Why is Rail Safety Important to Me?
- Lessons Learned During Accident Investigation

David Edwards

Australasian Transport Risk Solutions (ATRS) Pty Ltd

Australia

Member of Australasian Railway Association

SUMMARY

An organisation's greatest resource is its people. People can also be its greatest risk. Conventional risk management approaches focus on physical conditions and work processes, often overlooking the integral 'people element'. Our individual differences influence how we perceive our work environment, the tasks at hand, our skills and capabilities. Based on such perceptions, we make decisions on how we are going to behave.

This paper draws on research findings by Dennis Krallis and Andi Csontos of the Sydney Office of Deloitte Touche Tohmatsu and their paper "From Risk Perception to Safe Behaviour" to examine the factors that shape our perception and tolerance of risk and explore the link between risk perception and safe behaviour, and how this thinking may improve safety in the rail industry.

This paper also presents a case study of a major rail safety accident at Robertson in the Southern Highlands of NSW, Australia, on 19 May 1998, the critical failures that led to the accident and the investigation outcomes, and most importantly, my own personal journey and experiences through the incident, the investigation, and how this event impacted my life and has enabled me to provide an answer to the question "why is rail safety important to me".

In doing so, this paper provides the background to the accident causation factors that led to multiple engineering and safety system failures, the attempts by some to cover up those system failures, and the final human factors outcomes and impact on the railway operating company, its locomotive drivers, and those closely involved in managing the incident site, the investigation and its aftermath, and how risk perception may directly impact safety behaviour.

INTRODUCTION

Developing, maintaining and growing a safety culture in any organisation in these challenging financial times is never going to be easy, although conversely, it is easy to understand why some rail safety managers feel like giving up when under the pressure of budgets, bureaucracy and, in some cases, buffoons who think safety and risk management are areas that can be scaled back or eliminated in tough financial times.

Indeed in an era of commercialisation, privatisation and the required high "return on investment", well may a Chief Executive Office or other senior executive say after a major accident "***I did not know***". How many times have we heard that statement during a major rail accident inquiry, and of course if the person did not know, then we might ask "***Why didn't you know***". It is within this context that the "bean counters" should be reminded of the old saying "If you think safety is expensive, try having an accident".

So, especially during these times, it is important to learn from accident investigations and to ask ourselves the question "why is rail safety important to me", and perhaps "how much passion and drive do I have for the task". We should also not lose sight of the critical importance of sharing personal safety experiences and lessons learnt so that we may further improve our understanding of safety management.

The 1998 Robertson accident took the lives of two locomotive drivers, Mr John Anderson and Mr Wayne Dunstan, both of whom were young men with wives and young families. Both drivers were know to me and in the years preceding the incident when I was working in the driver training area, I had trained and certified one of them in safeworking network rules and in various driver training programs.

I present this conference paper within the context of the 1998 Robertson rail accident and the personal experiences and lessons that I learnt at that time and carried with me ever since. However, the Robertson case study cannot be discussed in isolation, as it and many other similar accidents are linked to safety risk perception, the level of safety risk we are prepared to accept, and our resulting safety behaviours.

I believe from the teachings contained in the excellent paper "From Risk Perception to Safe Behaviour", that there are four key elements that drive our personal perception of safety risk, they are our ***Attitudes***, ***Values***, ***Beliefs*** and ***Behaviours,*** and my reasoning will become apparent at the end of this paper and in the context of the case study to be discussed.

SAFETY RISK PERCEPTION

Our individual differences influence how we perceive our rail safety work environment, the tasks at hand, our skills and capabilities. Based on such perceptions, we make decisions on how we are going to behave. Therefore, we may well ask ourselves the question "what level of safety risk are we prepared to accept"?

Few organisations have actively addressed the issue of risk perception. Workplace risk assessments give little consideration to the differences in how we assess exposure, probability, consequence and overall risk. Research related to OHS has focused on the management of worker safety with little concern for the subjective interpretation of safety risks and effects (Morrow and Crum, 1998).

However, the way in which people think, feel and behave in response to risk is receiving increased attention, both amongst academics and professionals involved in promoting and regulating safety, and we in the rail industry would do well to learn from this experience.

Wilde advocates in his book, *Target Risk 2* (2001), that safety interventions need to consider risk perception and reduce the level of risk people are willing to tolerate if they are to be successful. Wilde claims that improvements in health and safety cannot be achieved through training, engineering or enforcement alone, stating that the extent of risk taking ultimately depends on the safety values that prevail in an organisation, not the level of safety technology available.

Factors that shape our perception & tolerance of risk include our general work environment, the company leadership (good or bad), management & supervisor role models that we encounter, our home & family life, our sporting lifestyle, and our organisational culture.

In arguing the case for a greater acceptance and understanding of safety culture and the importance of the perception of risk, this theory suggests that the level of risk perception, either personal or organisational, will directly influence the level of safety behaviour by that person or organisation.

HUMAN RISK ENVIRONMENT FACTORS

A number of factors contribute to how we view our work environment in terms of safety risk, they are:

- ***Memory***
  Our ability to learn varies from person to person, and our perception of an event impacts on what we remember, and our memory may be biased;

- ***Experience***
  Our memory is based on previous experience;

- ***Knowledge***
  People who take risks may not be less knowledgeable, however, may have a different perception of safety risk value;

- ***Mood***
  Our disposition or general mood (good or bad) affects how we function;

- ***Work stress***
  Time pressure and work load has a direct influence on the level of work stress;

- ***Group pressure***
  Perception also applies to groups, and again, may be either good positive pressure, or bad negative pressure which may cause a safety conscious person to revert to bad safety practices under group pressure;

- ***Risk exposure***
  If we believe a safety risk has been controlled, we may lower our risk rating and increase our potential risk taking behaviour, meaning that even if a safety hazard has mitigation measures in place to control that risk we should not assume that the risk exposure has been eliminated;

- ***Workplace safety performance***
  It does not follow that an organisation having "no safety incidents" is therefore a "safe workplace".

MOTIVATION

Most rail safety workers will not change their behaviour, beliefs or habits unless motivated to do so. Most will not change even if the change is for the better, unless there is a compelling reason to do so. Ingrained beliefs and behaviours need some help to shift.

A number of rail industry organisations have introduced the five minute, pre-start risk assessment, commonly referred to as a Take Five, to increase safety awareness prior to commencing site work. While these programs are value adding, we need to build on this existing process by incorporating the people elements.

It is not enough to ask what the physical, observable hazards are in the workplace. We must also ask what the psychological hazards are. Are we in the right state of mind to be undertaking this task? By focusing employees' attention on internal and external factors before commencing high-risk work, we are influencing behaviours up stream, during the cognitive, thinking and decision-making stages.

We have to persuade people to adopt new practices. We need to understand the external motivators (what our leaders motivate us to do) and internal motivators (what we motivate ourselves to do) that will encourage the use of risk perception tools.

Drawing on internal needs and desires; improving job satisfaction, creating feelings of success, building expertise and giving autonomy can lead to successful, long-term motivation. External motivators can also encourage desired behaviours and performance. Incentives such as recognition of achievements, increased responsibility, training, positive feedback and encouragement are all effective and may even create self-motivation, and longer-term behavioural change (Geller, 2005).

All of the discussed safety perception, safety value, motivation, and human risk environment factors (or the absence of them) played a significant part in the 1998 Robertson accident, and had the organisations and individuals involved had this knowledge at that time, perhaps the accident may have been prevented.

ROBERTSON ACCIDENT CASE STUDY

Robertson is a small country town in the NSW Southern Highlands approximately 100 kilometres from Sydney, Australia, and is situated on a heavy haul single line rail corridor running between the NSW coastal industrial centre of Port Kembla and Moss Vale where the line joins the main Southern rail corridor connecting Sydney to Melbourne.

The rail corridor running up to the incident site just to the East of the town of Robertson is on a steep rising grade of 1 in 30, and the corridor is used for the transport of coal, grain and steel. There are no regular passenger train services on this corridor.

At the incident site a major road highway (Illawarra Highway) passes over the rail line and in 1997 (a year prior to the accident in May 1998), a new higher level modern single span multi-lane highway bridge and road approaches were constructed adjacent to the original road bridge and abutments which were built in 1928.

As the old now redundant road bridge was the responsibility of the Rail Authority in NSW, and was now de-commissioned, in order to save on-going maintenance costs, a decision was taken to remove the bridge decking and original additional bridge piers, however, to leave the large concrete abutment walls in place.

In addition, a separate major track upgrade project was scheduled through the area and this involved removing the existing rail line and formation, lowering the rail formation bed, and re-building a new upgraded heavy haul rail line. Without doubt, the new formation and rail line was of a very high standard and quality for the future expansion of heavy freight trains planned to use this corridor.

In preparing the rail corridor at the accident site to accommodate the new track formation, the project engineers and their contractors cleared out the old formation and original ground level down to a level equal to the bottom of the original footings of the now redundant bridge abutment walls. It has always amazed me that any infrastructure engineer would do that without putting in place risk mitigation actions to stabilise the now exposed abutment walls.

Through the period of various maintenance works, track re-newal works, and the bridge decking removal works, all conducted at separate times by different contractors and under the control of a variety of supervising areas, each undertook their work in isolation and having no regard for the safety impact of their own work on the corridor, let along the combined impact of all works when put together.

At this stage the abutment walls were just standing there waiting for an active failure to occur which would cause one or both to collapse. That active failure occurred some two months later when a week of wet weather set in and the old redundant approach road soil embankments became water logged and expanded.

THE TRAIN

The train was No.1BY4 and was approximately 2 hours into a journey from Port Kembla in New South Wales, a costal port area approximately 80 kilometres South of Sydney, to the South Australian town of Whyalla. The two driver train crew were to operate the train on the first leg of the journey from Port Kembla to the town of Junee, a distance of approximately 450 kilometres, where they were to be relieved for the next leg of the journey.

The train was carrying a block load of 1,672 tonnes of coiled steel and consisted of 26 wagons (RCGX & RCGF wagons) and three locomotives and was permitted to travel to a maximum speed where permitted of 80 kph.

The locomotives were all NR class diesel electric locomotives with NR3 leading and in consist with NR26 and NR57. The NR class of locomotive is a GE-9, 4,000 hp 16 cylinder locomotive and there were 120 locomotives of that same class. Each locomotive weighed 130 tonne and was 22 metres in length over the couplers.

THE ACCIDENT

In the early hours of 19 May 1998, in thick fog, train 1BY4 was making steady progress up the steep 1 in 30 grade towards Robertson at a speed of 34 kph when the crew made an emergency brake application just seconds prior to hitting the top of the Northern side bridge abutment that had collapsed down and over the right hand rail in the direction of travel.

Given the very poor visibility, the locomotive crew had little time to react as the leading locomotive NR3 hit the concrete and derailed on the right hand side staying straight but now at an angle as the momentum of the train pushed it through the concrete, striking and wedging under the front right hand side of the locomotive a very large triangular piece of concrete that formed one of the abutment wing walls, rotating it like a pole vault, and flipping the lead locomotive over on to its left hand side.

The second driver had evacuated the cab into the vestibule area in an attempt to alight from the locomotive, while the other stayed in the driving seat. Both crew members were killed during the process of the locomotive flipping onto its left hand side and colliding with the Southern side abutment of the new highway bridge.

The second locomotive NR26 derailed all wheels, while the third locomotive NR57 remained fully railed as did all of the wagons in the train consist.

Following the derailment of train 1BY4, the safety system failures and poor safety culture continued to be displayed when an Area Controller at the Train Control Centre at Wollongong observed that the train had failed to exit the section at the anticipated time and tried to call the (now dead) train crew. Receiving no response after several attempts, the Area Controller made a wrong assumption that the crew must have had a problem such as a broken air hose and were stopped to fix it and had just decided not to communicate this information to the Control Centre.

Voice recordings of the Area Controller in question were later to reveal that he had abused the train crew to other colleagues thinking that they were ignoring him. This situation continued for in excess of 1 hour before action was initiated by the Area Controller to send a local ganger who lived at Robertson in search of the train.

At the time, I wondered if in similar circumstances an air traffic controller observed a plane on his radar just disappear, would he just blame the crew or a communications failure, or would he take immediate action to raise an alarm.

Again, this is all about our ***Attitudes***, ***Values***, ***Beliefs*** and ***Behaviours***, and while we did not know it at that time, the Robertson accident proves how important this thinking is to our contemporary safety thinking and understanding.

OTHER HIGH RISK LOCATIONS IDENTIFIED

During the first day of the accident site recovery and restoration work, the investigation team raised the question of other possible locations on the network where similar circumstances may have also seen the removal of a bridge deck from redundant road bridges across a rail line.

Following a hastily organised assessment organised by the Network Manager, two other similar sites were identified on the same rail corridor. The old bridge abutments at both of those sites were reinforced over the following two days by placing steel RSJ's between the abutment walls at the top to prevent any potential of a partial collapse. In the months following the Robertson accident all of the identified redundant bridge abutments were totally removed and the safety hazard eliminated.

CONTRIBUTING FACTORS

Like so many major accidents, the Robertson accident had a wide range of contributing factors most of which were latent factors that were inherent within a system that had not been fully designed, managed or assessed to cope with a rapid dis-aggregation of what was just a couple of years earlier a traditional vertically integrated rail authority with long established systems and processes, and clearly defined roles and responsibilities.

Leading up to the accident, the previous rail authority had been broken up into various stand alone entities, and the train operations (commuter operations remained in Government control) were largely privatised with new train operating companies formed.

The responsible stakeholders in NSW at the time of the Robertson accident were:

Organisation	**Rail Industry Function**
Rail Access Corporation (RAC)	Network Access & Infrastructure Manager;
State Rail Authority (SRA)	Train Control Provider;
Rail Services Authority (RSA)	Network Maintenance Provider;
Various Contractors	Renewal & Maintenance Project for RSA;
National Rail Corporation (NRC)	Train Operating Company.

Deficiencies in the system soon became evident within the early stages of the investigation including the complete lack of what later became known as Safety Interface Agreements between all parties, the fact that there had been little or no engineering design, control, or supervision (cost driven) of the various infrastructure projects at the accident site, there was no evidence that any aspect of the planned maintenance and the actual conduct of any of the maintenance works had been risk assessed, and there were no clear responsibilities or accountabilities for the maintenance works.

All in all, a lot of assumptions were made which provided for major hazards to go unrecognised and therefore not controlled, and individuals just focussed on specific project tasks, such as the removal of the old bridge deck, without having any thought, visibility or responsibility for the safety of the project and rail corridor as a whole.

In addition, the safety culture of the day while being apparent within the individual organisations, was non-existent across the environment as a whole with organisations and people just looking after their own patch as it were.

From an investigation perspective, it was also notable that the investigation team was not able to obtain what was believed to be some basis rail network maintenance planning and approval documentation as it was either nonexistent, was withheld, or that it had been potentially destroyed in the days following the accident.

The investigation team found no evidence of any risk assessments having been conducted, either separately for each component of the works, or for the project as a whole. Further, no clear evidence was ever presented of a senior engineering assessment, sign-off and authorisation for the works that led to this accident.

It is pleasing to now report that the lessons offered in the Robertson accident were accepted and today we operate in a totally difference and much improved rail safety environment. Principal in achieving that positive outcome was the rationalising of the number of organisations involved in managing a rail network, with now just the one single organisation to manage, control and maintain each of the various rail networks in Australia. This is a vast improvement on the structure that was in place in NSW in 1998.

PERSONAL SAFETY VALUES MOMENT

My confronting personal defining moment came on the 4th day of the incident site, the derailed and damaged rolling stock had been removed off-site, the track had been slewed across from the collapsed wall and repaired, and limited freight services were once again operating, and I was on-site as the incident site manager that day supervising what was a group of engineers undertaking geotechnical sampling of the soil and foundation composition that was once the foundation to the collapsed bridge abutment.

Early in the afternoon of that day a colleague from the rail network organisation informed me that one of the deceased drivers families had arrived on-site and that I needed to deal with them as I was the senior representative of the train operating company (National Rail Corporation) which was the employer of the train crew.

Now I have always worked by the principle that as an investigator, to remain impartial on any investigation you must not get involved in the potential emotion of dealing with the injured employee or in the case of a fatality, not to get involved with the management of the family issues etc. The aim was to remain detached and objective, and to have other appropriate senior managers assigned to provide the important support to the involved employees and in this case the families of the deceased.

Well, on this occasion I had no choice and went up onto the road bridge over the rail corridor to meet the family. The family group consisted of the wife, her parents, and an Uncle of one of our two locomotive drivers killed in the accident. They explained that they wished to be taken down onto the site and to the exact location were the loved one had been killed, I said yes, I would arrange for that to occur and I introduced myself and passed on my sincere sympathy for this tragic loss.

A few minutes later after I had arranged to safely take the family group down onto the site, the wife turned to me and said "so what is your job in my husband's company", to which I responded "I am the General Manager of Safety", to which she replied "well then, if you are responsible for safety, are you the one that I blame for my husband not coming home to me and his children".

To say that this was a terrifying moment for me is an understatement, and who could blame her for feeling that way. Of course there was no answer to her reasonable question, and in hindsight, we the collective people of the various rail industry organisations involved could and should have done so much more to prevent the accident that so badly affected the two involved families.

That day and few minutes of conversation on the Robertson incident site has remained with me ever since, and there is hardly a day goes by when I don't think of that conversation. It was that brief confronting conversation that provided for me a life changing experience where I became even more passionate about our responsibilities and obligations in providing a safe railway working environment for all people, and so we must. We have a duty of care to get our people home to their families at the end of their shift.

My safety ***Attitudes***, ***Values***, ***Beliefs*** and ***Behaviours*** all changed on that cold day in May 1998 at Robertson, and I just hope that in telling this story it may influence others to adopt the same passion for rail safety without suffering the loss of two innocent locomotive drivers, who were first and foremost loving husbands and fathers.

CONCLUSION

Professor James Reason once said, "never waste a good accident", and that statement is so true of the Robertson accident, if we can take some lessons from this tragic event, share them, and learn from them, we may have a chance of preventing another similar accident.

To that end, safety risk management remains a key ingredient of a proactive safety program and plays a vital role in the prevention of incidents and injuries in our rail industry. However, research has shown that risk assessments are subjective and risks are often rated inconsistently. If we are to continuously improve our safety performance and learn from accidents, we need to focus on the human aspect and individual differences.

The internal and external factors that combine to influence our perception and decision-making must be considered when undertaking any risk assessment or investigation, and used to encourage safe behaviour in the workplace. The aim is not to build new systems and processes but rather to revisit our existing safety programs and inject them with a people element.

Professor James Reason said in relation to corrective actions following a major accident "it is not always the best outcome to rush in and add additional new rules", perhaps we just need to better understand and consider the people element.

Why is rail safety so important to me? We have a duty of care not only to our organisations, but in particular, to the many rail safety workers to whom we hold a high obligation to provide a safe workplace and to get them home safely to their families after each shift.

My experience as a site manager and lead investigator in the 1998 Robertson accident and how a chance meeting on-site in the days following the accident with the wife and family members of one of the deceased train drivers in this accident, changed my life and gave me my continuing and everlasting "passion" for rail safety. I hope in sharing this experience with other IRSC delegates that others will likewise embrace my passion for rail safety and the higher safety values that we should all endeavour to achieve.

Rest in Peace John Anderson and Wayne Dunstan.