

Hi-Rail – a John Holland Perspective

Road/rail vehicle workshop – 30 October 2012

Michael Rogers

Hi – rail plant



- > What is hi-rail?
- Vehicles which have the capability to operate on wheels / tracks, or rail wheels
 - Three basic types
 - > Rail guidance system
 - > Friction drive
 - Self-propelled
 - Can be constructed by an OEM as an integral part of plant
 - > Often a 'conversion' of an existing machine
 - Hi-rail gear often copied or transferred from one application to another

Rail guidance system





Friction drive





Self-propelled







 We have no national approach to capturing incidents – which hampers effective and consistent learning.

- Some common occurrences
 - > Runaway or uncontrolled movement during on / off tracking.
 - > Runaway due of loss of braking whilst parked / stabled on rail.
 - > Runaway due to adverse grade or rail head conditions.
 - > Failure of mechanical / structural components.



- > No Australian standard currently in place for hi-rail.
- No life cycle approach, only requirements are interface requirements imposed by network managers – leaving a considerable gap with respect to design verification and validation.
- > Lack of RIM consistency with respect to interface requirements.
- A lack of guidance and consistent requirements for manufacturers and owners alike.
- Hi-rail suppliers have responded to a market where requirements are not defined, leading to a wide range of hi-rail designs and installations with varying degrees of engineering integrity.

What is John Holland doing?



- > Wholesale review of our approach to the engineering of our plant and rolling stock.
- Revised approach to the management of change and modification, targeting improvements in verification and validation of change.
- Greater emphasis upon technical approval within the capital expenditure application process.
- Use of a risk based approach to develop minimum requirements for control, braking, interlocking and annunciation elements of hi-rail equipment across our projects.

Minimum hi-rail requirements





Engineering control requirements



	HI-RAIL SYSTEM CONFIGURATION			
CONTROL CATEGORY	FRICTION DRIVE	RAIL GUIDANCE SYSTEM	SELF PROPELLED	
	F1.1) Control System to prevent deployment or retraction of one end of hi-rail system if other end not fully deployed or retracted.	R1.1) Hi-rail deployment system to have secondary locking when deployed where locking is not achieved through an over-centre design. If the secondary locking system is hydraulic it must comprise check valve / anti-burst components to prevent unplanned movement of hi-rail equipment.	S1.1) Control system to prevent rail drive system from engaging until hi- rail system fully deployed.	
1. INTERLOCK & CONTROLS	F1.2) Independent hi-rail control levers/buttons/switches cannot be operated simultaneously.		S1.2) Hi-rail system to include locking system when deployed. If this locking system is hydraulic it must comprise check valve / anti-burst components to prevent unplanned movement of hi-rail equipment.	
	F1.4) Tyre-hub interface to have secondary locking when deployed to ensure sufficient traction and braking is maintained at all times where locking is not achieved through an over-centre condition. Any such system must comprise check valve / anti-burst components to prevent unplanned movement of hi- rail equipment.			
	Procedure of emergency off-tracking/recovery system (where fitted) to eliminate potential for free wheeling			
	All hi-rail control levers/buttons/switches which are used to retract/deploy hi-rail system to be dual input ('missile switch') design, i.e.requires two actions to operate to eliminate potential for unintended operation. All hi-rail controls and their positions must be clearly labelled, easily identified and visible from the operating position.			

Engineering control requirements cont'd



	HI-RAIL SYSTEM CONFIGURATION		
CONTROL CATEGORY	FRICTION DRIVE	RAIL GUIDANCE SYSTEM	SELF PROPELLED
2. SERVICE BRAKES	F2.1) Braking system (road wheels) to be fail-safe configuration	ALL WHEELS ON RAIL	S2.1) Drive system to incorporate integral service brake, or have additional braking on driven axle
	F2.2) Braking performance on rail to be maintained where tyres are deflated/punctured.	R2.1) Brakes on minimum two rail wheels if base vehicle brakes not fail safe, or dual circuit.	S2.2) Braking system (rail wheels) to be fail-safe
	F2.3) Independent fail-safe braking system fitted to minimum two rail wheels (equiv. one axle)	F2.2) Braking performance on rail to be maintained where tyres are deflated/punctured.	S2.3) All rail wheels to be braked
		FRONT ELEVATED	
		R2.2) Service brakes on minimum two rail wheels (elevated end)	
		F2.2) Braking performance on rail to be maintained where tyres are deflated/punctured.	

Engineering control requirements cont'd



	HI-RAIL SYSTEM CONFIGURATION		
CONTROL CATEGORY	FRICTION DRIVE	RAIL GUIDANCE SYSTEM	SELF PROPELLED
3. PARK BRAKES	F3.1) Fail-safe park brake fitted to minimum two rail wheels (equiv. one axle). Where the road wheel parking brake only applies at one end of the base vehicle, the rail wheel park brake shall as a minimum apply to the opposite end. Park brake must hold GVM on 1 in 30 grade indefinitely. Performance to be supported by calculation.	ALL WHEELS ON RAIL	S3.1) Fail-safe park brake fitted to minimum two rail wheels (equiv. one axle). Park brake must hold GVM on 1 in 30 grade indefinitely. Performance to be supported by calculation.
	F3.2) Base vehicle park brake to be fail-safe	R3.1) Park brake applied to minimum two rail wheels (where the vehicle is not automatic transmission or fitted with fail-safe park brake). Park brake must hold GVM on 1 in 30 grade indefinitely. Performance to be supported by calculation.	
		FRONT ELEVATED	
		R3.2) Fail-safe park brake applied to minimum two rail wheels. Park brake must hold GVM on 1 in 30 grade indefinitely. Performance to be supported by calculation.	

Engineering control requirements cont'd



	HI-RAIL SYSTEM CONFIGURATION				
CONTROL CATEGORY	FRICTION DRIVE	RAIL GUIDANCE SYSTEM	SELF PROPELLED		
3. ANNUNCIATION	3.1) Annunciation to notify operator of hi-rail position. RECTRACTED / DEPLOYED / TRANSITION. 3.2) Annunciation in the form of LED lights or operation screen (touch screen). 3.3) LED Lights in flash mode at all times during TRANSITION.				
4. OTHER	 4.1) Driver Safety System (Vigilance Controls) must be installed where kinetic energy exceeds limit (600 kN/m) in accordance with RailCorp ESR0001-D 4.2) Closed section operation only where kinetic energy exceeds limit and no Driver Safety System installed. 4.3) All network specific requirements met prior to operation. 				

Current difficulties we face.

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- > Obtaining verification and validation of engineering integrity.
- Finding 'home-grown' suppliers who design and build to specified standards.
- > Obtaining information from OEMs when modifying equipment.
- Industry stance clients and subcontractors not seeing the issues as being industry issues.
- > Industry capability to meet higher standards in the short to medium term.

Where to next?



- Review and development of our plant and rolling stock management procedures, processes and systems to ensure effective management of assets throughout the life cycle.
- > A national database of incidents, allowing us all to learn and avoid repeat.
- An Australian standard for hi-rail vehicles which is applied consistently across states and territories.
- > Explicit and tangible client and industry support for initiatives to improve safety performance.