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BY:----------

United Group Rail
Technical Alliances and Product Development
Level 24, 1 Spring Street
Melbourne VIC 3000
Australia
Telephone: +61 3 9610 2658
Facsimile: +61 3 9610 2651

www.unitedgroupltd.com

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Road Safety Committee

UnitedGroup Rail

Road Safety Committee
Parliament House
Spring Street
East Melbourne
Vic 3002

5th October 2007

Dear Sir/Madam,

In response to your call for submissions for inquiry in improving safety at level crossings, please find attached a brief document explaining United Group Rail current level crossing protection systems and those in development.

We would be pleased to answer any questions you may have on these and other United Group Rail systems, and would welcome the opportunity to provide further information or product demonstrations upon request.

For further information please do not hesitate to contact me on the telephone number above or my mobile which is 0423 580 901.

Yours sincerely,

Mr Jim Watters

General Manager – Technical Alliances and Product Development
United Group Rail

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Authorisation Control

Version **1.01** of this document has been approved by the individuals shown in the table below.

Name	Department or Role	Signature	Date
Jim Watters	General Manager - Technical Alliances and Product Development		

Version **1.01** of this document has been endorsed by the individuals shown in the table below.

Name	Department or Role	Signature	Date

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0. EXECUTIVE SUMMARY

This paper outlines the current initiatives within United Group Rail Ltd (UGR) for the development of systems to reduce the level of risk and consequential seriousness of level crossing rail/road vehicle collision. Whilst the document does not fully detail the systems available, it intends to provide an introduction to existing and in-development UGR systems.

Further information on these systems is available on request from Mr Zachary Naylor (Product Development Manager – Asset Management Services) by telephone on (03) 9610 2652 or via email zachary.naylor@unitedgroupltd.com.

1. INTRODUCTION

1.1 PURPOSE

The purpose of this document is to:

- Detail level crossing protection systems that UGR could provide to improve the overall level of public safety at level crossings.
- Detail UGR remote condition monitoring systems that can improve the robustness of traditional level crossing protection systems and reduce the lifecycle costs of such systems.

1.2 BACKGROUND

A level crossing is a point at which the railway track intersects with a road and as such represents a risk where a train could collide with a road vehicle or pedestrian. In most urban areas and some suburban areas, level crossings usually offer protection against collisions through the use of physical barriers and/or warning systems that alert a road user that a train is approaching. Where such systems are in use, a train/road vehicle collision is usually due to road users either accidentally or intentionally driving through the level crossing when it is unsafe to do so. A collision often results in significant infrastructure and vehicle damage and may result in multiple fatalities to road or rail users.

1.3 THE SCOPE OF THE DOCUMENT

This document deals with traditional level crossing protection systems available from UGR, and also technologically advanced systems fully developed or currently in development by UGR.

2. THE PROBLEM EXPLAINED

On 18th July 2007, following a spate of high-profile and fatal road vehicle/train collisions, the Parliament of Victoria Road Safety Committee commenced an inquiry to investigate ways of improving safety at level crossings.

The goal of the inquiry is stated as:

> "That the Road Safety Committee inquire into and report by 29 February 2008 on existing, new and developing technologies for implementation to improve safety at level crossings."[1]

The closing date for submissions is 5th October 2007.

There are 3 key issues related to the mitigation of level crossing collisions:

1. One of the few places where road users can legitimately come into contact with a train is through level crossings. The most effective way of avoiding collisions is to physically separate roads from track, although in most cases this is not feasible due to the costs involved[2] and the need for trains to avoid gradients and tight curves wherever possible.
2. The design of the level crossing may be such that a road user may be unaware of the presence of a level crossing, or the crossing/road layout may amplify safety problems.
3. A road user may be willing to proceed across the level crossing even when a train is approaching.

Any proposed solution must address the issues above, or overcome one issue to such an extent that all issues have been mitigated to an acceptable level of risk.

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[1] John Eren, MP, Call for Submissions for inquire into Improving Safety at Level Crossings, 20 August 2007, Road Safety Committee, Victoria Parliament

[2] According to Victorian Government, a grade separation project for a single level crossing costs between $20 million and $100 million. "Building a Safer, more Secure Network", Action Ten, 2007. Available at http://www.doi.vic.gov.au/

3. FACTORS IN LEVEL CROSSING SAFETY

There are a number of factors which affect the safety of level crossings. Figure 1 shows the key factors identified during the review.

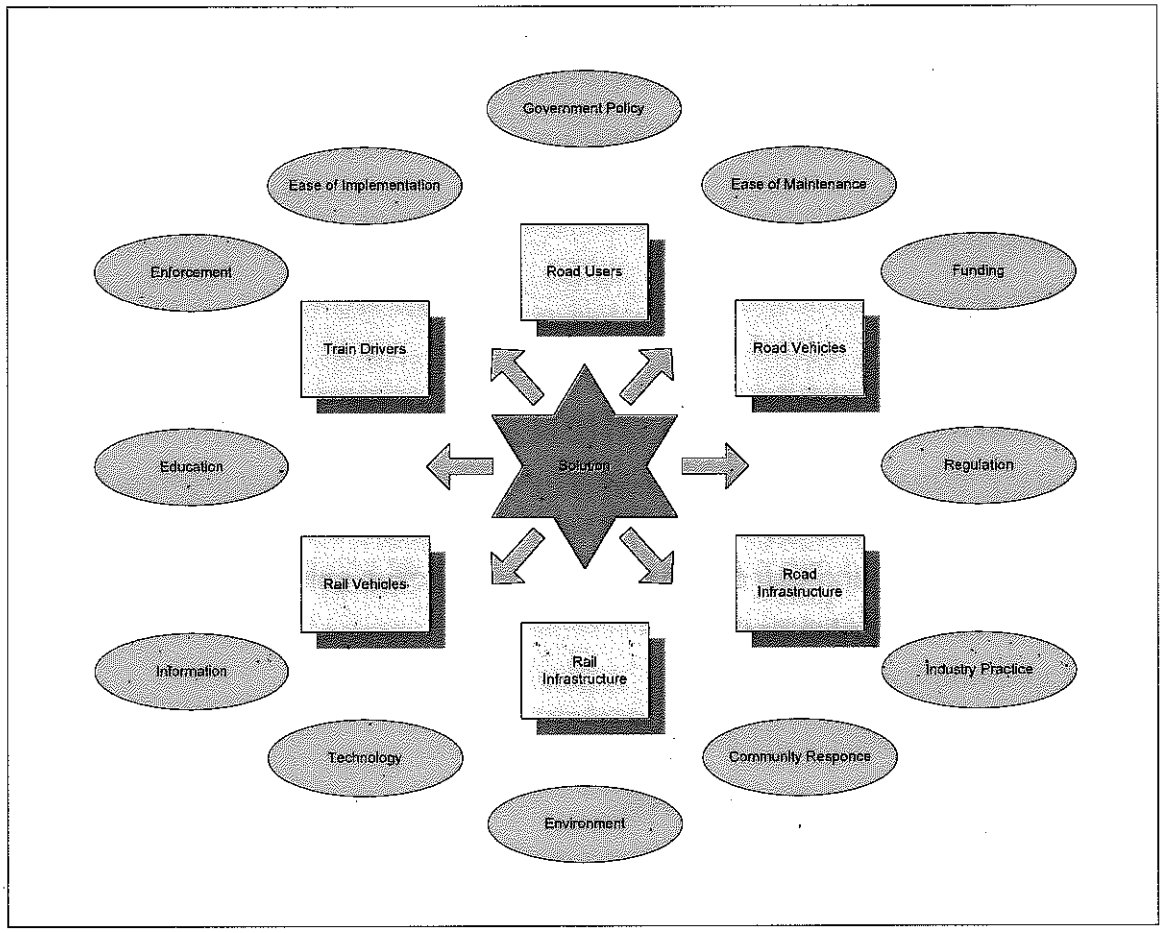

Figure 1 Components of Level Crossing Safety[3]

The Australian Transport Council (ATC) determine their strategy for level crossing safety as "to reduce the number, cost and trauma of crashes between trains and any other road users by the most cost-effective means"

[3] Adapted from a diagram in National Railway Level Crossing Safety Strategy, August 2003, Australian Transport Council

4. TRADITIONAL PASSIVE SOLUTIONS

Passive systems generally make little use of technology and do not require power supplies. They often rely on inexpensive means of reducing accident risk, although some options involve extensive civil engineering works such as the building of tunnels and bridges to physically separate the railway from the road.

UGR has experience in and can provide the following passive solutions:

- Level crossing approach road redesign
- Foliage removal
- Grade separation
- Rumble strips
- Warning signs

5. TRADITIONAL ACTIVE SOLUTIONS

A number of track-side systems are available off-the-shelf that provide differing levels of protection against collisions depending (usually) upon level of complexity and cost.

UGR has experience in and can provide the following active solutions:

- Signs, flashing lights and bells
- Half barriers, lights and bells
- Full barriers, lights and bells

6. MODERN ACTIVE SOLUTIONS

The advancement of technology within other industries has led to some systems which are well-suited to the rail environment.

6.1 LEVEL CROSSING OBSTRUCTION DETECTOR

UGR has a number of systems that detect the presence of an obstruction on the level crossing. These systems may interface with the existing track-side signalling system, and if needed, communicate directly with the train driver or even automatic train control systems that can apply brakes to slow down or stop the train. Such systems are especially useful for crossings where pedestrians may be at risk as they can provide extended protection for these types of users too.

6.2 CCTV SYSTEMS

Closed-circuit television monitoring systems are often installed at level crossings so that the signaller can monitor crossing activity and ensure crossing equipment is functioning safely and correctly. CCTV is used extensively in other industries including the monitoring of highway traffic, and the development of automatic number plate recognition (ANPR) technology has led to the extensive deployment of this technology around the world.

The use of ANPR enables CCTV monitoring of level crossings as required by the signaller, but also allows for the capture and, if needed, conviction of road users who contravene level crossing related law.

6.3 Variable Message Signs

United Group has extensive experience in electronic traffic management signs to dynamically change information displayed dependent upon the environment. United Group currently has nearly 2000 such signs in daily use across Australia to help traffic flows and protect the general public.

This technology is in use in a number of railways worldwide in applications as diverse as warning train drivers of high cross winds to train station information systems. The signs can dynamically display different information either transmitted from a control centre or by reacting to monitoring sensors on the ground or fitted to vehicles.

7. REMOTE CONDITION MONITORING (RCM) OF LEVEL CROSSINGS

Level crossing equipment must be highly reliable in order to ensure the safety of the road/rail system. A failure in such equipment could be disastrous and effective asset management is vital.

Routine inspections in level crossing (and other rail asset) equipment by engineers only go so far to ensuring reliability and the safety of the railway, and any deterioration of the condition of the asset between inspections may permit defects to persist for hours or days.

Many industries make use of remote condition monitoring technology and there has been huge investment in new technologies to make infrastructure 'intelligent'. The ability to automatically monitor asset condition remotely without human intervention, accurately predict future condition and arrange for maintenance to be undertaken before potential problems become a reality has obvious benefits to overall safety, efficiency, and reliability. Technology has been available off-the-shelf for some time that can be used to monitor the status and condition of level crossings and other railway infrastructure, and UGR has a portfolio of solutions in this sector, including advanced data management and analysis systems.

7.1 What Level Crossing Assets Can Be Monitored Remotely?

Practically all level crossing equipment can be monitored remotely. These include:

- Level crossing equipment activation
- Boom up/down
- Pedestrian gate open/close
- Road vehicle entry and exit to level crossing
- Pedestrian entry and exit to level crossing
- Points machine activation
- Presence-of-train detection
- Signalling systems
- CCTV
- Local road traffic lights

7.2 How is Information Displayed & Benefits to Business

The data collected can be retrieved and processed in real-time and displayed to end users using a variety of methods. Perhaps the most effective way of displaying rail and road asset information is via an intranet portal incorporating a geospatial information system (GIS) so that a user can relate the output against a map of the local area and easily compare against other data streams.

The GIS system would be based on internet technologies so that anyone with internet access (such as Government, train operating companies) could be given the ability to view the operation and condition of level crossing assets in real-time. The system could be linked to maintenance planning systems and asset registers so that an historic view of each asset can be provided along with all associated maintenance time and costs, spare parts usage and future planned works can be viewed and interrogated from the desktop.

Once a history has been gathered on asset condition, intelligent intervention levels can be set for maintenance and predictive algorithms used to accurately determine the future anticipated condition of those assets. This can be done in the background by computers, enabling resources to be used to ensure maintenance is done in the most effective manner to reduce overall costs whilst providing a step-change in performance, quality and efficiency.

8. IN-VEHICLE SYSTEMS

8.1 Recently Developed On-Train 'Vigilance' System

Vigilance systems are virtually standard equipment in passenger and freight items of rolling stock and protect the train by requiring a train driver to perform a simple task at the request of an on-board system, ensuring the driver is fully aware. UGR have recently developed a vigilance system integrated with GPS that not only ensures the driver is fully aware but brings his attention to upcoming future events for which he needs to be ready for. For example the vigilance system could bring the drivers attention to the presence of an upcoming level crossing or other safety risk.

This system has been fully developed and is due to commence service trials on 2 V-Line trains in November 2007.

8.2 Headlights, Ditch Lights and Side Marker Lights

In some jurisdictions the permanent use of headlights is required to assist in train awareness from the front. Ditch lights and side marker lights are intended to increase train awareness from the side. The application of ditch lights to new locomotives is part of a new Australian standard but is not specified as a retrofit as yet. Side marker lights on freight trains would generally require additional equipment on existing fleets, including the installation of electrical circuits.

Train lights are mentioned in the Australian Level Crossing Assessment Model (ALCAM) as a treatment to reduce hazards at pedestrian level crossings. However research conducted on behalf of the MRWA[4] indicates that a well-sighted observer had difficulty determining the speed and distance of a train using front lights alone. In the case of a train, the MRWA study showed that a B-double truck driver is unable to judge the time available to clear the crossing and then proceed over and fully clear the crossing before train arrival.

8.3 In-Development Train-Mounted Road User Warning Light System

The purpose of a conventional track-side warning system (i.e. lights and bells) is to identify to road users the presence of rail traffic. The effectiveness of these processes is intuitively compelling and assumed in such assessment systems such as the ALCAM model.

Nevertheless, a large number of level crossings have no active process to augment passive treatments and the road user must first notice the train then judge the possible hazard and cross or wait accordingly. This may present a risk to heavy road vehicles as described in section 8.2 above.

Therefore a process to increase the likelihood of the train being noticed, and a further process to assist the road user in risk evaluation can be expected to reduce the hazard at these crossings. This could be done by rolling out traditional active solutions to all crossings (in Australia this means installation at approximately 7000 additional crossings). A less obvious alternative is to provide a suitably recognisable and unambiguous signal on the front of the train (e.g. flashing red or red-and-blue lights), and activate this signal only when the train is approaching the crossing and represents a danger to the road user.

The warning system can be made to commence either from a set distance or according to the time the train has to crossing arrival (normal track side warnings work in this way). The lighting pattern may be configurable i.e. speeded up at the train nears the level crossing in order to alert the road user to the imminent danger.

This proposed system requires no additional track-side works or maintenance, and all equipment is locomotive/train mounted. The presence of the level crossing is determined by using a geospatial model which can also include other points of interest. This can be thought of as a software map which is loaded into the on-train equipment and a GPS receiver that tracks the train position to the map.

When the train approaches the level crossing the on-train system takes appropriate action according to its programmed logic.

The on-train vigilance described in section 8.1 above uses GPS and a geospatial model in this way, and is implemented to produce a set of train driver warnings according to vigilance rules. The system can have the extra level crossing functions readily incorporated. In the level crossing application the vigilance system will calculate the time to level crossing and automatically produce a control signal to commence flashing the lights.

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[4] Quoted in publication 'Reducing collisions at passive railway level crossings in Australia' (2002). p21, Austroads report AP-R208, National Library of Australia, ISBN 0 85588 629 3

It can also provide other outputs as required, for example the commencement of flashing ditch lights, giving a prompt to the driver to acknowledge the upcoming crossing by pressing a button or other evidence of awareness.

9. SUMMARY

United Group Rail is leading the way with railway protection and asset management solutions in Australia, and can deliver a range of level crossing protection systems depending on customer needs. Further information and system demonstrations can be provided upon request and United Group Rail welcomes any opportunity to do so.