED/TIED** are sufficient

Diagram 12.11 details how rail twistlocks are secured and pinned/tied.

✔ Always load LGD and LTD tank containers with the **outlet pipe to the centre** of the wagon

WHEN STACKING HALF-HEIGHT CONTAINERS, DO...

✔ Ensure that the double-stacked containers are securely locked together using **FOUR DOUBLE SHIPPING TWISTLOCKS** in the **FULLY LOCKED** position

DON'T...

✘ **DO NOT** stack **LOADED** containers **ON TOP OF** unloaded containers

OUTER CONTAINERS

The following four types of Tranz Link Container (HCC, HEC, HLC) MAY be placed on the OUTER SET of twistlocks on wagon classes HK, UK, UKA, UKC and USJ, BUT ONLY IF

➔ The doors face inboard (ie to the centre of the wagon)

PK WAGON RULE

On PK Wagons, the above containers MUST be loaded with the DOORS INBOARD

GENERAL RESTRICTION

✗ **DO NOT LOAD** GST and TST Tranz Link containers on IB or PK wagons

12.5 MULTIPLE STACKED CONTAINERS

MULTIPLE-STACKING RULES (for transportation only)

➔ The gross loading of multiple stacked **containers SHALL NOT EXCEED** the load limits defined for standard height containers (see section 12.3)

➔ The combined height of the multiple stacked containers shall not exceed 2.60 metres

DON'T...

✗ **DO NOT STACK** any other type of container

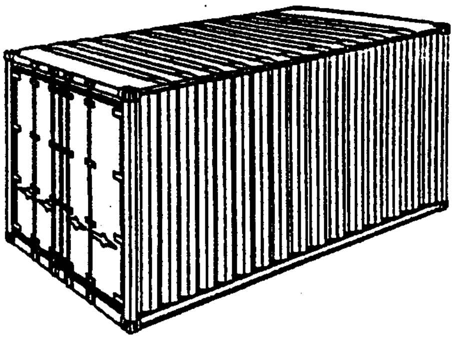
Refer to section 12.4 for the securing of containers on rail.

12.6 CONTAINER TYPES

Diagram 12.10 illustrates the container types most frequently found in the Tranz Link system.

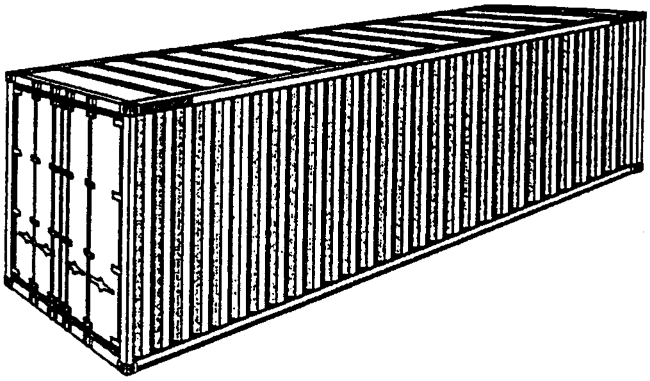
GENERAL BOX CONTAINER

6 metres (twenty feet) and 12 metres (forty feet) long containers used for ordinary cargo



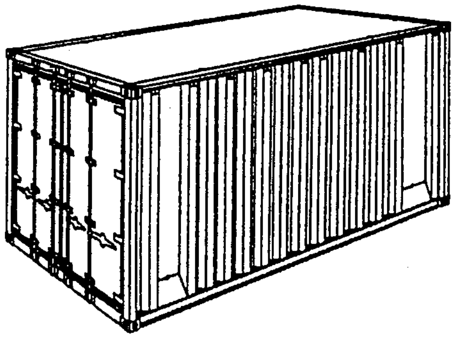
HIGH CUBE CONTAINER

Overheight containers used for light, bulky or high loads. Most are 12 metres (forty feet) long. Height is 2.8 or 2.9 metres



HARD TOP CONTAINER

6 metres (twenty feet) long containers with removable solid steel roofs. Used for heavy lifts, excessively high cargoes, and for loading from above (eg by crane). Some units have a removable doorheader to make loading and unloading easier.



OPEN TOP CONTAINER

6 metres (twenty feet) and 12 metres (forty feet) long containers with removable tarpaulin cover. Used for excessively high cargoes, and for loading from above (eg crane).

Some units have a removable doorheader to make loading and unloading easier.

Frequently referred to as TILT containers by british shippers.

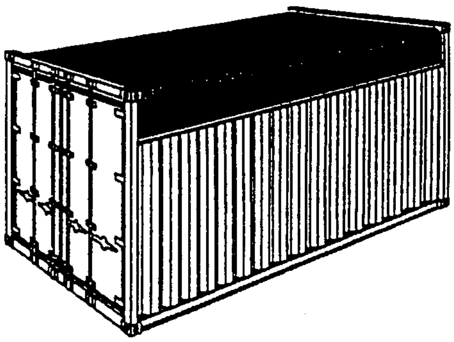
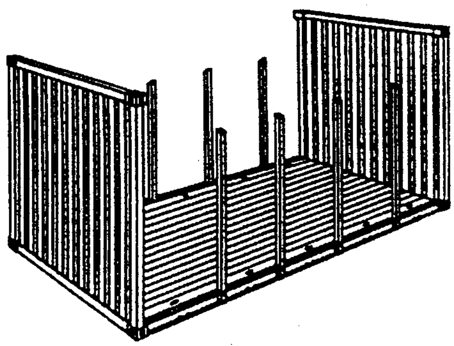


Diagram continued on next page....

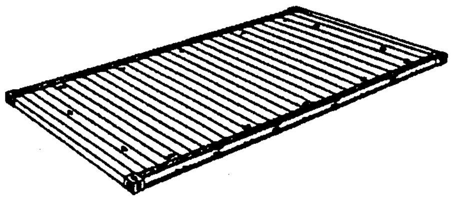
FLAT RACK CONTAINER

6 metres (twenty feet) and 12 metres (forty feet) long containers used for heavy lift and out of guage cargoes



PLATFORM CONTAINER

6 metres (twenty feet) and 12 metres (forty feet) long containers used for heavy lift and out of guage cargoes



VENTILATED CONTAINER

6 metres (twenty feet) long containers used for cargoes requiring ventilation

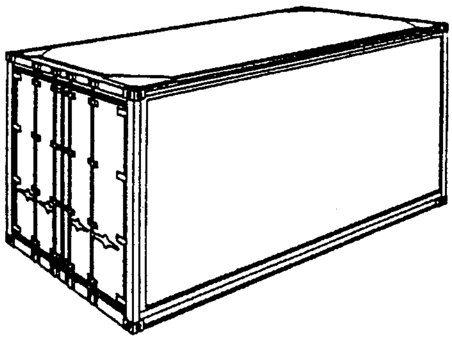


Diagram continued on next page....