The QR National integrated approach

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Abstract
The seemingly intractable issue of level crossing collisions has been the subject of countless industry studies over the years in just about every country of the world. While there has been excellent, robust work from committed and dedicated people, tragically there are still people dying every year. To address this Queensland Rail (QR) has moved beyond the operation of technical silos to form a taskforce that is representative of the challenge faced. Engineering, enforcement, education and innovation have established a multidisciplinary membership and engagement process. This has focussed on behavioural change initiatives through research and activation of strategy.

This paper outlines QR’s journey to achieving its vision of being world class in safety through innovation and how QR is moving level crossing treatments that were designed for the horse and cart age to the 21st Century.

Introduction
On 27 November 2008 QR suffered the tragic loss of two train drivers in a level crossing collision at Rungoo, Cairns. Following this tragic event QR’s Chief Executive Officer, Lance Hockridge initiated the establishment of a Level Crossing Taskforce. In bringing a greater urgency to improving safety at level crossings, it employed a multifaceted strategy, incorporating the elements of education, enforcement, and engineering. Outside of this, a desire for a revolutionary solution heralded the commencement of QR’s innovation journey.

BACKGROUND
Level crossing accidents and fatalities are issues that are of concern to rail authorities around the world. In Australia for the five years through to June 2008, there was an average of 82 collisions at level crossings per annum, resulting in around 15 fatalities per annum (refer to table 1). Compared to other road accidents, level crossing accidents are more likely to result in fatalities or injury.

Specifically:
- Crossing accidents are three times more likely to involve a fatality
- The serious injury risk for motor vehicle occupants in crossing accidents is 11 times greater.
- The mean length of hospital stay for motor vehicle occupants in crossing accidents is almost three times greater than other road accidents.

They are also more likely to result in greater property damage, and are more likely to have long term social impacts on the community (lost contribution to home and work productivity and quality of life, medical costs, etc). Indeed the cost of crashes has been previously reported by the ARA to average between $180,000 per crash in urban areas and $430,000 for rural areas. Another study of Level Crossing accidents in 1999 conducted by the Bureau of Transport and Regional Economics analysed the impact
and cost to society in terms of lost productivity and quality of life. The potential extent and scope for impact on innocent victims is also much greater.

In addition to this, level crossing accidents are also potentially the subject of legal action and intense media publicity where the actions of rail authorities and the public come under close scrutiny. This has been evidenced most recently with the high profile incidents at Kerang in 2007, when 11 people died and a further 20 were injured and in separate incidents in Mundoo, Rungoo and Mackay in North Queensland, Australia (when 4 people died) in 2008, 2009 and 2010 respectively.

With increasing volumes of both road and rail traffic, it is understandable to expect that the interface between these two transport modes will be the scene of increasing conflict in balancing the needs of the community, the economy and safety.

In Australia, there has been great pressure on road authorities to provide for ever-increasing road traffic numbers and this has generally led to the reluctance to implement any capacity reducing treatments. Previously, the Australian Transport Council noted the high costs required to implement active protection measures such as boom gates and flashing lights, costing in the vicinity of between $150,000 and $300,000 per crossing. In terms of an Australia wide cost, it was estimated to range from $1.2 to $1.8 billion, not including maintenance. Other measures such as grade separation would of course be significantly greater than this.

There have been some studies over the last decade that have sought to find causal factors related to level crossing accidents based on published accident reports, while other studies have employed survey based techniques on self reported behaviours.

From an environmental perspective though, there has been no clear consensus on any particular factors. Time of day, day of week, weather and road conditions, alcohol, drugs, fatigue and speed all had some bearing, but were not overly significant. Human factors and the role of unintentional errors have also been extensively considered in several studies internationally; however the statistical contribution is currently not fully known or understood.

Some significant themes were noted:

- The higher incidence at rural or regional crossings versus suburban, particularly where passively protected (without flashing lights or boom gates);
- The increasing prevalence of heavy vehicles;
- The high incidence of unreported rule breaking at crossings (all vehicle types);
- Poor underlying driver attitudes to road rule compliance;
- Soundproof state of modern vehicles

The increase in heavy vehicles involved in actual and near miss incidents is also of high concern, as these are most at risk of leading to fatalities and significant property damage.

Statistics released by BITRE (Bureau of Infrastructure, Transport and Regional Economics) have shown that for heavy vehicles:

- Average loads per vehicle have increased significantly in recent years (by 35% between 1991 and 2005) and are expected to continue.
- Total road freight for the 15 years through to 2006/07 more than doubled.
- Road freight volumes are forecast to increase significantly (2.9% pa, equating to a doubling over the next 25 year period).
- Projected increases in Freight, Coal and Passenger services predicted to double in some areas in next 10 years

With increases in volumes and capacities, the likelihood of large cost catastrophic events will only increase. The accident at Kerang in June 2007, where 11 people died and a further 20 were injured is an example of the devastating potential of level crossing collisions involving heavy vehicles.

The above has noted several challenges that needed to be addressed by the QR taskforce team. Bringing about a significant leap forward in level crossing safety requires overcoming a range of environmental, geographical, social and behavioural issues that shape the issue for the industry. There
is also the challenge of delivering new and previously unthought-of solutions. The following sections outline the elements of QRs’ journey in this area.

THE QR JOURNEY

Integration

The seemingly intractable issue of level crossing collisions has been the subject of countless industry studies over the years in just about every country of the world. Despite the significant work and resources focused on safety within the industry, there are still many people dying every year under circumstances that are arguably, very avoidable. While some countries have achieved significant reductions in incidents, it has been recognised that no one has yet “cracked the nut” on rail’s biggest safety challenge.

From a strategic perspective, QR has adopted a target of zero level crossing incidents on the rail network. QR has a strong history with engineering excellence and pre November 2008 over 90% (approximately) of budget allocation at level crossings were spent on engineering solutions. Since April 2009 QR budget allocation has been proportionally shared among activities that support the multifaceted strategy of the traditional pillars of enforcement, engineering and education. While a significant amount of good work has occurred in this area, it was recognised that breakthrough change required a further element in this package, namely innovation. Figure 1 illustrates this multifaceted approach, supported by these important pillars.

**Figure 1: QR Strategic approach to level crossing safety**
Membership and engagement

The level crossing taskforce engaged a broad expertise and diverse membership base from within QR, including Rail Safety experts, Signalling and Rolling stock engineers, the Infrastructure Owner, Train Drivers, Unions, Infrastructure Maintenance personnel, Train Operations staff, and representatives from Marketing, Communications, Legal and Finance. This all-inclusive approach has brought a greater collective focus and ownership to the level crossing problem. Progress and effectiveness of the Taskforce’s activities is monitored within internal governance protocols which includes oversight and authorisation by the QR Chief Executive Officer.

Externally, the collaborative approach with State Government authorities including the Queensland Police Services, The Rail Safety Regulator, Road and local government authorities has assisted the process to identify, develop and implement the broad education, enforcement and engineering initiatives. Furthermore, this has also been facilitated through the consultative and engagement process within the community of stakeholders including Transport Workers Union, Motor Vehicle Authorities, RACQ, Queensland Trucking Association and Local Government.

Operational Excellence

QR recognises that improvements within its own operations can have an impact on level crossing safety, particularly reducing wait time for motorists at level crossings. To this end extensive work is being undertaken in relation to reducing wait time at crossings by: evaluating all crew change locations and their impact on wait time at level crossings; ensuring that when temporary speed restrictions are put in place around level crossings that priorities are given to lifting these; as well as prioritising train movement around passing loops and single line operations to minimise delays to the general public.

Education

Some alarming findings were a result of a major research activity undertaken nationally which highlighted peoples risk taking behaviours and their perception of risk, along with their lack of knowledge of road rules at level crossings and enforcement for no compliance. QR embarked on an advertising campaign, which was nationally supported “Some things are worth waiting for” to address the findings.

Other areas of major concern are the amount of level crossing incidents that occur in regional areas involving heavy vehicles. QR engaged in a targeted campaign “Drivers Plea” with the heavy vehicle industry, including a presence at truck stops and meeting with heavy vehicle drivers at their depots. The success of the education campaigns come from the engagement of train drivers who produced a DVD featuring an emotional plea to the public not to take risks at level crossings and to allow them (the train drivers) to go home to their families safely each day. This strategy resulted in over 25% of people in Queensland with recall of the message.

With over 2000 train crew, the importance of getting the safety message to the community was vital. Train drivers are a tight bunch: predominantly male, very passionate and with strong union membership values. They also share a common desire to see a reduction in level crossing accidents. It became apparent that while high profile fatal collisions had an obvious severe impact, our train drivers were also facing near-miss risks on a daily basis.

Men and women were going to work every day and having their lives put at risk through the irresponsible actions of motorists disobeying clear signs and signals and level crossings. The feeling of complete helplessness in these situations was realised and it was important that, as an organisation, QR did whatever it could to minimise the potential risk. A group of train drivers who had been involved in incidents were willing to come forward and discuss the nature of their accidents in an effort to make the community aware of everyday level crossing risks.
All Unions with members employed by QR were actively engaged to provide their support and did so as willing participants to spread the word. Politicians and community leaders were also approached to gain their support and do whatever they could to pass the message on.

**Enforcement**

The approach to Enforcement has seen the emergence of two important pieces of work:

1. A collaborative Enforcement Model, aimed at utilising information through near miss and other reporting as better intelligence gathering and targeted enforcement activity involving police. The cooperation between train crew, Police and QR Operations to an extent not previously undertaken has already resulted in several key enforcement activities to date, which led to a focus on near miss reporting;

2. This cooperation has also lead to identification of hot spots via near miss reports state wide which have been then targeted at identified times by the QPS. This work is ongoing with quarterly meetings between train crew and police.

3. Behavioural and penalty research, extensively reflecting upon international experiences and how best to leverage the punishment framework embodied in legislation to best achieve behavioural change and compliance with road rules. Working closely with the broader government, QR is currently seeking a harsher and more nationally consistent penalty regime as a motivator of more compliant behaviour on the road.

**Engineering**

Globally many engineering enhancements have been either implemented or are being researched to reduce the risk at level crossings. At QR during the first 12 months of the integrated focus over 50 level crossings, which already met the treatment requirements required under the Australian Level Crossing Assessment Model (ALCAM) underwent major transformation.

The federal 66 and state 8 crossings (boom gates) have been completed, other work includes, upgrading of signage, crossing identification numbers with emergency contact numbers and the installation of Active Advanced Warning System at selected crossings.

**Innovation**

Consistent with the desire to look at this age old problem through new eyes, QR embarked on its innovation journey in April 2009, setting out to involve the best and most creative minds in the world, both inside and outside our industry, to identify and evaluate the truly “out of the box” solutions. The aim of the innovation work has been to eliminate level crossing incidents and accidents from the QR landscape.

Involving 30 team members from across the QR Company, some naïve to the level crossing issue, some world class in their chosen fields, though all focused on the aim of eliminating incidents and accidents at level crossings. The team worked for 22 contact days through an intensive immersion into the world of the vehicle driver and pedestrian at level crossings and a process of connective collaboration amongst the group. Through a facilitated process, it also effectively forced the group to apply a completely fresh approach of teams working together with greater effectiveness.

Below is the process used to create the bond between team members which has in-turn created the collaborative success of our taskforces vision and subsequent multidisciplinary approach towards our Companies future focus.
The process and campaign outcomes

There were a number of key objectives and outcomes that were being sought from the campaign:

1. To produce a suite of breakthrough innovative ideas that could address the level crossing issue, with solid implementation plans, measures and accountabilities.
2. To work initially with three teams (each to consist of 6-8 members to include a range of people from Executive General Managers to supervisors and engineers) to begin to acculturate innovation by applying it to the level crossings challenge.
3. To enable through innovation a substantial redeployment of the current funding programs earmarked for rail crossings in the coming and future fiscal years.

The process of the level crossing campaign passed through a series of stages in its journey.

Initially, a series of team workshops were run with a number of activities to set the climate for the remainder of the campaign, in particular to create the desired mindset and practical understanding of climate/thinking/action to make creativity happen.

Activities at this stage led to generating “nuggets” or pieces of information for later exploration, together with the formation of some beginning ideas. Some of the key perspectives that individuals considered were:
- That the nature of insight is about discovering hidden truths;
- Learn to creatively act on the insights; and
- That breakthrough insight is gained by being available to invention, absurdity, irrelevance and the new connections that these can produce.

The Immersion and Insight stages primarily focused on learning about and understanding the problem at a deeper level. The Insight Workshop is a highly refined process designed to maximize the probability of creating a few simple breakthrough insights. Findings from the prior stages are shared in creative ways amongst teams using a variety of tools to develop insights on which to base innovative solutions to prevent level crossings accidents.

The focus at the Catalytic stage was to move away from conventional research presentations and push thinking beyond standard concepts. Teams were forced to interrogate existing research and collect new stimulus on analogous issues for processing in non-conventional and creative ways during the Insight Workshop.

At the Invention stage additional creativity techniques were brought into the process, along with internal stakeholders to generate novel ways to bring the insights to life and to create breakthrough solutions. Finally, the selected solutions and concepts were further refined, with identification of actions and timeframes going forward.

The bringing together of diversity is an important aspect of the process. It increases the likelihood of maximising creativity by leveraging the knowledge and skills of teams and gaining commitment to action throughout the project. During the campaign, we had the opportunity to gain input and contact with a range of external people, all of whom added a wealth of insight and stimulus to the creativity process.

These people included:
- Users of level crossings including heavy vehicle drivers, motorbike riders, young drivers, older drivers, and pushbike riders.
- Work professionals that engage in risk as part of their work, such as skydivers, Abseil operators, IT and advertising professionals, gamblers, psychologists, and a pyrotechnical expert.
- Industry external stakeholders, government representatives and technical experts

The concepts

The result of this intensive process led to the identification of a series of breakthrough concepts – rich and diverse emerging ideas which each dealt with a slightly different aspect of the problem, and gave us a comprehensive pallet of solutions. As a result, we have ideas that change the design of crossings and
their environments, ideas that influence the behaviour of those who cross, and ideas that minimise the severity of collisions should they occur. Working as a suite of solutions (two are identified below), these ideas have the potential to change the way railways deal with level crossings forever.

**Diamond Smart**

A new diamond shaped crossing design that progressively slows traffic, and ultimately channels vehicles at risk to a safety zone away from the crossing. It lowers risk by reducing the speed of vehicles, increasing awareness and diverting any potential impact away from the crossing. It works via traffic calming on approach, visual barriers at the centre of the crossing, and a strong flipper gate which channels any wrong-doers into a braking bed or road.

![Figure 3: Diamond Smart Visualisation](image)

**Crossing Oracle**

Real time communication profiling and monitoring system aimed at predicting the risk of collisions and alerting train drivers and approaching crossers to take necessary actions. The system captures, analyses and stores image data of approaching crossers and uses the data, combined with current risk elements (speed, weather conditions, time of day, train approaching), to predict the likelihood of a collision and action to be taken. Information is communicated to the train driver and the approaching crosser.

![Figure 5: Crossing Oracle visualisation](image)

**CLOSING COMMENTS**

The outcomes of the level crossing campaign have demonstrated the potential and power of a collaborative and fresh approach to the level crossing environment. In a commitment to problem solving issues at level crossings and to eliminate incidents and accidents an integrated model has been used.
The approach of collaboration through innovation has created a team environment and a desire to achieve a common goal. The methodology used to build and strengthen the team towards achieving this challenge created an experience and an internal expertise for future challenges.

Essentially though, the importance of innovation throughout QRs’ operations as an everyday tool is recognised as essential to its long term business success. In working to this objective, the training of representatives through the business as innovation facilitators focusing on a range of safety initiatives has already occurred.

Eliminating level crossing incidents and accidents remains QR National’s level crossing taskforces number one target. The fact that the taskforce team is built by employees from across the business, representing many professions adds to the opportunity of its success.
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