Transport safety alert

INDEPENDENT TRANSPORT SAFETY REGULATOR
Safe transport for NSW

21 March 2012 | TSA no. 39

Effective operation and management of hi-rail equipment

Road/Rail Vehicles are to have effective

a) systems for securing during transitioning between travel modes or stowage

b) braking capacity during rail movements, and

c) management of rail guidance equipment.

Background

In the past, manufacturers (including OEMs) and ancillary equipment suppliers have developed road rail vehicles (RRVs), essentially, in response to market opportunities. Furthermore, Rail Infrastructure Managers (RIMs) have provided only minimal input into the management of the different stages of an RRV's life cycle starting from defining the concept design requirements through to the decommissioning process. As a result, there has been a proliferation of different types of rail plant and in some cases, this has been compounded by modifications to the RRVs, that may not have been optimised for the tasks intended to be carried out, or specified to a level that would have ensured an acceptable degree of safety.

A number of recent RRV incidents have resulted in either runaways and/or derailments due to the loss of braking capacity, the application of an insufficient braking force or the failure of the rail guidance equipment. In addition to issues concerning the inadequacy of the training and competency assessment process for RRV operators, these incidents have also highlighted the following safety concerns (grouped by category), namely:

- absence of sufficient braking force (whilst transitioning or during stowage)
  - hydraulically operated spring park brakes (or handbrakes) may lose their braking capacity as a result of blockages in the hydraulic system (due to the ingress of debris, particularly when changing attachments);
  - hydraulically driven motors may exhibit sufficient oil leakage to allow the pistons to retract and the motors to then free wheel;
  - RRVs that (through modification or otherwise) incorporate an inappropriate wiring (electrical) arrangement, may, negate any traction interlocking function and allow the vehicle to free wheel whilst transitioning between travel modes; and
  - RRVs in which the hi-rail wheels are driven and braked by friction forces transmitted through the road (rubber) tyres, such as via hub extensions to the rail wheels, have

experienced unintended movement on rail when transitioning between road and rail modes due to the application of an insufficient braking force.

- loss of braking capacity (during rail movements)
  - RRVs have had insufficient adhesion to provide adequate braking capacity for the load being hauled and for the ambient/rail conditions at the time.
- rail guidance equipment
  - rail guidance equipment such as stub axles and splined shafts have failed through fatigue due to a number of factors such as poor design, inadequate adjustment, inspection or maintenance practices or excessive or irregular load cycles; and
  - rail guidance equipment is retrofitted from one vehicle to a number of RRVs (over time) without taking into account the fatigue life of the hi-rail equipment nor its suitability for fitment to such vehicle types in the first place.

Further, there has been a pattern of such events occurring over the last few years. Examples (by category) are:

- absence of sufficient braking force (whilst transitioning or during stowage)
  - the operator of a 5.6 tonne hi-rail equipped Pettibone crane near Hawkesbury River was in the process of simultaneously disengaging the hi-rail wheels (ie. both front and rear) when the machine started to roll forward downhill. The engine stalled and the operator was unable to either re-start the engine or apply the brakes. The vehicle travelled approximately 2.7 km and reached a maximum speed of 60km/h before stopping.
  - a 7 tonne hi-rail Kobelco hydraulic excavator that had only just been parked on the Richmond Line began to move and was finally brought to rest approximately 100m from its initial location after an operator had boarded the RRV and applied the brake.
  - during off-tracking, the operator of a hi-rail 9 tonne Manitou high lift access vehicle at Mount Kuring-gai had disengaged one wheelset just prior to repeating the process for the remaining wheelset when the unit moved approximately 6m; and
  - a runaway hi-rail friction drive JCB tractor that struck and fatally injured a rail worker on the Perth City Link late last year.
- loss of braking capacity (during rail movements)
  - a Colmar high-ride excavator hauling a loaded (and unbraked) trailer at Glen Garry (Scotland) on a descending contaminated rail surface during inclement weather experienced insufficient adhesion at its braked wheels to stop on the grade.
- rail guidance equipment
  - a 24 tonne hi-rail Isuzu tipping truck derailed at Baal Bone as a result of a failed right hand stub axle. Subsequent metallurgical analysis revealed that the left hand stub axle, although still intact, had several very significant fractures.

- in early 2009, two 3 tonne hi-rail Land Cruisers derailed on consecutive days whilst travelling between Ivanhoe and Parkes. On both occasions, the flexitore splined shafts on the front hi-rail gear had suffered fatigue failure.

Actions

Rail infrastructure managers, rolling stock operators, designers, constructors, certifiers and maintainers shall therefore reassess as soon as reasonably practicable:

1. The coverage of these matters in their standards, operating practices, risk registers, asset management systems and other relevant documentation.
2. The appropriateness and effectiveness of existing risk controls (such as handbrakes and traction interlocking systems) to meet their intended purpose, ensuring that they are designed and maintained so that the RRV will remain stable and stationary on any grade (or track elevation) for an indefinite period under all foreseeable conditions.
3. The need for redundancy in risk controls including the fitment of a braking system (independent of the road wheels) to the rail wheels (of friction drive machines), the implementation of load-proportioning/monitoring systems, the use of chocks and/or the grounding of jib arm and attachments and crawler tracks as anchoring devices.
4. The training, competency and assessment of track vehicle operators and maintenance and inspection personnel and the currency of such competences. This should also include the adequacy of suitable training, competency assessment and instructions for transitioning between road and rail modes, including the requirements for ensuring that RRVs are adequately secured on varying gradients and stable on elevated track.
5. The maintenance and inspection procedures that manage a) the possibility of defective or poorly designed or maintained hi-rail gear, handbrakes and/or traction interlocking systems and b) the integrity and functionality of hydraulic and electrical/software systems and/or other control measures.
6. The adequacy of processes for monitoring compliance with the relevant on-track preventative maintenance instructions and procedures.
7. The ability of a suitably competent person to properly review the documents (listed below) and other related publications to extract and benefit from lessons learned from such incidents and publications.

Related documents

Rail infrastructure managers, rolling stock operators, designers, constructors, certifiers and maintainers should note the following related documents (by category):

- rail guidance equipment
  - MetallTech Report M2011-21_1 (Baal Bone incident) RailCorp Rolling Stock Technical Note RTN 08 Stub Axle Crack Tests for Road - Rail Vehicles
  - RailCorp Rolling Stock Technical Note RTN 009 Road Rail Suspension – Flexitors
- absence of sufficient braking force (whilst transitioning or during stowage)
  - RailCorp Rolling Stock Technical Note RTN 012 Safety Alert - Rail Road Vehicles with Hydraulic Drive Motors and Park Brake Systems
  - RailCorp Rolling Stock Technical Note RTN 013 Safety Alert - Road Rail Vehicle Runaway Conditions When Raising and Lowering on Rail

- RailCorp Rolling Stock Technical Note RTN 014 Safety Alert – Road Rail Vehicles Utilising Friction Drive Runaway Potentials – Suspended from Operations
- Runaway and collision of a road-rail vehicle near Raigmore, Inverness

  (http://www.raib.gov.uk/cms resources.cfm?file=/110711 R102011 Raigmore.pdf)
- Road-rail vehicle runaway incidents at Brentwood, Essex and at Birmingham Snow Hill

  (http://www.raib.gov.uk/cms resources.cfm?file=/090527 R112009 Brentwood.pdf)
- Safety Alert Notice No. RSN 2011-01 Braking Systems of Hi-rail Vehicles Department of Western Australia

- loss of braking capacity (during rail movements)
  - Investigation into runaways of road-rail vehicles and their trailers on Network Rail

    (http://www.raib.gov.uk/cms resources.cfm?file=/091029 R272009 RRV.pdf)
  - Runaway of a road-rail vehicle at Glen Garry

    (http://www.raib.gov.uk/cms resources.cfm?file=/090225 R052009 Glen Garry.pdf)

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