Road Rail Vehicle National Project – Human Factors Observations

safe railways for Australia

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1 Background

There have been a number of serious Road Rail Vehicle (RRV) incidents in Australia in recent years.

Analyses of RRV incidents both in Australia[1] and in the UK[2] have concluded that *"the vast majority of incidents involved human error"* while operating RRVs.

Those analyses concluded, in particular, that there was an over-reliance on administrative or behavioural controls (i.e. relying on failsafe human performance) for safety when the human error potential could have been identified and minimised (or eliminated) through technical (i.e. design) controls.

The essential contribution of Human Factors to safety is for just such circumstances – i.e. the identification of error potential, and the application of knowledge about human characteristics to improve the design of systems and equipment in order to minimise the potential for error and its consequences.

The ONRSR National Priority Project for RRV Safety was undertaken in response to these incidents and, in recognition of the above concerns, Human Factors observation was included as an adjunct to the present round of RRV safety compliance inspections.

2 Human Factors observations

The following observations are made in order to:

- gain a preliminary understanding of RRV operations and,
- examine the relationships between RRV interface[3] design (especially in-cab) and the potential for safety-related performance errors.

It is intended that the information will provide useful input to:

- RRV design and operation standards and guidelines (e.g., RISSB's AS 7502 and the proposed accompanying RRV Guidelines), and
- ONRSR's safety improvement objectives (including ONRSR's RRV Guideline).

Areas in which sound Human Factors integration will enable future safety and performance benefits include:

- Production of criteria for equipment design and/or procurement
- Development of procedures and guidance on operations, inspections and maintenance
- Making recommendations for effective and usable operational documentation
- Determining training requirements
- Advising investigations

2.1 Sub-optimal and/or consistent design

On viewing several different models and types of retro-fitted RRVs, ONRSR have noted that there is very little consistency across vehicle types in either:

- the structural and functional design of Rail Guidance System (RGS) in-cab controls or displays (i.e. what they look like, and how they operate); or

- the manner in which the RGS controls and displays, and other safety-critical controls (e.g., Emergency Stop Buttons; parking brake) are incorporated into, and located within, the existing vehicle cabs.

Inconsistencies between vehicles in the location or operation of controls, or how the status of the RGS is displayed, holds potential for the RRV operators to err in their operation of equipment or their understanding of the equipment's status, especially if changing from one vehicle to another.

The following figures show examples of design inconsistency in safety-critical controls and displays across several different vehicle types:

2.1.1 Rail Guidance System

Figure 1. Two vertically-oriented toggle switches; 6 status lamps
(of which 4 are shown illuminated); dymo-tape labels.

Located high on door post on left side of cab adjacent to entrance.

Figure 2. One press button; no status indications; one un-labelled and ambiguous symbol on button.

Located on multi-function control panel at lower right side of driving seat.

Figure 3. One horizontally-oriented (left / right) rocker switch (finger shown pressing to left side); 2 status lamps; no labels.

Located on left lower face of the front console.

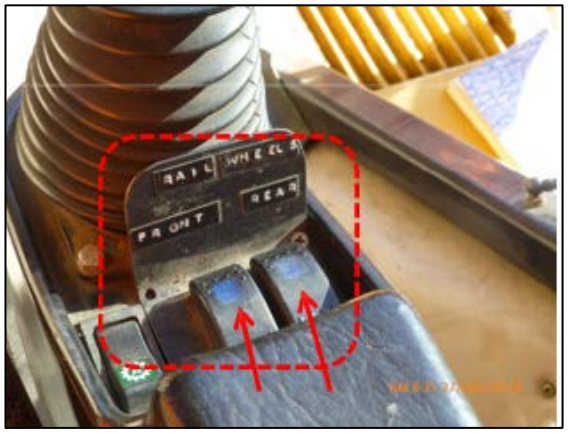

Figure 4. Two press switches (arrowed); switches appeared to contain blue-coloured embedded indicator lamps but these did not illuminate; dymo-tape labels.

Located in recess behind the main control stick just forward of driver's right arm rest.

Figure 5. One horizontally-oriented (left / right) rocker switch (arrowed); 2 status indicator lamps; no labels. A separate windscreen sticker (at the left of photo) with somewhat convoluted instructions for use (see photo at right). Located on the left side of the front console.

Figure 6. The separately located instructions sticker (refer RGS in photo at left). The left / right rocker switch (which activates front and rear rail wheels, respectively) is labelled on the sticker as “left / right” rather than “front / rear”.

Figure 7. Two forward / back-oriented 3-position slide switches; 2 status indicator lamps; dedicated labelling. Park brake was also located on this panel.

Located on low console in front and to the right of the main control stick.

Figure 8. RGS status display only (controls located separately); 6 status indicator lamps; dedicated labelling; lamp test button function.

Located in front and to the right of the driver at just below eye level and above other equipment (radio; rear view camera display monitor; etc.).

Figure 9. Older type RRV:
2 vertically-oriented rocker switches; 2 status indicator lamps; dedicated labelling.

Located low and to the right of the steering wheel on the front dash housing.

Figure 10. Newer type RRV: Touch-screen interface with RGS controls (at left); separate “Hyrail” park brake release button (at right).

Touch-screen located to the driver’s left side, projecting from the dash attachment. Park brake release button located low and to the right of the steering wheel on the front dash housing.

Figure 11. Copy of Figure 2 showing close proximity of numerous soft-key press-buttons for differing functions. See Figure 12 (at right) for close-up.

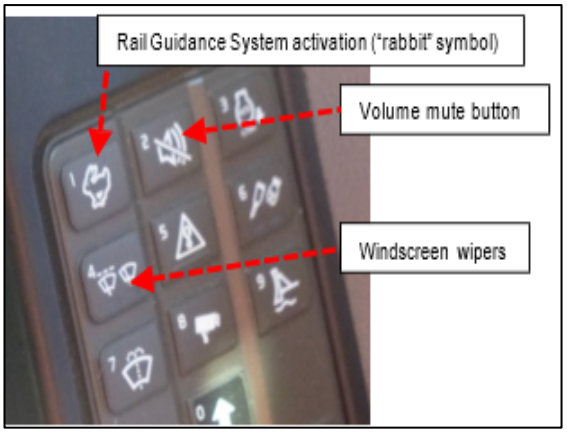

Figure 12. Close-up of Figure 11 showing close proximity of controls adjacent to single RGS control. The potential for inadvertent activation of adjacent switches is clear.

2.1.2 Emergency stop button

Figure 13. Interior Emergency Stop push-button: located low on the right cab interior wall; well outside driver's primary visual field.

Figure 14. Interior Emergency Stop push-button: located above the front equipment array and well within the driver's primary visual field.

Figure 15. Exterior Emergency Stop push-button: located at the front of the vehicle; requires reaching across the excavator's tracks in order to activate; infringing kinematic envelope.

Figure 16. Exterior Emergency Stop push-button: located on the left side of the vehicle; requires reaching in close proximity to rear road wheel in order to activate.

2.1.3 Parking brake

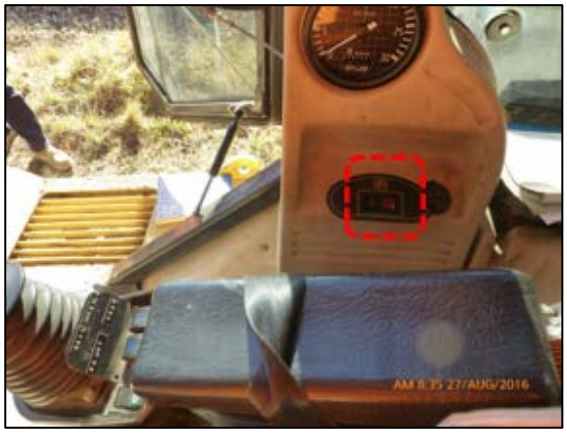

Figure 17. Most vehicle park brakes were located low and to the right rear side of the driving position, well outside of the driver's visual field.

Figure 18. Park brake for RGS co-located with the RGS operation switches.

Figure 19. Hi-rail parking brake release button (***not*** application button) located low and to the right of the steering wheel on the front dash housing. Park brake application was activated via the touch screen.

2.1.4 Poor installation

The standard of installation and / or maintenance of some of the retro-fitted in-cab RGS control fixtures in some vehicles was poor.

For example, in one case, some of the screws affixing an RGS panel were missing.

In another case, sharp-edged screw heads were projecting proud of the panel surface adjacent to the switches, presenting a laceration risk (this was drawn to the attention of the RRV operator the time).

2.2 Visual issues

Safety-critical functions must be readily detectable and accessible if delays in operation or errors of omission are to be minimised.

2.2.1 Safety-critical control / display locations

Safety-critical controls or displays should be placed where the RRV operator can readily locate and operate them without having to either:

- remember to operate the function (e.g., apply parking brake); or
- search for the function when under stress or time pressure, such as when a rapid response is critical (e.g., use of Emergency Stop Button during a roll-away).

The location of the Emergency Stop Button (ESB) varied between vehicle types. This presents a significant safety risk because the conditions under which a driver may have to activate an ESB are, by definition, emergency conditions when human response time is critical.

The potential for error (including forgetting errors, confusion, attentional difficulties, and similar cognitive decrements) is exacerbated when under stress or time pressure.

2.2.2 In-cab display visibility

RRV driving cabs are increasingly incorporating screen-based equipment.

The extent to which these and other visual displays have been evaluated as suitable for the dynamic driving environment with its highly variable directions and intensities of ambient illumination is not known. However, it should be noted that safety issues have been identified in other transport modalities (conventional rolling stock, aviation, road transport) where screen-based equipment has been incorporated without adequate attention to applying Human Factors principles in equipment selection or installation.

Some screen-based equipment observed (e.g., Figure 21) appears to have incorporated some limited shrouding to mitigate glare / reflection, while others (e.g., Figure 20) do not, and appear to have been installed in an orientation that would maximise reflection and glare.

Some displays appeared to allow adjustability in their orientation. However, most did not despite this also being a well-known approach to mitigating glare and reflection.

Figure 20. Multiple in-cab screens and displays.

Figure 21. Multiple in-cab screens and displays.

Figure 22. Touch screen installed in newer RRVs.

2.2.3 Ineffective visual information

Most of the RRVs inspected featured an excessive number of information stickers placed over a significant portion of the available window space (see Figures 23 – 26). These stickers featured compelling title words such as *"Warning", "Danger", "Caution", "Notice"* and similar.

Each of the RRV operators questioned about these stated that they did not refer to these signs at all during the course of their work. The impression they gave was best summarised by one driver who stated (verbatim): *"I don't look at them at all. If I had to use them to know what to do, I shouldn't be here!"*

That comment succinctly highlights the main issue. Examination of the excessive number and ad-hoc distribution of these stickers about the cab show that it would be unrealistic to expect an RRV operator to be able to quickly find a sticker related to any one particular issue.

Figure 23. View of stickers on right-side cab window.

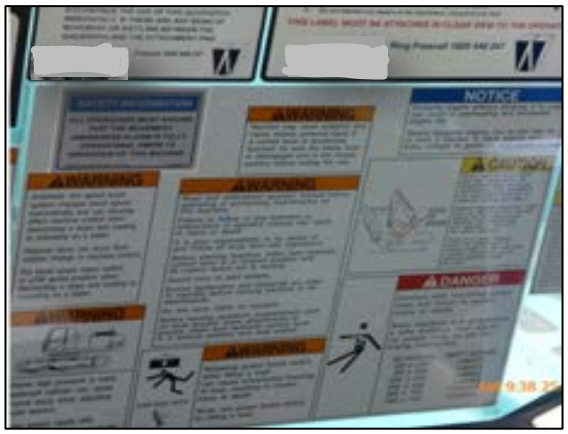

Figure 24. Close-up of stickers.

Figure 25. View of stickers on right-side cab window.

Figure 26. View of stickers on right-side cab window.

Figures 27 (a) and (b) appear to provide some support for the view that the various warning stickers placed about the vehicle are, in this case at least, ascribed little-to-no importance; i.e., the “Danger” of which the sticker warns has been completely obscured by the registration

Figure 27(a). The vehicle registration plate has been affixed partly over a “*Danger*” sticker, concealing the nature of the danger of which it warns. See also Figure 27(b).

Figure 27(b)

2.2.4 Visual clutter

In addition to the display of in-cab signage being ineffective (as noted in 4.2.3 above and in Figures 23 – 26), it presents a significant amount of visual clutter in the various operating fields of view of the driver.

An established Human Factors principle is that no unnecessary visual features should be placed in the operating fields of view of drivers or equipment operators in order to minimise the potential for visual detection difficulties (including obscuring sight lines and causing distraction) resulting in errors or other failures.

2.3 Ineffective or inconsistent operating information

A number of inconsistencies were noted in examining the extent to which there was agreement between RRV operational requirements or information (as set out in equipment or operations manuals) and the procedures actually adopted by RRV operators.

The most notable discrepancy was that between RRV operators' beliefs about the role of steering when in rail mode and the instructions relating to this in the RRV manuals.

> Articulated dump trucks:

RRV operators operating articulated dump trucks stated that they believed it was important to *not* affix the pivot joint lock when travelling in rail mode as, they stated, it was important to be able to steer the vehicle slightly when encountering significant curves in order to not risk derailment and excessive wear.

By contrast, the equipment manual for these trucks explicitly stated that the pivot joint lock must "*always*" be mounted when driving on the rails "*for safety reasons*" and also to "*prevent excessive wear*" (refer Figures 28 – 30).

The manual and the RRV operators' beliefs are clearly in direct contradiction. The RRV operators stated they based their operating behaviour on experience with the equipment. By contrast, the basis for the instructions in the manual are not known.

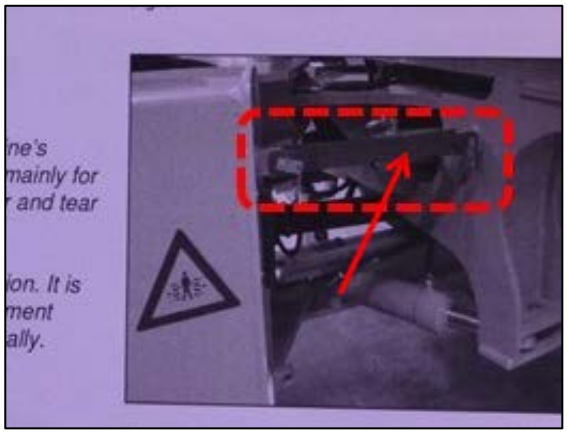

Figure 28. Excerpt from an articulateddump truck manual. The photograph shows the pivot lock bar (arrowed) in the horizontal locked position (cf. Figure 30 [the same view] where the bar is clearly not in the locked position).

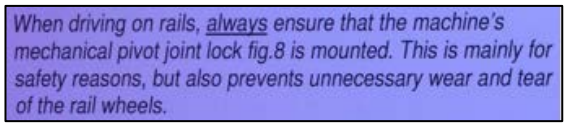

Figure 29. Close up of excerpt from an articulated dump-truck manual (adjacent to photo shown in Figure 28).

Figure 30. View clearly showing the pivot lock (red bar) not locked in place. The RRV was on the rails at the time. Notably, the pivot lock bar appeared new and showed no indication of use.

The operating manual for the one of the newer RRV's instructs the drivers as follows:

> *"Do not steer the vehicle when driving on rail. The steering wheel must be set to straight-ahead before moving off."*

Although a seemingly important safety-critical requirement to prevent potential for derailment, this instruction is quite inconspicuous, only appearing in normal text and not until page 18 of the Manual (see Figures 31 – 32).

Maintenance personnel advised that some of the older RRVs had a retro-fitted strap which the driver affixed to the steering wheel to prevent steering when in rail mode, but that it was eventually removed. The reason for its removal was not known.

The newer RRVs do not feature any fixture that could stablise the steering wheel in the straight-ahead position.

There are two issues with this:

- Other important information related to vehicle operation has been conspicuously highlighted throughout the manual (see Figure 33 for example) or placed on stickers on the windscreen close to the driver's line of sight (Figure 34). However, the essential instruction about the steering wheel position while on the rails – arguably one of the more important concerns prior to, and during, rail operations – receives only cursory and inconspicuous attention.

- There is no design feature that could lock or stabilise the steering wheel in the straight-ahead position to eliminate the potential for inadvertent or erroneous movement of the steering wheel resulting in derailment.

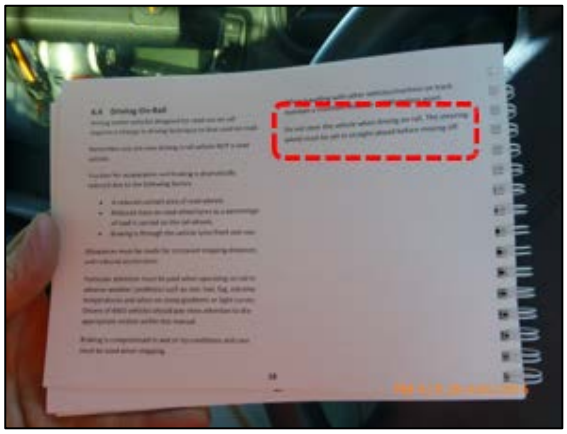

Figure 31. Essential information regarding the safety-critical instructions for steering wheel position and avoidance of steering appears only in an inconspicuous paragraph in the Operating Manual for the RRV.

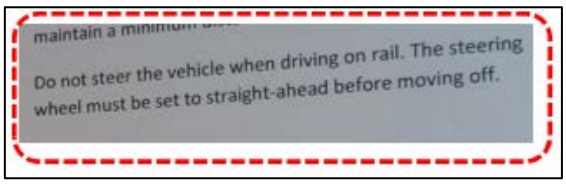

Figure 32. Close up of Figure 31 showing instruction regarding steering.

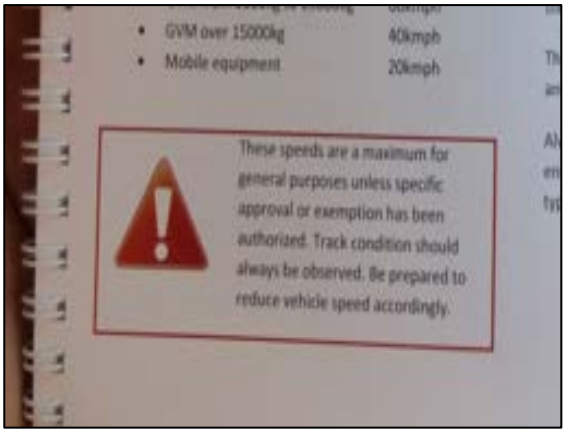

Figure 33. Example of other important information being conspicuously highlighted in the Operating Manual.

Figure 34. Warning and information stickers placed on interior of vehicle's windscreen.

2.3.1 Incompatible operating manual

One RRV which was relatively new, had an operating manual containing instructions for a RGS that was entirely different to that actually installed in the vehicle (see Figures 35-36).

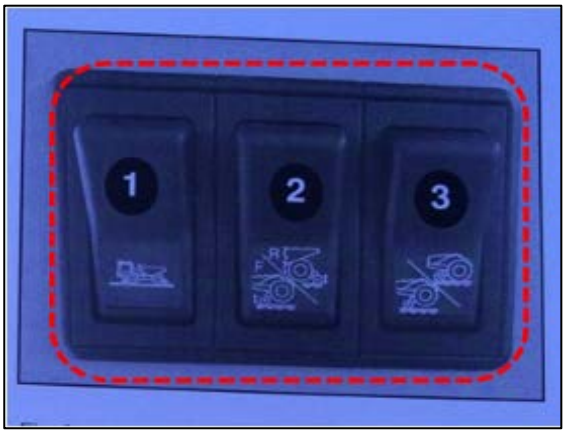

Figure 35. An image from the articulated dump truck RRV Operating Manual showing an RGS switch configuration entirely different to that which was installed (see Figure 36).

Figure 36. An instruction sticker in the same RRV showing the actual RGS controls. These are completely different to those shown in the Operating Manual held in the vehicle.

Several other RRVs had operating manuals on board that were the original equipment manufacturer's manual for the pre-retrofit road vehicle and which, therefore, contained no information on the retrofitted RGS.

2.3.2 Ambiguous visual information

One type of RRV featured a number of stickers at the top of the windscreen. One of these was a conspicuous "Warning" sticker with the following instruction (see Figure 37 – 38):

> *"Please consult fitting instructions manual, prior to adjusting brake proportioning valve (brake bias) to ensure correct braking performance."*

Reference to ensuring "correct braking performance" indicates this is a safety-critical function. However:

- the vehicle did not contain a "*Fitting Instructions Manual*",
- the personnel on site did not know what a "*brake proportioning valve*" was, and
- given that the sign was emplaced directly in front of the driver, it was unclear whether this is something that should be done by the vehicle driver / operator on each trip or, alternatively, something done either during initial installation or during periodic maintenance.

In summary, the use of a red, visually compelling "Warning" sign is confusing and ineffective if there is no immediately available information about its meaning.

Figure 37. Numerous information stickers placed at the top of the RRV windscreen.

Figure 38. Close up of the "brake proportioning valve" warning sticker.

3 Conclusions

The following comments are made in the context of the *Rail Safety National Law (RSNL) Regulation (Schedule 1, Section 17)* which requires:

- *procedures to ensure that Human Factors matters are taken into account during the development, operation and maintenance of the safety management system, and*
- *the integration of Human Factors principles and knowledge into all relevant aspects of operational and business systems.*

The RRV Human Factors observations and analyses set out in this report indicate a number of deficiencies in two major categories:

- The designs and installations of the physical retrofits have, in many instances, failed to incorporate well-established Human Factors / Ergonomics principles and knowledge, particularly those related to control and display design, layout, installation and usability.
- The design, delivery and management of information relevant to safe, effective and error-free operation has been deficient in several respects. Several safety-critical issues, including those related to on-rail procedures (e.g., steering; braking), and vehicle documentation (including on-rail safety procedures; RGS operation; warnings; etc.) are either not covered or are poorly (and inconsistently) communicated.

From these Human Factors (HF) observations, a number of specific HF related design issues, risks and potential controls can be identified. These are set out in the table at Appendix 1.

There are a number of current sources of HF information available which specifically address

risk management and design guidance for RRV operations. These include:

- AS 7533.4: 2013 Australian Railway Rollingstock – Driving Cabs – Infrastructure Maintenance.
- AS 7502: 2016 Road Rail Vehicles
- ONRSR (2016) Guideline: Road/Rail Vehicle Management & Operations

In addition, more general equipment design and safety management standards which address Human Factors and Ergonomics include:

- AS 4024 (Series): 2014 Safety of Machinery
- AS 4292.1: 2006 Railway safety management. Part 1: General requirements.

Rail transport operators are strongly encouraged to familiarise themselves with the Rail Safety National Law in respect to human factors integration using these standards and guideline.

Appendix 1 Table of design issues, risks and observations

Design issue	Risk	Comments / Controls / Observations
Sub-optimal or inconsistent design	Inconsistencies in the location, method of operation, or display of essential (safety-critical) functions can present a number of potential error-related conditions to a driver, resulting in, for example: > Inadvertent operation of the wrong control (e.g., causing a "start" instead of a "stop" function, or vice versa) > Incorrect operation of the correct control (e.g., moving a switch or lever in the wrong direction) > Delay in locating and activating a control when under time pressure (e.g., in an emergency situation such as a roll-away) > Failure to recognise or differentiate between correct and incorrect status of the RGS (due, for example, to inconsistency or ambiguity in how status is indicated on the RGS in-cab equipment) Specific examples observed include: > **Mode error:** If the RRV operator operates the equipment believing it to be in the correct mode (when it is not), this holds potential for derailment or unexpected / uncontrolled movement and, depending on the surroundings, possibly collision. > **Poor control-response compatibility:** This refers to a confusing or ambiguous relationship between the orientation and operation of a control and the expected movement or response of the equipment, leading to an error in the operation of the control. The equipment. [e.g., a 2-position switch with a horizontal (left-right) orientation used to operate a front-rear or up-down function, both of which are more visually compatible with a vertical (up-down) switch orientation.] > **Changing vehicles:** The above risks may be considerably exacerbated in circumstances where the Track Vehicle Operator (RRV OPERATOR) is required to change from one RRV to another during the course of operations and finds controls and displays in different locations and / or operating or displaying differently.	It is acknowledged that there are some limitations on precisely where additional (retro-fit) equipment can be placed due to the pre-existing layouts in the original road vehicles which, themselves, vary widely in design. However, there remain ample opportunities to provide a degree of standardisation in both design and placement of RGS and related safety-critical equipment that would minimise, if not entirely eliminate, the potential for the types of driver errors described here. In terms of the RGS in-cab equipment itself, there do not appear to be any constraints on adopting a consistent approach to its structural and functional design. Although there are many sources of Human Factors guidelines on the design of controls and displays, benefit is likely to be gained if guidance relevant to rolling stock (and specifically RRVs) were incorporated in relevant standards and / or guidelines such as AS 7533.4, AS 7502 and pending RISSB RRV Guideline. By way of example, some actions directly implied from the observations in this report might include: > Orient switches or controls, and their associated indicators, to be visually compatible with the expected direction of equipment response.

Design issue	Risk	Comments / Controls / Observations
	> **Internal Emergency Stop:** An important example of the above is seen in the location of Emergency Stop Buttons (ESBs). Some RRVs had these in a prominent location in front and slightly to the right of the driver, close to the driver's primary visual field. However, on other RRVs, these were distributed in a number of alternative locations, including out of sight of the driver when in the normal driving position. There is an obvious risk associated with any delay in locating the ESB in an emergency situation. > **Parking brake:** Similarly, the parking brake on most RRVs was located well outside the RRV OPERATOR's visual field. When under time pressure, work demands, or other constraints, errors of omission (e.g., *forgetting to activate park brake*) are significantly more likely if conspicuous cues are not present in the driver's operating visual field. A number of roll-away incidents have been associated with a failure to set the park brake. > **External Emergency Stop:** Some externally mounted ESBs were positioned such that a user would have to reach across the moving treads of an excavator to operate it.	> Ensure adequate clearance (and other design features as necessary) are incorporated to eliminate the potential for inadvertent activation of any safety-critical control. > Design and locate safety-critical functions to ensure both visibility and conspicuity for the operator. > Where feasible, incorporate interlocking to effect safety-critical functions rather than relying on the operator's memory. > Locate safety-critical functions in the same or closely similar locations in all vehicle cabs; e.g., ESB located within, and at the right side of, the driver's operating visual field in every vehicle. > Determine (through industry analysis) appropriate and safe locations for external ESBs and install these in that location on every vehicle.
Poor display/control identification	Many of the in-cab displays and controls featured ambiguous or non-existent labelling. As well as being an independent problem, this also exacerbates the problem of poor control-response compatibility, especially for RRV Operators who change from one vehicle to another. In some cases, temporary labelling (dymo-tape) was used, leading to the potential for these to fall off over time.	Ensure controls and displays have conspicuous, unambiguous and permanently affixed labelling related to their operation. Adequate inspection and maintenance regimes should include control installation, labelling, etc. in their scope.

Design issue	Risk	Comments / Controls / Recommendations
Poor installation	An example of poor design, installation or maintenance of in-cab equipment was observed where screws to affix an RGS panel were missing and, in another instance were projecting sharp-edged screw heads presenting a laceration risk to the driver. > If a RRV Operator slices open the tip of a finger while engaged in controlling the vehicle or operating its equipment, this could cause the operator to suddenly react and consequently, be distracted from the task-at-hand, either of which could result in unsafe movement of equipment or vehicle. > Poor manufacturing, installation or maintenance standards may be indicative of a failure to give due consideration to safe and effective design and functioning of RGS units and may be symptomatic of more serious unrevealed design flaws.	Design and / or procurement criteria for any equipment should address aspects of installation such as described here. Adequate inspection and maintenance regimes should also include the in-cab RGS in their scope.
In-cab display visibility	The incorporation of any in-cab visual indicators, including display screens, gauges and indicator lamps, present potential for the following risks: > Bright daytime working conditions may result in significant on-screen reflections or glare which can compromise the ability of the driver to see the on-screen information or notice any unsafe condition being indicated. > Bright ambient illumination may obscure the lit or unlit status of coloured and often dimly-illuminated indicator lamps which, in turn, may compromise the ability of the driver to determine the equipment status. > By contrast, if the luminance of in-cab displays or indicators is made too bright (which is sometimes done to address the above-described risks), it can adversely affect a driver's night vision if the vehicle is also used for night work.	Proposed or existing retro-fit installations of RGS equipment should be subject to analyses to determine optimum solutions for displays and indicators. Design mitigation features could include (but are not necessarily limited to) the following: > Adjustable mountings to allow orientation adjustments > Use of shrouds > Location in shielded locations within cab > Adjustable luminance (where applicable) for displays or indicators > Where an indicator conveys a safety-critical status, consider supplementing visual indicator with audible alert.

Design issue	Risk	Comments / Controls / Recommendations
Ineffective visual information and visual clutter	Placement of an excessive number of (apparently unused) signs / stickers over the driving cab windows presents an unnecessary level of visual clutter, much of it within or close to the driver's sightlines when operating the vehicle. These are unnecessarily distracting and, in some cases, potentially obscure a portion of their view of the vehicle surroundings, presenting the risk that a driver may not notice an impending collision (with persons or structures). Informal discussions suggest these notices are being displayed as an exercise by equipment suppliers to avert what they assume may be the potential for legal liability if, in the event of an incident, they appear to have failed to draw important information to the driver's attention.	A more effective and efficient approach for the notices that manufacturers believe must be available to drivers would be for these to be incorporated into the Equipment or Operations Manuals where they could be readily found under the appropriate contents heading. Their content should also necessarily form part of the training and competency assessment for RRV operators. A task and needs analysis may assist in determining which are essential for display (and where).
Ineffective or inconsistent operating information	Conflicting instructions: In some instances, conflict between RRV operators' beliefs about on-rail steering and the instructions in operating manuals was identified. In one observed case, although a steering lock mechanism was available, it was not being used because the RRV operator believed it was necessary to enable some degree of steering. Improper use of steering while on-rail presents a clear derailment risk. It is not known whether this conflict has previously been identified by either operators or manufacturers through any task analysis or risk assessment, nor whether any analysis has been undertaken to resolve this discrepancy and determine which process represents optimum safety. No steering lock: In another case, where steering while on-rail is specifically proscribed in the operating manual, no mechanical facility was provided to prevent the potential for inadvertent (or erroneous) steering. This again presents a clear derailment risk.	**Re conflicting information:** Operators and / or manufacturers should examine the identified discrepancy between RRV Operators' beliefs and the instructions set out in the Operating Manuals about steering locks in order to determine an appropriate and safe approach. This should then be placed explicitly and conspicuously in Manuals, as well as in training and instructions for RRV Operators. Whether the findings will result in a universal recommendation or one that varies with the specific type of vehicle and / or work conditions should equally be made clear. Where it is identified that steering must not occur in rail mode, a steering lock function could be installed to prevent the potential for inadvertent or erroneous movement of the RRV's steering controls.

	Inconspicuous safety information: While some safety- critical information was highlighted conspicuously in the Operating Manual, the information related to steering was not. This presents a risk that this information is either missed, forgotten or misunderstood as not important for safety. Incorrect operating manuals in vehicles: In some cases, the Operating Manuals in the RRVs was for the OEM vehicle and contained no information about the RGS or working on rail. **Ambiguous (and therefore ineffective) warning:** In one observed case, a conspicuous warning sticker about an apparently safety-critical (braking) function was present. However, that function (*"brake proportioning valve")* was not known by personnel on site, nor was the manual relevant to it available in the vehicle.	In relation to documentation within vehicles, there are several reasonable expectations: As part of a sound safety management system, a vehicle (of any type, including RRVs) should contain such documentation as necessary to enable safe and effective operations. This usually includes, as a minimum, vehicle-specific operating manual, log book, pre-start inspection checklists, incident report forms, and any other necessary safety-related documentation. > Pre-start inspection checklists should clearly delineate between tests and inspections that should be performed prior to or after engaging rail mode. > Documentation should be specific to the vehicle in which it is held. Where the vehicle has been retro-fitted with additional functions (e.g., a RGS), the vehicle manuals should either be updated or additional operational documentation related to the extra functions should also be held in the vehicle. > Documentation should have been subject to review such that: ▪ the information it contains is both accurate and applicable to the vehicle; ▪ there is no conflict between information in the documents and that contained elsewhere (e.g., in procedures or SWM documents); ▪ the information (especially if safety-critical) is both conspicuous and made relevant to the applicable users (e.g., RRV operator; maintainer)