3.1 Conclusions

- On the basis of the information supplied to us, it is our view that the standard form of notification of SPAD incidents to LTSA from railways operators provided insufficient information for LTSA to adequately judge the public safety risk entailed by apparent changes in incident rates for Type A SPADs. TRL has argued that the quality of LTSA data was not impaired by any reluctance on its part to supply information to LTSA, and that in its view LTSA interest in SPAD rates arose from TRL notification of the phenomenon. These arguments notwithstanding, it is our view that LTSA's oversight and regulatory role would be assisted if the standard form of incident notification included a larger set of information, determined by LTSA, about each incident.
- The incidence rate for Type A SPADs has decreased since early in 2002 when TRL sharpened its focus on SPAD reduction measures. It is reasonable to assume that the reduction was a consequence of that increased attention. The beginning of the period of reduction coincided also with LTSA concern with incidence rates.
- Medium term instability in incidence rates for Type A SPADs was observed in Tranz Metro Wellington operations and Tranz Scenic operations over the period November 01 to October 02. That may indicate that it is yet too early to conclude that reduction in rates is a sustained effect in those operations. Complacency now would not be justified in relation to those two operations.
- Because Trans Metro Wellington and Tranz Scenic services are both passenger transport operations with the potential for more costly accidents, they would seem to be priority targets for attention in SPAD reduction efforts.
- No single factor or even a small set of factors was identified as responsible for the incidence of Type A SPADs. Consequently, finely targeted reduction measures addressing one or two specific causative factors are unlikely to have a major effect on reduction of rates. A broad spectrum approach is needed.
- At the time of the review TRL had taken tangible action in relation to the factor "driver distraction" and in relation to fatigue management. Both these interventions are likely to have had a beneficial effect on Type A SPAD rates. Other measures were in various stages of planning or implementation.
- Incidence of Type B SPADs is increasing sharply, although increased reporting rates may have affected the data. The consequences of this type of SPAD are generally safe. They are produced by power failure or signal faults. Attention should be directed to these as well, if only because too high a rate might induce train drivers to assume that an unexpectedly red signal is a malfunctioning signal.
- Our inquiries and risk assessment workshop described a large number of factors likely to affect the incidence of Type A SPADs. These ranged from hardware deficiencies in trains and signals, through recruitment and training variables, internal communications, fault reporting and response, to general safety culture and low morale. All these factors should be addressed for SPAD reduction.
- At present TRL is placing a heavy reliance on human performance as the SPAD prevention method. Human performance has its limitations, and humans need as much-support as they can get in all aspects of work. In many ways this support seems lacking in TRL.
- We have not recommended expensive hardware approaches to SPAD reduction, such as the installation of automatic train control systems. These seem unfeasible

in the TRL context. Much could be achieved by relatively inexpensive attention to the many factors identified.

3.2 Recommendations

3.2.1 Key Recommendations

Type A SPADs are the class of SPAD events of most concern. This is because they have potentially serious consequences and are much more frequent than the other dangerous classes, Types C and D. **Type** A SPADs result predominantly from human errors of various types. SPAD reduction measures, consequently, need to address the problem of human errors. Conceptually there are three main types of approach:

1. Correct the features of the human - workplace interface that are likely to promote the commission of errors (eg., by ergonomics, signal engineering).
2. Reduce the likelihood of errors that might occur irrespective of the human - workplace interface (eg., by training, fatigue management, and attention to intangibles such as improving morale & safety consciousness).
3. Reduce the vulnerability of the rail system to the effects of errors when they occur (eg., by installation of train stops, provision of overrun space).

Type B SPADs might be thought of as a different class of events in that, except in rare circumstances, their consequences are not dangerous. Type Bs need to be addressed to reduce the possibility of drivers attributing an unexpected red signal to a fault rather than danger.

Although the above categories might provide an organising principle for SPAD reduction interventions, they do not provide a basis for prioritising actions. The large number of possible actions suggested or recommended in this report, might, instead, be grouped in terms of the time scale in which they might be begun. It is noted that no single factor is likely to have a large effect on reducing SPAD incident rates, many factors need to be addressed.

Key recommendations, however, are:

- The signal-by-signal SPAD risk assessment planned by TRL should be expedited. Those signals identified as high-risk should receive engineering interventions preferentially.
- Corporate attention to staff morale and safety consciousness should be intensified particularly in the Tranz Metro Wellington operation. This requires action on many fronts including seemingly mundane matters such as cleanliness of driver's cabs, and communication of corporate intentions to staff.
- Improvements to the operation and responsiveness of fault monitoring and reporting systems should be actively pursued.

Plus the additional recommendation that:

- More comprehensive information on the detail of SPAD incidents should be included in the standard form of notification of incidents from railways operators to

LTSA. It is considered that this would assist LTSA in the performance of its oversight and regulatory duties.

3.2.2 Specific Recommendations

3.2.2.1 In the Immediate Term

- Expedite systematic SPAD risk assessment of individual signals. It is suggested this begin with multi-SPADed signals and those recognised as "traps"
- It is suggested that the SPAD incident database be queried to identify multi-SPAD signals. These may require preferential SPAD preventative measures.
- Address morale issues (particularly in TMW operation) on many fronts including the tangible, inexpensive measures of cleaning cabs and windscreens and restraining fire extinguishers in driver's cabs.
- Encourage the development of safety consciousness by means such as continuation of CRM training as an ongoing process, and encouraging guards to learn signal indications.

3.2.2.2 In the Short Term

- . Apply existing signal engineering expertise to identify safety improvements that could be made, such as re-siting problem signals, replacing bulbs with LED arrays, installing train stops, etc.
- Remove from the signalling system instances of two yellow signals preceding a red.
- Analyse Type B SPAD data, and use other means, to identify signals prone to Type B failures (power supply, and signal malfunction). Investigate means of reducing the incidence of these failures.
- Continue SPAD risk assessment of signals beyond those recognised as multi-SPAD or "trap" signals.
- Assess the effectiveness of channels of communication between fault identifiers and those rectifying them, including by evaluating feedback and operation of the "155" facility. Continue attention to fine tuning the fault monitoring systems.
- Continue work to improve morale (especially in TMW operation) by, for example, permanently rectifying windscreen wiper faults, spraying track ballast weeds, setting up cleaning procedures for drivers cabs, instituting maintenance of driver's seats and their adjustment mechanisms, and so on.
- Examine with a view to implementing, a number of training measures, including:
  - introduction of regular refresher training for all drivers (professional input, and input from the LOM Palmerston North, for the design of these is suggested)
  - provision of "train the trainer" instruction for new Tutor Drivers
  - instruction for drivers in calling signal indications or names rather than signal aspects
- Evaluate roster monitoring software for fatigue management in TR Freight operations. Despite effective fatigue management measures already implemented, high fatigue-risk shifts still exist in this operation, and may need watching.

- If possible, provide certainty, or at least more comprehensive information, to TMW staff about the future of the operation. That should assist morale improvement.
- In line with international trends in SPAD reduction we recommend that a more neutral approach to the second stage of SPAD investigation would be desirable. Renaming the "Disciplinary Meetings" and adopting an approach directed to explaining the SPAD incident, rather than ascribing blame for the incident, is suggested.
- PLUS, although not SPAD reduction measures as such:
  - TRL may wish to revisit changes it made to British definitions of Type B and C SPADs. Reconsideration is suggested on the grounds that the changes adopted tend to confuse the consequences of Type C events, and have at least the potential to convey the impression that TRL is more focussed on apportioning blame for SPAD events than on the safety risks associated with them.
  - Consideration might also be given to modifying causation categories used to describe incidents. Existing categories sometimes seem to present difficulties to investigators. One possible alternative approach using "decision trees" was suggested in this report.
  - It is also recommended to disseminate amongst staff more detailed information about the definitions of SPAD events used by TRL.

3.2.2.3 In the Medium Term

- Continue the processes begun in the immediate and short term, with implementation of interventions where possible.
- SPAD incident records, not just the summary database, should be examined for recurring "upstream" factors contributing to the observed human errors. Those assigned the causal category "Concentration" in particular may yield clues for SPAD reduction.
- Assess the relative costs, including risk costs, associated with retention or replacement of searchlight signals.
- Assess whether placing signals at the ends of stations in the metropolitan area would assist drivers.
- Provide the maintenance depot with appropriate equipment or systems for maintaining the train types they service, for example, equipment for maintaining disc brakes.
- Secure EMU driver's cabs so that access is only provided to those with the appropriate key. A wall across the full width of the car with a locked door is suggested. If internal windows are considered desirable they need to be able to be blacked out to reduce night time reflections on the driver's windscreen.

3.2.2.4 In the Long Term

- Implement, where shown feasible, those measures assessed, evaluated or investigated in the earlier stages.
- Ensure continued attention to safety consciousness, morale, CRM principles, evolution of training, etc., so that these are not seen as processes that can be "completed".

- Ensure that any new rolling stock provides better vision for drivers.
- Obtain professional ergonomics advice, both physical and cognitive, for the acquisition of any new hardware, especially rolling stock. Ergonomics needs to be considered at the tender preparation and evaluation stage, and throughout design and manufacture. Existing hardware exhibits many difficult-to-rectify ergonomic faults.

