Report 98-116

Train 9282

derailment

Wadestown

15 October 1998

Abstract

On Thursday 15 October 1998, at about 1407 hours, Train 9282, comprising 4 English Electric multiple unit cars running from Wellington to Johnsonville, derailed while negotiating the turnout from the up main to the down main at the south end of Wadestown.

The 2 leading cars were derailed. There were no injuries. A worn switch rail on the turnout which permitted 2 bogies to be directed to the up main as the remainder of the train followed the intended route to the down main caused the derailment. A safety issue identified was the failure of the Tranz Rail inspection regime to detect and correct the worn switch before it reached derailment condition.

Contents

Figures

List of Abbreviations

CTC	Centralised Train Control
LE	locomotive engineer
LTSA	Land Transport Safety Authority
POD	point of derailment
Tranz Rail	Tranz Rail Limited

Rail Incident Report 98-116

Data Summary

Train type and number:	suburban electric multiple unit, 9282	
Date and time:	15 October 1998, 1407 hours	
Location:	Wadestown, 3.007 km Johnsonville Line	
Type of occurrence:	derailment	
Persons on board:	crew:	3
	passengers:	28
Injuries:	crew:	nil
	passengers:	nil
Damage:	unit:	moderate
	track:	moderate
Investigator-in-Charge:	R E Howe	

1. Factual Information

1.1 Narrative

1.1.1 On 15 October 1998 Train 9282 was the scheduled 1402 hours suburban service from Wellington to Johnsonville. The 4 car consist comprised D2660 (leading), DM470, D2842 and DM562.

1.1.2 Train 9282 was crewed by a locomotive engineer (LE), a guard, and a passenger operator. There were 28 passengers on board at the time of the derailment.

1.1.3 Due to a bulb failure in Signal 8RA (the Up Departure from the up main at Wadestown), Train Control had taken advantage of the recent introduction of Centralised Traffic Control (CTC) on the Johnsonville Line to route trains through the down main. (Since May 1998 the up and down main at Wadestown had been signalled for two-way running to improve operating flexibility.)

1.1.4 The last train through the up main had been Train 9240 just after midday. Train 9282 was the fourth to be routed up the down main due to the problem with Signal 8RA.

1.1.5 The LE of Train 9282 stated he was not aware that he was to be routed to the down main at Wadestown. As he exited Tunnel 2 some 400 m from Wadestown he received a yellow indication on the intermediate signal and slowed in anticipation of the next signal at red. On exiting Tunnel 3 he estimated his train speed was 25 km/h when he saw Signal 4R at red and slowed further. He then saw the low speed light on Signal 4R indicating he was routed to the down main, slowed his train to 20 km/h, and continued under low power. He saw that number 3 up main points were correctly set for his movement to the down main.

1.1.6 Shortly after passing over the points he felt rough riding and shaking and realised his train had derailed. He applied emergency braking some 28 m past the points and the train came to a stop 59 m beyond the points. The trailing bogie of the leading car and the leading and trailing bogies of the second car were derailed and came to rest as shown in Figure 1.

1.1.7 Passengers were informed of the incident by on-train staff and were permitted to disembark once the pantograph had been lowered, the train had been secured, and Train Control had confirmed that the overhead power supply had been isolated.

1.1.8 After lowering the pantograph the LE tried to contact Train Control on his train radio. The backup batteries for use when disconnected from the power supply were not functional. The LE was not carrying his personal mobile phone, so he borrowed a mobile phone from a passenger in the front car and contacted Train Control. Subsequent investigation showed the backup batteries' life had expired.

1.1.9 Passengers were taken out on a relief train from the north end due to the poor access to Wadestown loop.

(Photograph supplied courtesy of the Dominion)

Figure 1
The 2 leading cars following the derailment (the 2 trailing cars which were at the bottom of the picture were not derailed and have been pulled clear). The view is looking to Johnsonville with the up main on the left and the down main on the right

1.2 Witnesses

1.2.1 Tranz Rail do not record passenger details on metropolitan commuter services. Tranz Rail staff did not record passenger particulars after the incident and it was not possible to follow up the passengers' perspective of events except for one passenger who came forward voluntarily. This passenger stated that he was seated on the right side of the leading car as the train approached Wadestown when "there was an enormous bang and a lurch, like an earthquake". He was thrown forward and suffered some minor bruising and abrasions when his shins impacted on the seat ahead.

1.3 Site details

1.3.1 The main line at Wadestown is on a 1 in 40 ascending grade to Johnsonville. Number 3 up main turnout to the down main (commonly referred to as Turnout 1) comes off the inside of a nominal 200 m radius right hand curve on the main line. To achieve a practical radius on the curved road of the turnout the up main leg had a nominal 700 m radius right hand curvature. The resulting turnout curve to the down main had a nominal 80 m radius curvature.

1.3.2 Turnout 1 was a 91 lb/yard 1 in 7½ turnout with an 18 foot switch, and had been installed in 1981. Figure 2 shows the layout. It had been programmed for replacement for some years and the renewal was to be carried out over the weekend following the derailment.

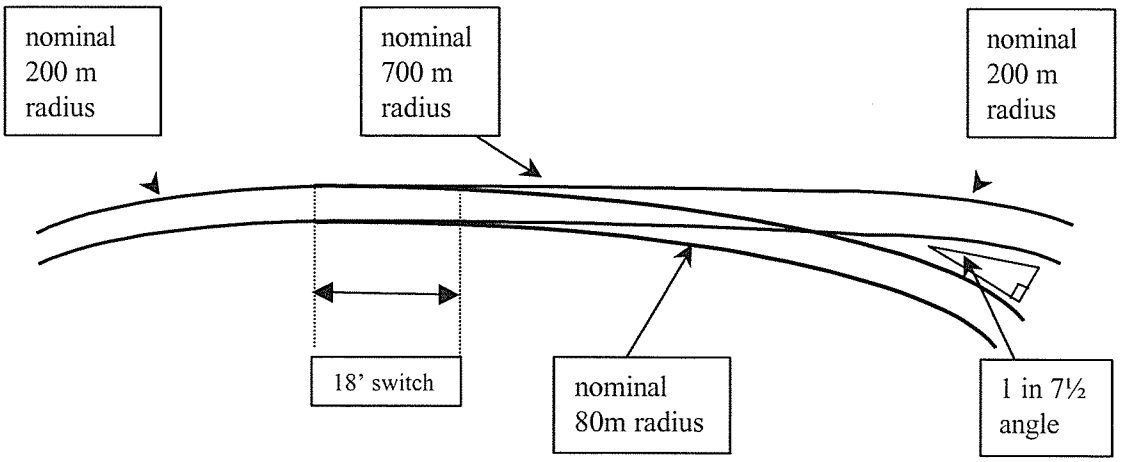


Figure 2
Layout of Turnout 1

1.3.3 It is normal for sidewear to occur on the curved leg of a turnout due to lateral forces associated with the curve radius. This curve wear is significantly increased when negotiating an 80m radius curve instead of the 109 m radius curve for such a turnout off straight track.

1.3.4 Site investigation following the derailment showed Turnout 1 was set for the intended movement to the down main. However, the left-hand switch controlling the movement of Train 9282 to the down main was chipped and worn, with an approximate 80 mm x 20 mm portion of the switch fractured and resting on the stock rail (see Figure 3). For comparative purposes the relatively unworn left-hand switch on the north end turnout at Wadestown is shown in Figure 4.

1.3.5 The fracture patterns of the switch showed no rust except at the leading face (nose) of the switch. The width of the rusted leading face was approximately 4 mm (see Figures 5 and 6).

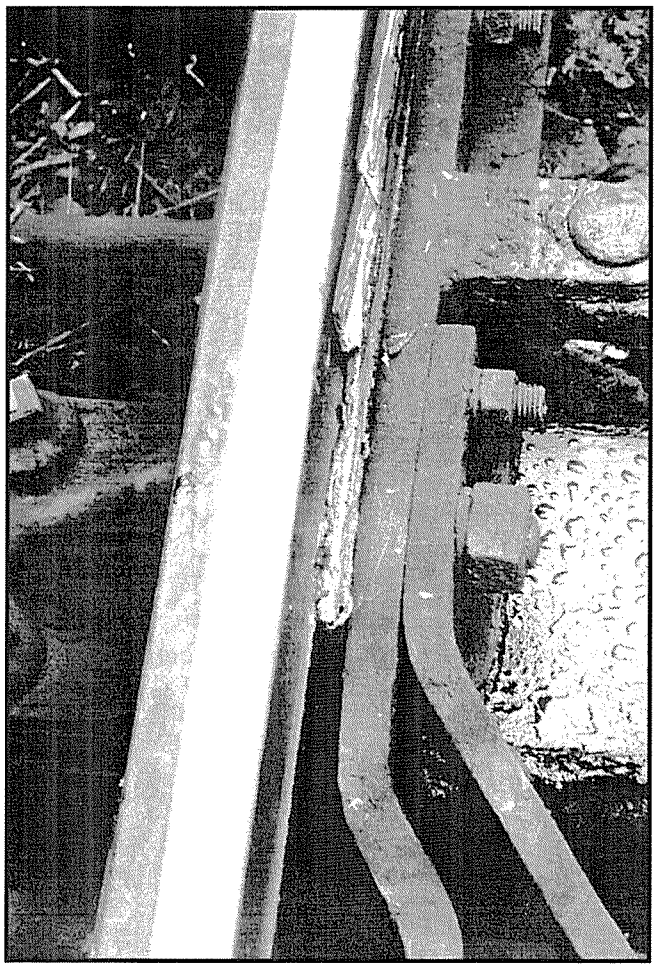


Figure 3
The worn left-hand switch on Turnout 1

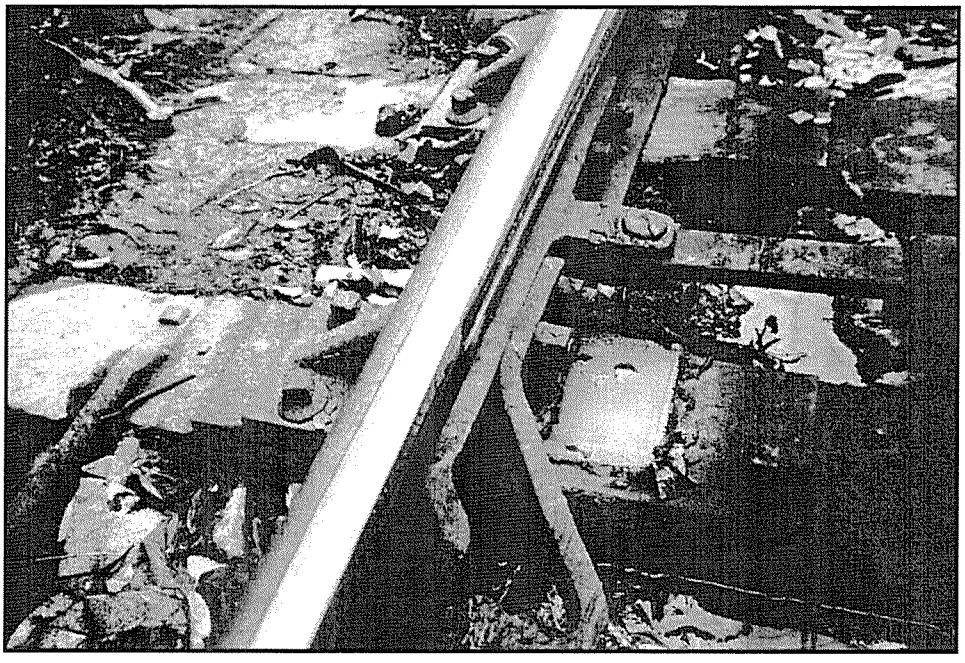


Figure 4
The relatively unworn left-hand switch on the turnout at the north end of Wadestown

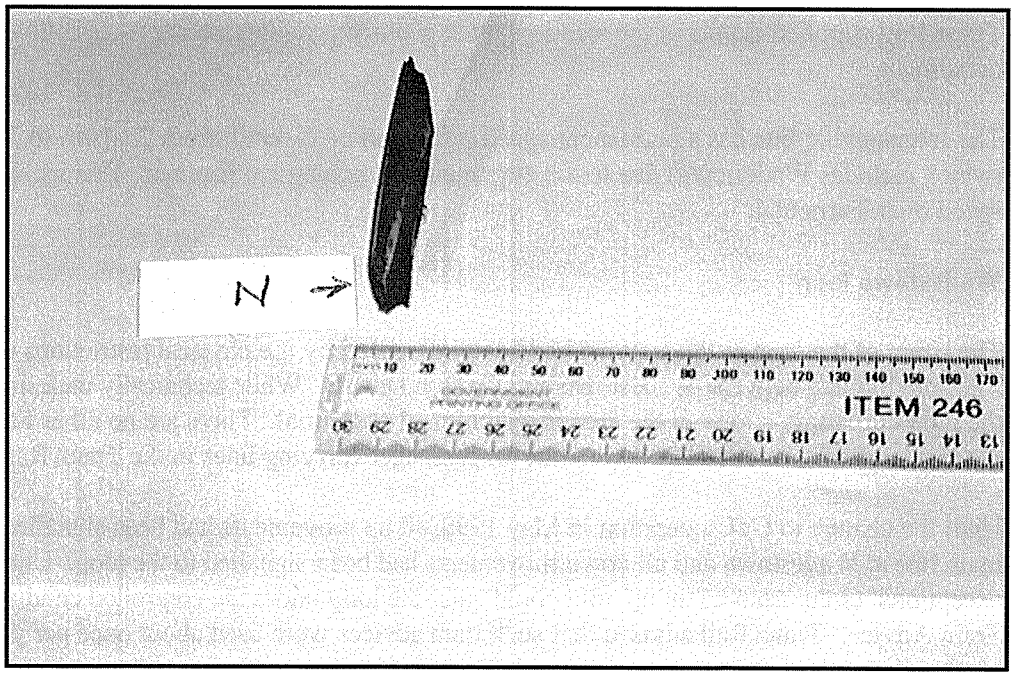


Figure 5

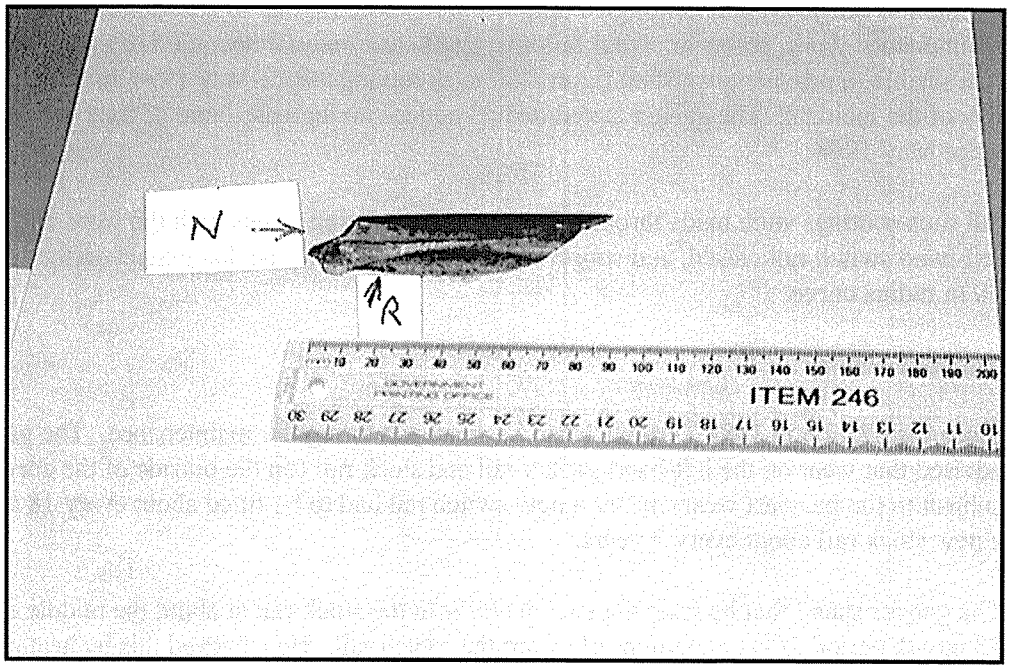


Figure 6
The fractured portion of the switch found in position following the derailment.
The 4 mm wide rusted switch nose is marked N.
The ramp which caused the derailment is marked R

1.3.6 Wheel marks found on the back of the switch rail indicated a wheel had mounted the front of the switch blade and dropped between the switch rail and the stock rail.

1.3.7 Tranz Rail supplied details of the standard track geometry measurements taken following the derailment.

1.3.8 The Johnsonville line has a permanent speed restriction of 25 km/h from 2.10 km to 3.59 km (which includes Wadestown) due to the alignment and geological features. This includes the speed over Turnout 1.

1.4 Wadestown loop

1.4.1 The siting of the loop at Wadestown had been influenced by the physical restrictions on the Johnsonville line between Wadestown and Crofton Downs. While technically undesirable due to the tight curvature, a loop in the area is operationally essential. There are no other turnouts off the inside of curves around 200 m radius on passenger carrying lines in the Tranz Rail system.

1.4.2 Until the change to CTC operation in May 1998, all up movements had been signalled to the main line at Wadestown and all down movements had been signalled to the loop. Under exceptional circumstances an up train could enter the loop under the controlled conditions of Train Advice. Tranz Rail advised that such train advices were used about once per year. As a result, all signalled up movements through Turnout 1 were over facing points with the left-hand switch open and the relatively lightly worn right-hand switch supplying wheel guidance to the up main on the inside of a 700 m radius curve.

1.4.3 Since May 1998 the new CTC operation had been signalled for two-way running on both the up main and the down main. Tranz Rail advised that under CTC the signalled movements from the up main to the down main through Turnout 1 were more regular to accommodate planned maintenance work, points or signal failures, and to test manual operation of the CTC. Tranz Rail was unable to provide quantified figures for such routings since May 1998 but 4 occurred on the day of the incident. The ganger stated he had noticed an increased rate of wear on Turnout 1 since May 1998.

1.4.4 All such routings were made through Turnout 1 over facing points with the worn and chipped left-hand switch rail closed, and supplying wheel guidance to the down main on the outside of an 80 m radius curve.

1.5 Turnout history

1.5.1 Since installation in 1981 Turnout 1 had been subject to regular maintenance. The ganger advised that wear on the left-hand switch rail and stock rail (on the outside of the curve and subject to the heaviest wear) meant a new switch rail had to be fitted about every 18 months and a new stock rail about every 3 years.

1.5.2 The ganger stated that he reset the switch closer to the stock rail at about the middle of each 18 month period to get maximum life from the switch rail. He achieved this by heating the switch blade over the front 400 mm approximately and tapping the blade to bend it to fit closer to the stock rail. He stated this was a practice which had been used for many years to extend the life of turnouts in yards. Turnout 1 at Wadestown was the only main line turnout which he maintained in this manner because of its tight curvature and related rapid wear. He stated this particular switch was not maintained by grinding. (Grinding was the normal maintenance procedure for reshaping of the points to extend the life of switch blades (Appendix 1, Clause 1)).

1.5.3 Records showed the left hand switch and curved closure rail behind the switch were last renewed on 18 May 1997. There were no records of the resetting of the switch between May 1997 and October 1998, although the ganger stated this had been done in the usual time frame around February 1998.

1.5.4 The turnout had been nominated for renewal by the local track management in 1996. Due to a combination of renewal priorities and turnout supply difficulties renewal was deferred until 1998.

1.5.5 The fractured portion of the switch was tested for hardness and found to conform to the specifications under which the switch was supplied. Examination of the fresh fracture face showed a brittle failure.

1.6 Turnout maintenance requirements

1.6.1 The relevant code requirements regarding the policy on the use of, and the maintenance and repair of, track structures as related to this incident are included at Appendix 1.

1.6.2 Resetting switch blades by heating them and bending them to fit the stock rail was not an approved Tranz Rail maintenance procedure due to the uncontrolled application of heat and the possible effect on rail structure and behaviour. The Tranz Rail track standards engineer, regional track and structures manager (Palmerston North), and track and structures manager (Wellington) all stated they were unaware of this practice being used on main lines or in yards.

1.7 Inspection requirements

1.7.1 The current code requirement for patrolling and inspecting dated January 1996 are included as Appendix 2. These are basically unchanged from the requirements applicable in 1995 when Tranz Rail's safety system was approved by the Land Transport Safety Authority (LTSA). The only change of note is that in 1994 Code P29, "Inspection by Line Inspectors", specified "Inspection shall be on foot, or suitable slow moving (approximately 6 km/h) trolley". This has now been changed to, "Inspection shall be on foot, or suitable slow moving trolley, or HRV[1]".

1.7.2 The Tranz Rail track staff structure at the time allocated one full-time patrolman for the track and structures manager Wellington area. This area took in all tracks to 106.425 km North Island Main Trunk and to 129 km Wairarapa Line, including all branches.

1.7.3 Turnout 1 was not included in the essential features list for specific inspection (Code P36).

1.7.4 The line inspector structure had altered during the period prior to the incident. In May 1998 Tranz Rail had adopted a 3 region track structure. The Central region (which included Wellington) had 4 track and structures managers reporting to the regional track and structures manager and there were originally 3 line inspectors carrying out line inspection for the region. This was reduced to 2 inspectors in May 1998 and to one in November 1998. Code P29 inspection requirements were achieved by each of the track and structures managers carrying out more of the line inspector inspections. Any such inspections were understood to be part of the track and structures managers' own inspections as required by Code P28.

1.8 Event recorder

1.8.1 The locomotive event recorder was extracted and the short log, which gave details of speed, air pressure and throttle position every second for 6 minutes prior to the completion of recording, was supplied for analysis. The time of extraction was not taken and it was not possible to relate logged time to actual time with confidence.

[1] HRV is a high rail vehicle, i.e. a road vehicle adapted to allow running on rail when required.

1.9 Wheel profiles

1.9.1 The profiles of all wheels were measured following the derailment and they were found to be within tolerance.

1.10 Personnel

1.10.1 The LE was a qualified grade one locomotive engineer and held a current operating certificate.

1.10.2 The patroller at the time of the incident had been acting in the role for the first time. His acting period had commenced 8 days prior to the incident. He stated that he was briefed by the track and structures manager, and accompanied by the relevant length ganger during his first day of patrolling. His only patrol of the Johnsonville line was on 9 October, 6 days prior to the incident. He stated he was not given any guidelines on frequency of patrolling and was unaware of the required frequency for patrolling passenger lines (Code P21). He patrolled the Johnsonville line once during his 9 days acting. He made no written reports of his patrols during that period. Fortnightly patrol reports filed by the appointed patroller prior to this acting period did not show the specific dates of each patrol and therefore the frequency of patrolling the Johsonville Line could not be determined. (The appointed patroller at that time was deceased).

1.10.3 The ganger had been in charge of the length for approximately 10 years and had worked in the Wellington area since 1977. His last code inspection prior to the incident was carried out on 18 September 1998, about one month prior to the incident, and listed no defects for the turnout in question. He stated he could not recall looking at the turnout and assessing its condition, but was sure he would have, and that his assessment would have taken into account the planned early replacement.

1.10.4 The appointed line inspector at the time of the incident had not covered this area of track since reorganisation had extended his original area. The last line inspection had been carried out by the track and structures manager in May 1998, when acting as line inspector, and coincided with the end of his acting period. Matters found during line inspection inspections, and any work required as a result, are recorded in the track inspection diary for the tracks concerned. The ganger for the Johnsonville Line was not required to directly input data to the inspection diary. His LGR-1 report form was required to list any defects that were not already on the worklist, and any found during a patrol. Entries to the track inspection diary were made principally by the line inspector and the track and structures manager (by inspection or from any items on the LGR-1 reports he considered necessary).

1.10.5 The track inspection diary for the Johnsonville Line, which recorded all actions required arising from various inspections and their priority, included one entry for Turnout 1. The relevant diary extract read:

Record Gang	Line Yard	From To Reported by	Job Type Speed r	Fault Action	Priority Job grp
32076 MT1	Jvill	3100 3100 LJ 02/04/1997	Turnout	WADESTOWN SOUTH END : TOUT 1 : 21PTS WEAR CLOSURE, WORN SWITCH, LOOSE CHECK ETC - RENEW 1997	1 Prod

The entry was made following a line inspector inspection in April 1997 (just prior to replacement of the switch), which is the last date of diaried action required arising from a line inspector inspection of the Johnsonville Line before May 1998. Tranz Rail's track standards manager advised that lines were not being inspected twice per year (as required by Code P25) and that all lines were now being inspected once a year by either the line inspector or a delegated person. This change to the code requirements had not been formalised and no specific approval had been issued for the Johnsonville Line to be inspected annually, or for that annual inspection to be delegated.

1.10.6 Apart from the diary entry of April 1997 no inspection reports could be found which specifically referred to wear on the left-hand switch on Turnout 1 at Wadestown.

1.10.7 The track and structures manager had been in the position for approximately 5 years. He indicated his own code inspection requirements were achieved by a mix of high rail vehicle inspection, specific site inspection, and walking inspections. The use of high rail vehicles on the Johnsonville Line was generally restricted to Sundays due to traffic density. The track and structures manager stated he could not recall inspecting the full length of the Johnsonville Line with the ganger. His code inspection requirements were met by localised site visits covering sections of track. He had been on site at Wadestown with the ganger some months prior to the derailment for initial planning of the proposed turnout renewal, and also on the morning of the derailment doing final work planning. He did not recall being aware of specific switch wear requiring action from his May inspection or the above site visits.

2. Analysis

2.1 The derailment

2.1.1 The position of the derailed vehicles, the marks on the rail and the condition of the switch indicated the derailment occurred when the leading left wheel of the trailing bogie of D2660 rode up the left-hand switch rail and dropped between the switch rail and the stock rail. The switch was then forced open and the trailing bogie and the leading bogie of DM470 were directed to the up main. The distance between the leading bogie and the trailing bogie of DM470 allowed the switch to close again and the remainder of the train was directed to the down main before being partly derailed.

2.1.2 There was nothing unusual in the track geometry leading up to the point of derailment (POD) which would have contributed to the derailment. The maximum running rail wear was within tolerance.

2.1.3 The broken portion of the switch blade was the cause of the ramping, and probably failed under the train.

2.1.4 Although the train event recorder extraction time was not recorded, by using the train departure time as a datum a difference of one hour was established, which is consistent with the standard correlation allowing for daylight saving. The short log was analysed on this basis and showed a speed of 27 km/h at the POD. The LE's report indicated that he applied the brakes approximately 28 m beyond the POD and the log indicated a stopping distance of 30 m. This was consistent with the position at which the train came to rest.

2.2 Turnout maintenance

2.2.1 The requirements for turnout maintenance (Appendix 1) stated the nose of switch blades must not be wider than 2 mm. Turnout 1 switch blade was approximately 4 mm wide prior to the failure of the portion which initiated the derailment. The rust on the nose of the switch blade showed that this condition had been present for months, rather than days. The switch wear limits (Figure 3 of Appendix 1) for switches 4572 mm and longer referred to "half wear" of 300 mm and "full wear" of 600 mm. These were intended as guidelines for grinding (Clause 11 of Appendix 1) to achieve the desired less than 2 mm at the nose, with wear beyond 600 mm requiring replacement of the switch. However, the only track task instruction relating to switch maintenance (Document T/T B5-4, Appendix 1) did not refer to grinding as a technique.

2.2.2 Because of its tight curvature, Turnout 1 at Wadestown was subjected to unusually high lateral forces causing severe and rapid wear over the first 200 to 300 mm of the switch. The ganger's experience with yard turnouts had been to use a non-standard practice (heating and bending) as a technique to extend switch life under the unusual wear conditions. His adoption of such a practice may have been due in part to the difficulty in interpreting and applying the code requirements to the Wadestown installation and the lack of instructions regarding grinding. Track management staff were unaware of this non-standard practice despite its regular use in this gang area.

2.2.3 The brittle fracture of the failed portion of the switch in place after the derailment was consistent with overload. The normal hardness indicated that the undesirable practice of heating and bending the switch was unlikely to have been a factor in this failure. The failure was initiated by shock wheel loadings created by the 4 mm blunt nose arising from earlier wear.

2.3 Operational factors

2.3.1 The increased use of Turnout 1 for facing movements from May 1998 increased shock loading on the switch blade and presented an increased risk of derailment due to switch wear. The increased risk did not appear to have been recognised or allowed for in the critical period between introduction of this practice and renewal of the turnout.

2.4 Inspection

2.4.1 The deteriorating condition of the switch should have been identified, and appropriate action taken, before it reached the condition that initiated the derailment. The turnout was a known area of unusually severe switch wear. This knowledge, together with an understanding of the changed operational procedures and the significance of the renewal timing some 17 months after the last switch replacement, should have alerted staff to the need for increased surveillance.

2.4.2 Under normal circumstances a patrol would not be expected to identify the wear problem which existed at Wadestown. Such problems develop over time and their identification and monitoring would primarily fall within the ganger's inspection requirements. However, in view of the known unusual wear problem associated with the turnout, the change of traffic pattern, and the need to closely monitor deterioration in track approaching renewal, it would have been prudent for the track and structures manager to have included the switch condition on the "essential features list" (Appendix 2, clause P36).

2.4.3 The acting patrolman was not patrolling the Johnsonville line at the frequency required by the code over the 8 days prior to the incident. The records of patrolling in the months prior to the incident were not sufficiently detailed to determine at what frequency the line was being patrolled before the acting period, but based on the size of the area that one man was expected to patrol there is some doubt that the required code frequency for passenger carrying lines was being achieved, or that it was reasonably achievable.

2.4.4 The ganger's 6 weekly inspection should have identified the hazard of the worn and blunt switch. The fact that it did not could be attributed to the relatively few non-CTC operation movements involving movements to the down main through Turnout 1 during the gangers 10 years in the area.

2.4.5 The track and structures manager carried out the last detailed inspection in May 1998 approximately one year after the installation of the switch, and possibly 2 to 3 months after it had been reset by heating. It is possible that switch wear was within allowable limits at this time. His presence on-site on 2 subsequent occasions, the last the morning of the derailment, did not detect a maintenance problem. His pre-occupation with planning renewal was the likely reason for not detecting the problem, which was certainly present on the morning of the derailment.

2.4.6 Due to restructuring, and the changes in staff this involved, Tranz Rail had introduced an inspection regime substantially different from that in place when their safety system was approved, and from that laid down in the code. In particular, all line inspections were annual, and the reduction in the number of line inspectors meant a high number of such inspections were progressively being carried out by track and structures managers and considered as part of their own inspection. The result of this was less track inspection than that intended by the code.

2.4.7 The timing and the nature of the last line inspection carried out at Wadestown did, however, fulfil the code requirements as related to the incident (line inspection by the track and structures manager 5 months prior to the incident). However the failure of track management staff to identify the regular use of the non-standard practice of heating and bending switch rails, and the generally unappreciated effect that the change in train operating practice had on switch wear and related risk exposure are examples of shortcomings in the track quality management system. Such shortcomings could have been overcome by a different inspection regime relating to the continuity, quality and frequency of the track inspections.

2.4.8 If Tranz Rail consider that changes to the frequency of inspections and the manner in which they are carried out, and restructuring of the staff who carry them out, are justified, it is important that these are introduced in a controlled manner with code amendment or specific exemption preceding rather than following such changes. In addition such changes to inspection requirements constitute a variation to the Tranz Rail safety system. Clause 6E of the Transport Services Licensing Act 1989 and its amendments refers to "Application by operator to vary approved safety system" and 6E(1) stated "Any rail service operator may at any time apply to the Director for approval of any variation of the operators approved safety system". In this particular case the variations were not submitted to the LTSA and the authority was unaware of the changes to inspection requirements introduced between the date of approval of Tranz Rail's safety system and this incident. Changes to inspection requirements relate directly to Clause 6C(2)(a) of the Act which states:

> (2) The Director shall not approve any proposed safety system unless he or she is satisfied that –
> (a) When the proposed safety system is implemented it will reasonably protect persons likely to be significantly at risk of death or serious injury through the operation of a rail service vehicle and should therefore be approved by the Director of the LTSA.

2.4.9 Tranz Rail submitted that the type of changes made to their inspection regime relating to this incident did not require them to obtain LTSA approval.

2.4.10 Tranz Rail and the LTSA are currently negotiating a Memorandum of Understanding covering variations to Tranz Rail's approved safety system. For this reason no safety recommendations regarding variations to safety systems have been made with respect to this incident.

2.5 Post-incident action

2.5.1 The lack of radio communication following the incident did not adversely affect the follow up action because the LE was able to borrow a mobile telephone from a passenger. However, this may not always be the case. It is desirable that train staff have access to reliable communication equipment in such circumstances.

3. Findings

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

3.1 Train 9282was being operated correctly at the time of the incident.

3.2 The derailment was caused by brittle failure of a worn switch which induced wheel ramping at the point of the switch.

3.3 The failure was initiated by wheel loading associated with the changed traffic pattern to suit operational demand.

3.4 The switch wear prior to the brittle failure had resulted in the nose of the switch being twice the permissible maximum width.

3.5 It is unlikely that the failure was brought forward by the unauthorised use of heat to reset the switch rail close to the stock rail.

3.6 Tranz Rail were not patrolling and inspecting the Johnsonville Line to code requirements.

3.7 Tranz Rail's patrolling and inspection regime had not identified either the excessive switch wear or the long established unauthorised practice of heating switch rails and bending them to increase service life.

3.8 It would have been prudent for the track and structures manager to have included Turnout 1 switch wear on the 'essential features' list to bring it within the required patrol frequency for observation.

3.9 Tranz Rail had introduced a new train operating system without fully appreciating the effect on the heavily loaded Turnout 1 at Wadestown as it approached the end of its economic life.

3.10 The requirement for staff to assess turnout condition and initiate any maintenance action with regard to Turnout 1 between May and October 1998 was probably overlooked by them because of the planned renewal of the turnout in October 1998.

3.11 The turnout switch wear was predicable, and could be monitored and maintained, and the derailment was therefore not directly related to the deferred renewal date for Turnout 1.

4. Safety Actions

4.1 Tranz Rail are now exploring the use of an incident follow up checklist for ensuring a consistent approach to all factors which may be highlighted by such incidents.

4.2 Tranz Rail have initiated a more detailed six monthly battery check to replace the present annual check, and a check of the circuits and the load which they place on the batteries in these units.

4.3 Turnout 1 was renewed as planned following the incident. The new 50 kg turnout has improved alignment features and better wear resistant capability. While this does not overcome the inherent problem at Wadestown it should ensure a longer switch life.

4.4 Tranz Rail advised that prior to the incident code inspection requirements were being reviewed to define location related inspection frequencies and that this review is still in hand, taking into account the lessons learnt at Wadestown.

5. Safety Recommendation

5.1 On 6 October 1999 it was recommended to the managing director of Tranz Rail that he:

5.1.1 Implements a track inspection regime of a standard and to a frequency that:

- identifies and protects predictable weak spots
- detects repeated non-standard practices

and that the inspection requirements are formalised and adhered to (046/99).

5.2 On 1 November the managing director of Tranz Rail responded as follows:

5.2.1 Tranz Rail accepts safety recommendation 0496/99.

Your recommendation, however, does not add anything new to the existing process. The ongoing management of the system requires that these items be continually reviewed and revisited. Changes as a result of review have already been made to these processes and further review of the entire inspection regime is continuing.

As such we find that the recommendation is already in place.

Approved for publication 6 October 1999

Hon. W P Jeffries
Chief Commissioner

Appendix 1

wheels and thus reduce switch wear. They also act as a safeguard against split points derailments.

Protectors should be fitted to turnouts where heavy switch wear occurs. They must not be installed in turnouts where train speeds are more than 25km/hr.

"Mack" protectors are supplied in one size only, for 91lb rail. They must not be fitted to badly worn rail: the top of the protector must not extend above the bottom of the rail - head radius and must fit snugly to the side of the rail head.

Note: only one protector must be fitted per turnout, on the straight road side. Where both roads are curved, ie. split turnout, at the switch having the greatest wear.

The protector plate (part No MC1) can be reversed when one edge is worn.

Stock Item No. 16894S/2:

Switch Protector set complete: 168944/4

10. TRACK STRUCTURE MAINTENANCE - GENERAL

Track structures must be inspected closely by T & SM for gauge, cant, twists, wear, breakages, flangeway clearances, fastening tightness, sleeper condition, adequacy of ballast, packing, and drainage.

The adjustment of switch throw and fit must be checked. Point boxes, and tension of springs or clearances of throw-over levers must be examined to ensure that fastenings are tight and the levers are effective. Switch heelplate fishbolts must be examined to check that they are tight. Loose heel bolts reduce both switch security and material service life.

Switch blades must fit closely to stockrails, which must not move laterally under load. The nose of switchblades must not be wider than 2mm. The lie of the switches should be checked to confirm that wheel flanges are guided properly and will not ride up the point of the switch.

Excessive turnout of out of square (ie, one switch blade leads the other) that causes signals points rodding to rub against the adjacent sleeper or tie plate is to be promptly corrected.

Pins in switch brackets must be checked to ensure that split pins or grip clips (SSI 160140/7) are fitted and secure.

The top of rail for diverging roads must be level beyond the heel of frog to a point where track centres are 2.0 metres.

11. REPAIR OF TRACK STRUCTURE COMPONENTS

(a) Frogs and wing-rails: CSP/51 refers to procedures to follow (by certified staff).

(b) Switch points: Maximum allowable wear for all lengths of switch is shown on Fig 3. When full wear is reached the switch must be renewed. If the stock rail is so worn that the new switch will not close neatly without any gap, it must also be replaced.

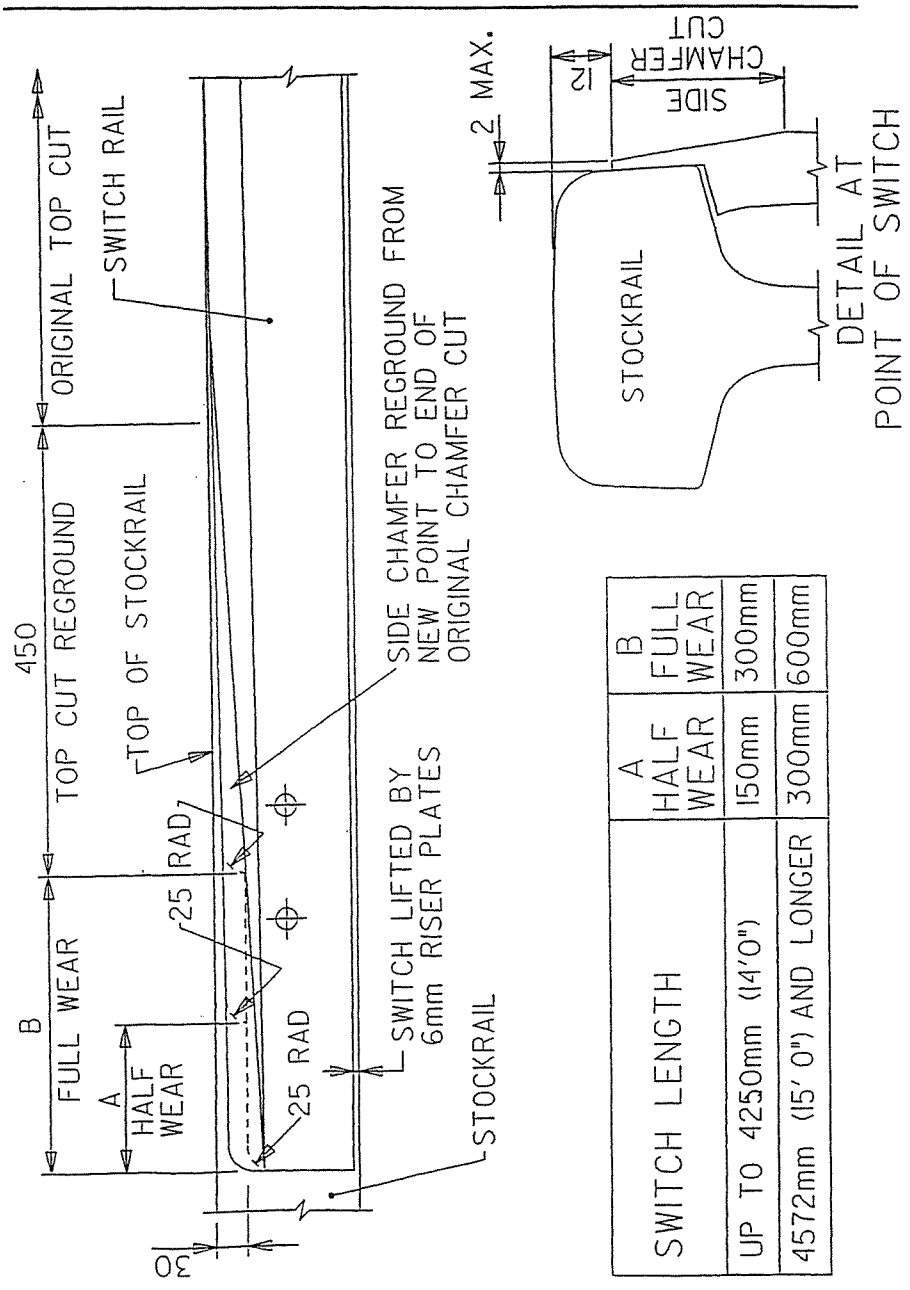
Chipped switches affected by wear or damaged by operational mistakes such as a run through, must be replaced or reprofiled (see below). Blunt switches, bruised while "kicking" or through wheel hit while lying "half-cocked" should also be reshaped to conform.

Reshaping of the points of switches must be carried out by grinding to the profile shown in Fig 3. The procedure is covered by task instruction.

12. DRAINAGE OF TRACK STRUCTURES

Special attention must be paid to drainage around track structures. Provision must be made for taking water away from points wells, frogs, points motors and interlocking equipment.

Dirt, oil and rubbish must not be allowed to accumulate and interfere with the free drainage of turnout areas.



SWITCH LENGTH	A HALF WEAR	B FULL WEAR
UP TO 4250mm (14'0")	150mm	300mm
4572mm (15' 0") AND LONGER	300mm	600mm

SWITCH WEAR LIMITS FIG 3

TRANZ RAIL LTD

OPERATIONS GROUP

TRACK TASK INSTRUCTION

Document T/T:	**B5-4**	**Contact:**	T.Hodder
Issue: 2		**Date Effective:**	01.09.96
Distribution: To all track staff		**Review Date:**	30.08.00

Task: Check switch wear and repair or replace

Also See:

Work Site Safety Plan
Rules and Regulations
Track Code P.66
Track Code Supplement CSP/63 & CSP/73

Tools and Materials Required:

Protective clothing and Equipment
Switch and if required a Stock Rail of the correct weight and size
Fishbolt Spanner for the correct rail weight

STEPS:

1. On inspections, check that switches are not worn or broken beyond the standard as shown in the Track Code Supplement CSP/63.

2. If switches are suitable for welding, advise Ganger/T&S Manager

3. If a replacement switch is required, arrange for a switch of the same length and weight to be on site.

NB: If the replacement is in an interlocked area, arrange with signals staff a suitable date and time. It may also be necessary to replace the stock rail to match the switch to be installed. see (CSP/73)

4. Arrange with Train Control or Officer in charge for track occupation and provide protection if required.

6. Undo heel bolts and remove bolts.

7. Roll out old switch.

8. Roll in new switch.

9. Install ferrules in front bolt holes.

10. Insert heel bolts, washers and nuts. (Huck type)

11. Loctite glue can be used on the thread of bolts.

12. Tighten nuts.

13. Check that switches work correctly.

14. Advise Train Control or Officer in charge that work is completed and protection has been removed.

15. Remove all surplus materials and clean up work site before moving onto next job.

Appendix 2

PATROLS AND INSPECTIONS - LENGTH GANGS

P.20 PATROLS are to be made in compliance with Clause P.21, P.22, P.23 and P.24. The purpose of the patrol is to ensure the track is safe for the passage of trains at authorised speeds until the next scheduled patrol. The patrol may be done by motor trolley or hi-rail vehicle. In areas where the use of hi-rail vehicles and/or trolleys are not allowed, the patrol may be carried out from a suitable train and other means to comply with clause P.24.

P.21 PATROL FREQUENCY

Lines are to be patrolled in compliance with Clause P.20 and as follows:

LINES	FREQUENCY	PATROL BY
All lines with regular Passenger services or more than 2 million gross tonnes of traffic p.a.	Twice per week (with a maximum of 5 days between patrols).	Any competent staff member with suitable training as approved by the Track and Structures Manager.
All other lines	Once per week (with a maximum of 10 days between patrols).	As above.

P.22 SPECIAL PATROLS in times of possible danger are required to be carried out. Length Gangers must arrange for such patrols as they consider necessary to safeguard the passage of trains when:

- There is any likelihood of damage to or obstruction of the line due to storm, flood, earthquake or fire.
- There is possible danger from gales and high winds. The scale in Fig P.96 will assist in estimating wind speeds.

- There is a risk to trains from any other cause such as track damage from defective locomotives or wagons, dragging equipment or displaced loads.
- There is a possibility of track buckles, refer clause P.90.

In any situation a special patrol may replace any normal patrol provided the requirements of the patrol are met.

P.23 HOLIDAY PATROL

When a holiday falls on any day on which a patrol would normally be made or when otherwise regular services are cancelled the following provisions will apply:

- When regular services have been cancelled, if there have been no trains for more than five (5) days, a patrol is required not more than 24 hours prior to the running of the first train.
- Patrol days are to be rescheduled to comply with Clause P.21.

P.24 THE REQUIREMENTS OF A TRACK PATROL are as follows:

(a) Observe the track, including on bridges, looking for any significant change to top or line, and checking they are satisfactory.

(b) Watch for train damage, such as wheel burns, impacts from dragging gear or fallen loads.

(c) Check drains and waterways are clear.

(d) Check level crossings alarms as directed by Code P.127.

(e) Observe trackside signs to ensure they are in place and visible.

(f) Watch for stock trespass or potential stock trespass.

(h) In electrified areas, observe the overhead lines and structures for signs of damage.

(i) Check areas which have been specially listed in the essential features list, refer P.36.

(j) Check for any other matters which could affect the safe running of trains, including clearance encroachments.

(k) Observe any locked turnouts - CSP/73 Section 6 refers.

P.25 INSPECTIONS

The following table summarises the minimum inspection requirements:

INSPECTION TYPE	CODE CLAUSE	FREQUENCY	INSPECTION RESPONSIBILITY
Curve boards, M186	P.28 P.103	Each 6 months	Track & Structures Managers
Locomotive runs	P.28	Three per year	Track & Structures Managers
EM.80 exceedances	P.91	As required	Track & Structures Managers
Length Gangers inspections	P.26	Each 6 or 8 weeks. Refer clause P.27	Gangers
Track & Structures Managers Inspections	P.28	Each 12 months	Track & Structures Managers
Line Inspectors Inspections	P.29	Two per year	Line Inspectors
EM80	P.91	One or two runs per year	EM.80 Car Operator
Private Sidings & Lines	P.30	Once per year	Line Inspectors

P.26 LENGTH GANGERS INSPECTIONS are made by Length Gangers in compliance with clause P.25.

The purpose of the inspection is to provide detailed information on the condition of the track materials and geometry. Sites identified on the current work list are to be inspected to ensure that the track condition is still safe and not deteriorating. Refer also to Clause P.91 on EM.80 exceedances.

All aspects of the track that are not within tolerances, and are not on the current worklist or EM.80 exceedance report are to be recorded.

A mainline inspection shall be done from a suitable slow moving inspection trolley or HRV at a rate of approximately 30 - 40 km/day. Inspections of yards should be carried out on foot.

It is envisaged the length be inspected over a 2 - 3 day period.

Inspection as required of essential features.

P.27 FREQUENCY OF INSPECTIONS

Inspections are to be made by Length Gangers such that the following lines are inspected on a **six weekly cycle**:

- NAL (0km - Waitakere), Newmarket
- NIMT
- ECMT, Murupara, Kinleith, Mt Maunganui, Rotorua
- Wairarapa (0km - Masterton), Johnsonville, Melling
- PNGL (0km - 180km)
- MNL, MSL
- Midland, SWL, Ngakawau
- All other lines will be inspected on an **eight weekly cycle**.

P.28 TRACK AND STRUCTURES MANAGERS INSPECTIONS

T & S M are required to carry out inspections as per clause P.25.

(a) Track Inspections

Sufficient Supervisor inspections are to be carried out to ensure:

- Each length is being maintained to the required standard (Clause P.46).
- Construction standards are being complied with (Clause P.44).
- Track material standards are being complied with (Clause P.61).

T & S M are to inspect their mainlines and yards at least once over a twelve month period.

T & S M should do their inspection in conjunction with their Length ganger(s).

(b) EM 80

T & S M should follow up on the EM.80 track evaluation car exceedances as required in Clause P.91

(c) Locomotive Runs

Locomotive runs are to be made by T & S M over all main line sections on which scheduled daytime trains operate. T & S M are to preferrably travel in the locomotive cab of the fastest available train to assess:

- The ride quality of the track
- Positioning of track signs, including TSR sites
- Viewlines at level crossings and to signs and signals

Safety precautions being observed at work sites.

(d) Curve Boards and Curve Warning Boards (M.186)

Refer to Clauses P.103.

(e) Gangers Codes, Code Supplements and other appropriate documentation is to be audited at least once each year.

P.29 INSPECTIONS BY LINE INSPECTORS

Detailed inspections will be carried out by Line Inspectors such that all mainlines and yards are inspected twice in a twelve month period. The period between inspections should be at least five (5) months, but not more than seven (7) months.

Inspection shall be on foot or suitable slow moving trolley or HRV.

Approval may be given by MTM for some track to be inspected as follows:

- Once only
- Once by Line Inspector and once by delegated person

Refer to CSP/21.

P.30 PRIVATE SIDINGS AND PRIVATE LINES over which TRL rolling stock is authorised to run must be inspected at least once every 12 months. Any repairs done or further work required is to be included in Ganger's report or Inspection Dairy report.

Inspectors should advise Private Siding holders when inspections are being done or alternatively advise the local freight representative.

In cases where the siding or line owner regularly attends to maintenance, Inspectors must state in their reports, the name of the person to whom, and when, they have drawn attention to the work required.

P.31 SIDINGS ON WHARVES are to be treated as private sidings and private lines.

P.32 to P.35 RESERVED

P.36 ESSENTIAL FEATURES LIST

An essential features list is to be compiled by the T & S M for each track length, and a copy held by the Length Ganger The list shall record any features on the length which are to be specially checked during every patrol or inspection of the length or features that should be specifically monitored on a special patrol eg slips or flood levels at bridges during heavy rainfall.

The original copy of the list is to be held by the T & S M. It must be reviewed as required, but at least each 3 months and reissued accordingly. The list must be signed by me T & S M and show a date of issue.

Essential features lists are to be available to any staff that may be required to carry out a track patrol, special patrol, or an inspection.

P.37 REPORTS ON PATROLS AND INSPECTIONS are to be provided by Length Gangers on form LGR.1 as follows:

(i) Patrols (including special patrols)

All relevant details are to be shown on the form. Any defects found that are not:

- immediately repaired
- already shown on the work list

are to be reported.

(ii) Inspections

As per patrols.

The completed LGR.1 form is to be forwarded to the T & S M each fortnight.

On receipt of LGR.1 forms, T & S M must:

(i) Note receipt to record that the inspection has been done and to confirm that the length is being systematically covered by regular inspections.