

Level Crossing Safety Interventions Register ADDITIONAL MATERIAL BELOW			Active, passive or both	Urban or regional or both	Pedestrian, car, truck, all, etc	H (>\$500k) M (>\$100k & <\$500k) L (<\$100k) N/A			
Title	Supporting material (online)	Known locations	Crossing type	Known applications	Targeted user interaction	Cost (per site)	Known evaluation	Date entered	Last updated
Advanced warning lights/signs + in-pavement strobes		South Australia	active	existing	all MV	M	Active Advanced Warnings Signs (AAWS) installed at seven locations in South Australia.		12/05/2019
Wayside horns	reference material	US	both	both	all	M	Whistle boards have been removed from the Adelaide Metropolitan Passenger Rail Network due to concerns about complacency and in preference to horn being sounded only when needed. ADDITIONAL MATERIAL BELOW		12/05/2019
LX obstruction - inductive loop	reference material	US	active	both	all MV	L	ADDITIONAL MATERIAL BELOW		
LX obstruction - laser, RADAR, etc	reference material	UK	active	both	all MV	H	ADDITIONAL MATERIAL BELOW		
Passive to active - alt tech		existing	passive	regional	all MV	L			
Second train coming		US, South Australia	active	both	pedestrian	L	Another Train Coming visual sign trialled in Victoria, at Centre Rd, Bentleigh circa 2008. Trial concluded limited effectiveness, with violations still occurring. Fitment of Emergency Exit Gate Latches provides a greater risk reduction and negates the need for these signs. Source: Bentleigh Final Report, Version 1.9, 9 April 2010, VicTrack. Now in use in South Australia on the Adelaide Metro Passenger Rail Network.		12/05/2019
Gated & signalled farm crossing (Network Rail design)		UK	active	regional	all	H			
LX cameras	https://www.acri.net.au/vysionics-vectorlx-system-evaluation/	existing	both	both	all	M	Victoria had enforcement cameras installed at one crossing (Midland Hwy, Bagshot) enforcing red light and speed offences and was working towards wider roll out and investigating options for enforcing queuing across level crossings. ACRI Projects LC01/B evaluated effectiveness of Vysionics enforcement cameras at complex road/rail intersections. Red light and speed cameras installed at multiple locations in South Australia.		12/05/2019
Road & rail signal interlocking to prevent queuing		existing	active	both	all MV	M	Traffic Light Coordination is implemented in Victoria where a traffic light controlled junction results in queuing across the crossing, or at the crossing, to ensure the signals provide a consistent message to the road user. KiwiRail has developed a standard in conjunction with NZ road engineers to define the level crossing / traffic light interface. Queue relocation used in South Australia.		13/05/2019
Interfacing adjacent traffic signals with active level crossing controls through wireless technology.		South Australia	active	both	all MV	M	Current trial of LIDAR system in South Australia.		15/05/2019
Additional cross arms added to existing posts and wired directly into existing signalling equipment.		N/A	active	both	all MV	M			
Automatic reset and 'charge-fail' remote monitoring functionality reduces crossing closures caused by vandals tampering with boom barriers.		N/A	active	both	all	L			
Solar/LED/strobes to illuminate pedestrian crossing paths/road traffic lanes at road crossings.	https://www.acri.net.au/lc18-evaluating-level-crossing-visual-warning-devices-for-pedestrians-using-eye-tracking/	Trial at some sites in NZ network	both	urban	pedestrian	L	Current ACRI Project LC18 has completed investigating the pedestrian element. Key findings include positive effects of in-ground LEDs at passive level crossings with a maze for attracting attention, checking for trains and attitudes. Distracted pedestrians scanning performance similar to non-distracted pedestrians with the LEDs. Longer term evaluation and further understanding of non-compliant pedestrians recommended. Also trialled in NSW at pedestrian road crossings by TfNSW Centre for Road Safety.		4/04/2019
Surface markings applied to level crossings to clearly delineate the crossing boundaries for pedestrians.		N/A	both	both	pedestrian	L			
Redesigning intersection length for the elimination of short stacking and queuing problems.		N/A	both	both	all MV	H	Victoria: Considered in the design of new road layouts, difficult to achieve in brown fields locations. Specific signage installed at some locations, providing the length of the holding space prior to crossing, to ensure motorists able to make informed decision.		
Over-height detectors installed at level crossings alerts heavy vehicles to overhead powerlines.		KR use this at some locations in Auckland	both	both	all MV	M			

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UHF radio communication - voice message across UHF channel 40 to heavy haulage users that the crossing is activated.		FMG Pilbara	active	both	truck	L	Victoria trialled a similar concept (PIXIE) in 2012. Outcome was to not progress to implementation as the system provides warnings to road users that may not be crossing the level crossings, which reduces the effectiveness of the warning and provides a nuisance factor. In use by FMG in Pilbara on approach to one particular public active level crossing.		
Re-positioning signs - to display level crossing warning signs earlier to motorists.		N/A	both	both	all MV	VL			
Active signs for passive crossings - warns drivers they are approaching a passive level crossing;	https://www.acri.net.au/active-expect-trains-sign-trial/	N/A	passive	both	all	VL	ACRI Project LC16 - Active Expect Train signs. Trial (1) evaluated with ACRI involved 'Expect Trains' warning. Trial (2) is in conjunction with NZTA with message 'Stop Ahead'.		4/04/2019
Advance flashing light signals to warn drivers they are approaching a level crossing.		existing	both	both	all MV	M	Active Advanced Warnings Signs (AAWS) installed on all highways in Victoria with a speed limit >60km/h, completed in ~2008. Also now at use at some locations in NZ		
Active passive roadside signage system 'APRSS' - an autonomous system that is wirelessly controlled with solar power and provides active advanced warnings.		N/A				N/A			
Lockable pedestrian gates at level crossings using an electromagnetic locking system linked to signalling systems.		existing	active	both	pedestrian	M	Victoria: Emergency Exit Gate Latches (EEGL) trialled in 2008 now part of standard equipment for upgrades and a retrofit program underway. Predominately using electromagnetic gate leatches, some locations mechanical gate latches. AS1742.7 requires a mechanism to be installed to prevent misuse of the emergency exit gate latches. Also now standard for installations in NZ and in use in South Australia. EEGL is not always effective, when pedestrian crossing is adjacent to a roadway, as violations may continue to occur using the roadway to cross the line.		15/05/2019
Manual deactivation of level crossing through wireless remote technology when loading or unloading long distance trains.		N/A							
Passive crossing sighting improvements - combination of warning signs for particular hazards, trial of mirrors to improve sighting for heavy vehicle drivers at acute angled crossings and reduced road speeds where sighting is poor.		N/A				L	Initial mirror trial undertaken in Victoria 2017. Further work underway to quantify benefits and application scenarios.		
Pixie- provides an audible warning to drivers of an approaching train at level crossings, utilising in-vehicle audio systems.		N/A	both	regional	truck	M	Victoria trialled this in 2012. Outcome was to not progress to implementation as the system provides warnings to road users that may not be crossing the level crossing, which reduces the effectiveness of the warning and provides a nuisance factor.		
Stage Door - a double sided overhead gantry that incorporates current safety measures and warning messages when a train is approaching.	reference material	N/A	active	both	all	H	ADDITIONAL MATERIAL BELOW		
"New signage system revolutionises level crossings" (to regulate the speed of heavy vehicles on the approach to active crossings)	reference material	LXF	active	both	b-double	M	ADDITIONAL MATERIAL BELOW		
Traffic Signal Modification - Providing train direction information to traffic light controller to improve congestion around level crossings where parallel roads exist.		Victorian Trial	active	urban	all MV	L	Victoria: Trial site selected implementation of trial late 2018.		
Pedestrian Crossing Gap Fillers - Reduce risks associated with the flange gap	https://www.acri.net.au/lc15-identifying-and-testing-products-that-eliminate-the-need-for-level-crossing-rail-flange-gaps/		both	both	pedestrian	L	ACRI Project LC15 Victoria has included this in the Victorian Railway Crossing Safety Strategy Action Plan. ACRI Project LC15B field trials and whole of life costing assessment, proposal currently under review.		4/04/2019

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Retro-reflective screens -Passive solution for improved conspicuity of tabletop carriages at level crossings at night	https://www.acri.net.au/lc11b-evaluating-retro-reflective-screens-to-aid-conspicuity-of-tabletop-carriages-at-passive-level-crossings/		both	both	all MV	L	ACRI Project LC11 ARTC pilot trials at crossings in South Australia as part of LC11B project. Lab experiments to confirm effectiveness now underway. Preliminary findings promising.	4/04/2019	
Identifying improved stimuli for road user attention at level crossings	https://www.acri.net.au/lc13b-identifying-improved-stimuli-for-road-user-attention-at-level-crossings/			both	all MV	L	ACRI Project LC13B found improved visual stimuli from the flashing lights of a range of larger size and faster flash rate patterns. ACRI Project LC13C currently under proposal review for further field trials and simulations including inattentive blindness effectiveness where possible.	4/04/2019	
Extended warning for long vehicles at short stacked intersections		Telephone Road, East Coast Main Trunk Line, NZ	both	both	truck	M	Length detection of approaching vehicles to trigger early start of level crossing alarms if a long vehicle is detected and a train is also approaching	17/04/2019	
Rail Active Crossing System (RAXS)						N/A	Aurizon currently planning for trial of low cost RAXS which includes no dependency on mains power; flexible modular unit; no trackside trenching/cabling; and real time monitoring and intelligent reporting. Currently subject to costing, site decisions and supporting documentation for funding.	13/05/2019	
HIMA Safety Controllers	https://www.hima.com/en/industries-solutions/rail					N/A	Aurizon currently investigating possibility though no trial planned at this stage	13/05/2019	
Rio Tinto Auto Haul network: presence detection		Rio Tinto Pilbara autonomous network			All	H	Automatic stopping of approaching train if any presence detected on level crossing	13/05/2019	
Convex mirrors on private passive crossings		FMG Pilbara	passive	Regional		L	Convex mirrors installed on private passive crossings in yard areas with more than one track to enable road users to see if an approaching train may be obscured by a train on an adjacent track.	13/05/2019	
Geofencing	https://www.teletracon.com.au/telematics-definitions/what-is-geofencing	FMG Pilbara			Truck	N/A	FMG has worked with major trucking companies in the Pilbara to provide control of approaching heavy vehicle speeds via geofencing	15/05/2019	
Oscillating ditch lights on locomotives		FMG Pilbara		Both	All	N/A	FMG trialling this on approach to public level crossings with the aim of offering road users greater ability to gauge the distance to an approaching train, especially at night.	3/06/2019	
Real-time level crossing information system for fire trucks		USA		Urban		N/A	Federal Railroad Administration working with a developer on system requirements for a in-vehicle notification to alert emergency vehicles when a level crossing is blocked and therefore blocking a route and delaying arrival at a scene.	3/06/2019	

Emerging Concepts	
<p>Idea: C-ITS level crossing warnings for the application of emerging road vehicle warning technology.</p>	<p>Victoria: Included in action plan for our strategy. Currently reviewing road industry activity to determine how and when to undertake activities. Trial undertaken in 2012 in collaboration between PTV (VRCSSC) and Latrobe University proofed the concept and the benefit of V2I communications for level crossings. Trial recommended awaiting the road industry progressing C-ITS further, including the wider adoption of the technology.</p>
<p>Idea: Diamond Smart. A combination of road geometry that lowers angle of approach, an impact gate to deflect vehicles, and a slip road to capture diverted cars.</p>	
<p>Idea: Oracle - system connecting the train, infrastructure and the environment providing drivers' messages (via overhead gantrie screens) if their predicted crash risk is high.</p>	
<p>Valet - active LED light system integrated into the road on level crossing approach that reacts depending on activity in the level crossing environment.</p>	<p>Duplicate of Solar/LED/Strobes above.</p>
Blinky Bill	
Intelligent Roads	
iTrack Alert	
Break-in and Lock-out	
Wireless road-rail traffic light controller	
LED keep track clear signs	<p>Victoria investigated this in 2016 but was not trialled due to concerns with users 'gaming' the system, using it as an additional queue to know when to move onto/off the tracks rather than preventing stopping on tracks.</p>

Additional Materials

Stage Door

Innovation Begins: Level Crossing Safety

- Innovation concept started under QR Limited
- To generate insight which is open to *invention, absurdity, irrelevance, and new connections*
- Project focus on level crossing safety
- Five level crossing concepts developed



Setting new standards of excellence for safety, for a new-look Queensland Rail



Valet: Under construction - near Ingham, North Queensland

- Pilot site selected near Ingham, North Qld
- Construction to begin May/June 2011
- Remote monitoring system detects train movements and road traffic
- Embedded road lights similar to airport runway
- Effectiveness analysis to be completed post-installation



Setting new standards of excellence for safety, for a new-look Queensland Rail



Wayside Horns



<http://ctcinc.com/wp-content/uploads/2017/03/DataSheet-WaysideHorns-2017.pdf>

LX obstruction - inductive loop

[inductive loop 1.MP4](#)

[inductive loop 2.MP4](#)

LX obstruction - laser, RADAR, etc



new signage system revolutionalises level crossings

Idea Development

Idea Name	
Headline of idea	New signage system revolutionises level crossings
Summary of idea	
How it works	<ul style="list-style-type: none"> > Solar powered signage system that activates on train approach > Cost efficient upgrades for passive level crossings
Key features and functionality	<ul style="list-style-type: none"> > Save time > Save fuel > Save money > Save lives
Key benefits	<ul style="list-style-type: none"> > Active > Advanced warning > Active trackside warning > Solar powered > Environmentally friendly > Low cost > Currently 80% of 23,500 crossings (approx. 18,000) level crossings to benefit.
What needs to be done prior to the concept working (interdependencies, etc.)	<ul style="list-style-type: none"> > Type approval
Who needs to be involved	<ul style="list-style-type: none"> - Rail Authorities - Suppliers - Road managers - Standards authority
Short / mid / long term implementations	
High level next steps	<ul style="list-style-type: none"> > Sign face approval > Amendment to include in ALCAM
Remaining questions to be answered	

Idea Assessment

Ideas	How well does it overcome the key challenges for your character?	Is the idea new and intriguing?	Is the idea easy to implement?	Will the idea assist other level crossing players?	How big an impact will it have on improving safety?
1 Traffic Signal Interface Interfacing adjacent traffic signals with active level crossing controls	3	2	3	4	3
2 Public awareness campaigns Media exposure to highlight the safety risk associated with level crossings.	2	1	4	3	2
3 Enforcement options Liaising with Police to consider alternative law enforcement options for offences. Enforcement options to have higher penalties than standard traffic infringement notices, particularly when an offence results in a near miss or incident, where the lives of train crew and passengers are endangered.	2	1	4	3	3
4 Incident Reporting Use of incident reporting to identify and raise the risk profile	1	2	2	3	3
5 UHF Radio Communication Voice message across UHF channel 40 to heavy haulage users that the crossing is activated and that a train is approaching	5	4	4	4	3
6 Engagement with road owners to reinforce their accountability re signage, road markings, etc. Establishment of relationship with local council associations in particular.	2	2	2	3	3
7 Active Passive Roadside Signage System "APRSS" An active advanced warning system which is controlled wirelessly with solar power and is not dependent on external power or trackside cabling.	4	5	4	4	4
8 Laser high load detectors. The system alerts heavy vehicle drivers if they are likely to hit overhead powerlines.	4	4	5	3	4
9 Valet Active LED light system integrated into the road on level crossing approach, that react depending on activity at level crossing environment.	4	4	3	4	4
10 Stage Door A double sided overhead gantry that incorporates current safety measures and warning messages when a train is approaching	3	4	3	3	3