

# A Rail Tale

In 2005, Parliament passed new legislation to regulate railway safety in New Zealand. Applying international best practice, the Railways Act took a goal-based approach that utilised the Safety Case concept as the foundation for regulatory oversight. This article describes the Transport Agency's experience in implementing this regulatory approach, particularly the Safety Case concept. The change required the Transport Agency to first recognise that fully harnessing the legislation required a transformational response and then, along with the wider industry, address the challenges faced in developing and implementing an appropriate regulatory operating model

Railway safety is just one of many areas in New Zealand where a goal-based approach has been adopted. Goal-based safety regulation offers the potential to provide organisations with more flexibility in meeting their obligations. It contrasts with prescriptive-based regulation, where government seeks to manage risks on industry's behalf, not necessarily more reliably, by voluminous

and continually growing instruction on safety requirements (Robens, 1972).

Regulators are fast building the skillsets required in response to this change in regulatory practice, supported by cross-government capability building initiatives such as G-Reg. However, as the Transport Agency has found, the change is not just about new skills. It is about transformational change to enable

organisations and staff to make best use of their new regulatory tools and skillset.

As a result, the Transport Agency is changing the way it interacts with the organisations it regulates, and how it measures the success of regulatory interventions. Its experiences are not unique among the regulatory community (New Zealand Productivity Commission, 2014).

## The Railway Story

Railways in New Zealand recently celebrated its 150th year – the first public railway joined Christchurch to Ferrymead in 1863, just 23 years after the signing of the Treaty of Waitangi. The railway industry has been through peaks and troughs – both in its role as a driving force behind the growth of our nation and in its success in keeping its workers and passengers safe.

### *1863 – 1983: The emergence of a nationalised rail network*

17 years after the Provincial Government created the 7km Christchurch-Ferrymead link, the network had grown to 1,900km and New Zealand Railways, the national rail provider, was created. By 1920 railways ran the length of the country and carried 28 million passengers per year - in a country with a population of only a million.

Table 1: Disasters in New Zealand's early rail history

Year	Location	Fatalities	Event
1923	Ongarue	17	Auckland to Wellington passenger service hit landslide and derailed
1936	Ratana	7	Wellington to New Plymouth passenger service overturned due to excessive speed on a corner
1943	Hyde	21	Cromwell to Dunedin passenger service overturned due to excessive speed on a corner
1948	Seddon	6	Picton to Christchurch passenger service overturned due to excessive speed on a corner
1953	Tangiwai	151	Wellington to Auckland passenger service fell into the Whangaehu River after a lahar sweeps away the bridge

As the network continued to grow, the safety systems required to manage it grew as well. Rail is an activity exposed to low frequency, high consequence accidents – movement of large objects at speed has always meant a complex system of controls are required to prevent fatalities. Vulnerabilities have been learnt the hard way in some cases (see Table 1).

The national rail provider took a strong, but prescriptive approach to safety – as all industries of the day did. It created a quality management system based on an ever expanding mountain of rules, policies and schematics to dictate safety.

By the 1950s, rail was starting to decline in popularity as a series of shocks hit the industry. The widespread uptake of motor cars cut passenger numbers, and deregulation in the 1970s and 1980s saw a considerable move of freight tonnage to road. New Zealand Rail had been a government department for most of its existence but, struggling to cope with these shocks, was turned into a State Owned Enterprise in 1982 in an attempt to turn the industry around.

#### 1983 – 2005: A struggling system

Government efforts to cut costs and restructure to address rail's profitability ultimately culminated in the sale of the national rail provider to a private consortium in 1993. Staff numbers, peaking at 21,000 in 1982, had dropped to below 5,000 by this stage.

The following decade was one of the hardest in New Zealand rail's history as ownership and investment drifted. The business was renamed Tranz Rail and subject to aggressive profit strategies.

Former Treasury official John Wilson (Wilson, 2010) wrote that, by 2001:

Tranz Rail's financial problems were now creating visible shortfalls in the capital asset replacement programme

The prescriptive-based safety system strained with the pressures of rapid downsizing, asset deterioration and increased production. Prescriptive-based regulatory approaches give a sense of security because they are comparatively simple to confirm compliance. However, whether this compliance achieves safety is more difficult to confirm – changing circumstances, such as railways saw over those two decades, can easily destroy this link.

After five Tranz Rail workers died in a 7 month period (a fatality rate eight times higher than the national worker average) the Wilson Ministerial Inquiry was initiated (New Zealand Government, 2000; Williams, 2000). The Wilson Ministerial Inquiry identified fundamental flaws in the railways regulatory approach.

the number of [safety system] documents is in the range of 1,000 to 2,000 and the number of drawings is in the region of 100,000. It would appear that the scale of documentation is unmanageable relative to the aim of securing a safe system ... The sheer extent and coverage of the [regulator] Approved Safety System renders it unwieldy and probably impenetrable to outside observers. (New Zealand Government, 2000, p.23)

This echoes the findings of a seminal 1972 inquiry of worker health and safety by Lord Robens in the United Kingdom. Robens proposed focusing on the level of safety that must be achieved (the "goal"), rather than how it was achieved (Robens, 1972). He foresaw prescriptive regulation was fatally flawed in that, as complexities grew, it would unacceptably throttle safety improvements. Businesses wouldn't be able to exploit safety advances or adopt customised approaches.

#### Post 2005: The way forward?

In 2005, Railways Act came into force, regulating an industry that was far different to that of the previous 140 years. Although the national rail provider returned to government ownership, its staff numbers were down to 3,500 and it operated a network of only 3,700 km (from a peak, 50 years earlier, of 5,689km). However, the wider industry had proliferated - today there are about 100 licensed rail participants using a huge variety of rail vehicles for commuting, freight, servicing, tourist and heritage purposes.

The commentary for the Railways Act did not identify it as a goal-based approach, but the principles were there. The Select Committee sought to enable a co-regulatory framework and flexibility in how safety requirements were met, and the Act imposed an overarching duty of care for all rail activities, primarily that the operator:

.. must ensure, so far as is reasonably practicable, that none of the rail activities for which it is responsible causes, or is likely to cause, the death of, or serious injury to, individuals.

The Act put in place a bespoke regulator that oversees a licensing regime for those operating rail vehicles or controlling a network. To obtain a licence, operators must have a Safety Case approved by the regulator. The regulator has powers to conduct in-depth system assessments of the operator to verify compliance with the Safety Case and other safety documentation. The Act allows the regulator to intervene more directly if

there are immediate safety risks or if non-compliances are detected.

However, the decade following the enactment of the Railways Act 2005 demonstrated the difficulty in applying a goal-based approach on a deeply established industry without sufficient appreciation of the change it entailed. The potential of the approach was not fully recognised and the regulator was under-prepared to deliver the altered style and thinking required to fully exploit it. Particularly, the oversight of Safety Cases, a powerful tool for implementing a goal-based regime (see boxed text “*What is a Safety Case?*”) was under-utilised. Instead, a process-based operating model was adopted that focused heavily on mechanically auditing activities across all operators.

#### Recognising the need for transformation

Following the Wilson Inquiry and passing of the new Act, railway deaths and serious injuries significantly reduced but, as has been found before, the absence of accidents is not proof of safety. There was uncertainty over the role of the regulator and the robustness of safety protections.

Change was needed, and the railway industry was fortunate in that its impetus for this change did not come from a catastrophic accident, but as part of a general push towards improved regulatory services by the Transport Agency, the industry and other government agencies, particularly in the wake of regulatory failures such as the 2010 Pike River Mining Disaster.

A number of internal and independent reports helped the Transport Agency understand where the gaps lay and became the catalyst for a multi-year improvement project that is still underway. In particular, a report by Australasian Transport Risk Solutions (2013) made 18 observations and commented:

... there is considerable room for improvement. This conclusion is based on the results of the international benchmarking analysis, feedback received from the stakeholders, and evidence found by the review team which suggests that the current administrative and

## What is a Safety Case?

Safety Cases originated in the nuclear power industry in the late 1950s but their potential value for other high-risk, specialised industries was recognised after accidents in the chemical industry (particularly Flixborough in 1974 and Seveso in 1976) and then more widely after the Cullen Inquiry into the 1988 Piper Alpha explosion.

#### Principles of Safety Cases

Safety Cases are based on three principles common to most goal-based approaches (Leveson, 2011).

- Risks must be reduced below a specified threshold of acceptability
- Those who create risks are responsible for controlling those risks
- Government set safety goals and operators decide the appropriate methods to achieve those goals

The Safety Case delivers on these principles in a way that allows the regulator to focus on what is being achieved rather than how it is being achieved, while still providing a degree of assurance as to the quality of the operator’s methods.

A key element of a Safety Case is that it is an argument, not a summary. An argument convinces an audience of a premise – in this case, confidence that an operator can achieve its safety commitments. As with an argument, the rationale in a Safety Case must be able to be tested. The United Kingdom’s Defence Standard 00-56 notes a Safety Case to be:

a structured argument, supported by a body of evidence, that provides a compelling, comprehensible and valid case that a system is safe for a given application in a given environment.

Because a Safety Case communicates this rationale for how the operator will keep safe, it sits apart from the management systems to provide direction and integrate them.

When a regulator intervenes in a goal-based approach, it is on the basis that the operator has not demonstrated it has developed its approach in a robust manner and so is unlikely to be able to meet its goals. The regulator is not critiquing the safety approach taken but the method the operator used to determine it.

support arrangements within NZTA for such a safety critical independent rail safety regulator function to be less than an acceptable standard. (Australasian Transport Risk Solutions, 2013, p.5)

The various reviews recommended a series of tactical changes, such as elevating the regulator in the Transport Agency hierarchy, increasing regulatory staff numbers, broadening the skill-base and performing greater analysis. However none, including the Wilson Inquiry, explicitly highlighted the need to move to a goal-based culture or the challenges this would entail.

It was only once the Transport Agency, while implementing these tactical changes, reflected more deeply on the core drivers for the problems these reviews highlighted that it began to recognise that moving to a goal-based regime in rail safety and delivering the required standard of regulatory service was a more fundamental shift.

A dramatic shift in the regulatory framework, from a prescriptive to a goal basis, can have a disorientating impact on the regulators and the regulated if not recognised and can, ultimately, lead to regulatory failure (Mumford, 2011; Black, 2014). For instance, New Zealand’s leaky building crisis was partially attributed to such a change. Mumford (2011) noted that

## The New Zealand Rail Industry in 2017

6,200 workers are employed by, or volunteer for, licensed rail participants in New Zealand. Many of these workers are proud to be from a long lineage of rail workers, have known rail all their lives and have seen a number of structural models come and go. The industry carries 34 million passengers and 18 million tonnes of freight every year, across 4,260km of rail network, on everything from brand-new commuter fleets to hand-restored museum pieces. Those licensed to operate railways include:

- KiwiRail, a State Owned Enterprise that employs 3,700 staff. As the national rail provider, it controls and maintains the 3,744km national rail network and operates all national freight and passenger services.
- Transdev Auckland and Transdev Wellington operate the two metropolitan commuter services, carrying 32 million passengers every year.
- Industrial businesses utilising rail to load and move freight on their sites or to service their infrastructure.
- Tourist and Heritage services operating rail services to showcase rail history and/or provide tourist experiences. Running excursions on the national network or their own railways, they operate a huge range of vehicles including full-sized heritage locomotives, trams, cable-cars, custom-built rail cars and modified golf-carts.

In addition to this, more than 200 organisations operate rail vehicles under others' licences, to provide vehicle and infrastructure maintenance services.

the haste to move away from an expensive (if reliable) standards-based approach to a more flexible regime resulted in discarding previous safeguards without adequate consideration of what was replacing them. Mumford commented:

New Zealand moved into an unknown future while burning the bridges to its past.

To be successful, the Transport Agency needed to redefine its rail safety role, how it engaged with the industry, and how it exerted its influence over the industry.

A cultural change such as this is referred to as transformational change. It fundamentally alters the strategy by which an organisation achieves its objective. Existing skills, behaviours and approaches are no longer suitable and have to be adapted, enhanced or replaced (Cummings and Worley, 2009; New Zealand Productivity Commission, 2014).

The national rail provider was also going through its own transformational change. Along with a heavy period of asset renewal and developing new safety

approaches, it was exploring its role as manager of the national rail system under such a regulatory framework. A particular challenge for it was reconciling how its safety outcomes related to those of the operators under its supervision on the network.

Smaller operators, on the other hand, experienced difficulties in maintaining the competencies and documentation to comply with a regulatory framework more often applied to multi-national, high-risk industries than small hobbyist. They were still looking for clear, prescriptive expectations from the regulator as to how to be compliant with the safety requirements rather than moving into a goal-based mind-set.

Regulator and regulated alike were struggling to understand their respective responsibilities and approaches to meeting those responsibilities in a goal-based regulatory framework.

### Making the changes

The Transport Agency took a learning, highly adaptive approach to its rail safety transformational change, rather than

implementing a pre-planned strategy. This reflected that the transformational nature of the change was only gradually recognised after the simpler, task-driven change programme had been begun. In addition, with the rail industry going through parallel changes, the approach needed flexibility to navigate a shifting environment.

In addition, the change was relatively compartmentalised within the wider Transport Agency. It sought direction from the senior leadership and values of the organisation, but it only had a transformational impact on a small number of teams who had direct roles in enabling a goal-based approach to rail safety. Achieving the change did not require a whole-of-organisation shift. As a result, although the changes were deep, they were narrow and more manageable.

Successful change required two significant perceptual changes to be made.

### Roles in the regulatory framework

To understand its role in the regulatory framework, the Transport Agency had to understand what it meant for the operator to own the risks of its activities – a concept that felt contrary to the regulatory role. Regulation is enacted to provide assurance that the risks that society finds unacceptable are addressed (New Zealand Productivity Commission, 2014). It is the responsibility of the regulator to provide this assurance, and it is therefore natural for a regulator to feel most comfortable when meeting this duty directly by controlling the risk itself (for instance, by approving safety measures) rather than entrusting management of the risks to the operator. The challenge became for the Transport Agency to let go of this role and meet its duty through more indirect methods.

Some in the industry were coming to the same conclusion. The rail industry had been challenging themselves and the Transport Agency as to where responsibilities and accountabilities lay for safety, and what tools could support clearer accountabilities and allow the regulator to have confidence the industry would deliver on their safety commitments.

To enable such an approach, some regulatory tools, such as the Safety Case, needed to be recognised as being of equal, or greater, value to the industry than the

regulator – a fact commented on by Lord Cullen in the Piper Alpha Inquiry. Haddon-Cave (2009) paraphrased his observations, noting that the purpose of Safety Cases was:

to assure [the company] that its operations were safe ... Whilst the Safety Case had a further role in demonstrating this to the regulatory body, this latter function was a matter of only secondary importance. (p.166)

#### *Becoming a risk-based regulator*

With the focus on high-level outcomes, moving to a goal-based approach facilitates the Transport Agency in becoming a risk-based regulator, as expected of all agencies (New Zealand Government, 2017). Previously the Transport Agency had taken an across-the-board approach to oversight, working across all areas of harm and pursuing serious issues as they arose. This was an ineffective approach (Sparrow, 2008; Baldwin and Black, 2007) as it spread Transport Agency resources too thinly and intervention was too transient to have lasting effect.

Again, this challenge can generate uneasiness. Becoming a risk-based regulator means consciously deprioritising other potential sources of harm. These sources of harm may still be important, but just not as important as others. In addition, there is uncertainty in decisions as to where the greatest risk is.

The result is it places a great deal of responsibility on the regulator - what if the Transport Agency makes the wrong choice and it is a different risk that leads to the next catastrophic accident? Being clear about the evidence base (and limitations of it) and each party's accountabilities in respect of the targeted risks and general risks helps move beyond the inertia this can cause.

#### **Reflecting these changes through Safety Cases**

The Transport Agency's re-positioning of the Safety Case's role in the regulatory framework has been a core outcome of the change process. Better utilisation of this tool is both reflecting and driving many of the changed perspectives within

## The RAF Nimrod mid-air explosion

The Haddon-Cave inquiry (Haddon-Cave, 2009) into the loss 14 aircrew after British Royal Air Force (RAF) Nimrod XV230 exploded in mid-air serves as one of the most well examined and illustrative studies of the potential weaknesses of Safety Cases.

The report made 12 observations, which included the following failures of the Safety Case process at the RAF

1. Safety Cases had become too long, bureaucratic and contained impenetrable detail, often simply to give a "thud factor".
2. Safety Cases gave equal attention to minor hazards as they did catastrophic hazards.
3. Safety Cases were routinely outsourced and reduced to mere back-office paperwork with little appreciation or personal interest in the subject of the Safety Case.
4. Safety Cases were a compliance document that looked for evidence to justify a predetermined answer that the system is safe, rather than look for evidence as to why it might not be.
5. Safety Cases were "shelfware", rather than living documents to keep abreast of hazards and cultural changes.

Haddon-Cave commented:

The Nimrod Safety Case was a lamentable job from start to finish. It was riddled with errors... Its production is a story of incompetence, complacency and cynicism... The best opportunity to prevent the accident to XV230 was, tragically, lost.

the Transport Agency and the industry. The Transport Agency has gained several insights regarding its regulatory role and being a risk-based regulator through focusing on this tool.

These insights are similar to many other industries' experiences with Safety Cases, such as the Nimrod mid-air explosion (see boxed text), the Gulf Oil disaster (United States, 2011) and as surveyed by the United Kingdom Health and Safety Executive (Vectra Group Limited, 2003).

#### *Avoid owning the risk*

A Safety Case doesn't work well when used in a prescriptive way. The natural tendency is for an operator to describe how it is managing its safety. However, when a Safety Case descends into nothing more than a summary of how the safety measures are being carried out, all it offers is paper safety.

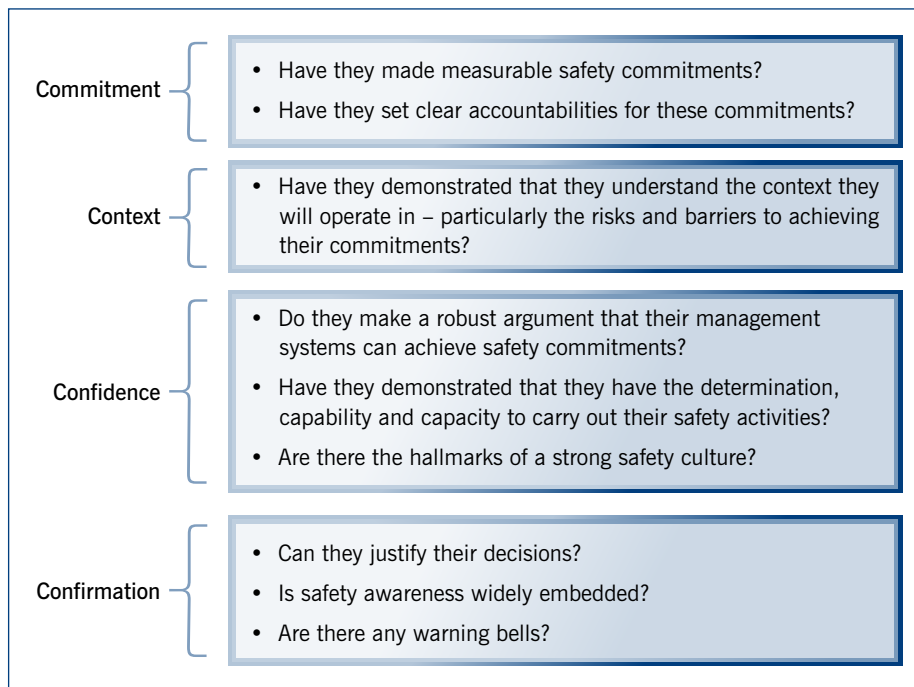
Safety Cases, in particular, require discipline by the Transport Agency to maintain its regulatory role by following goal-based principles and resist using its rail technical expertise to double-check the operator has chosen the appropriate safety approach. Instead, to ensure that an operator owns the risks of its activities, approval needs to be based on the strength of the operator's argument.

A consequence of this is that the regulator requires broad, rather than deep, expertise to assess a Safety Case. Rather than relying solely on rail and safety expertise, to critique the argument the Transport Agency staff also have to have expertise in such aspects as change management, assurance, safety systems and governance.

#### *Underpin trust with evidence*

In the traditional use of Safety Cases for heavy equipment installations, the Safety Case provides confidence by providing direct evidence of safety. However, for an

Figure 1: The Safety Case providing a trust framework



organisational Safety Case like in railways, such definitive evidence is not available – particularly when first licensed.

But rather than requiring blind trust, the Safety Case provides the Transport Agency with a framework to structure its confidence around – a robust and evidenced argument, embedded in the organisation, that the operator will achieve its safety commitments (see Figure 1).

This allows the Transport Agency to better understand the value-add of its role. Its engagement with operators is about building confidence in the Safety Case argument, rather than approving the safety system approach.

As an example, approval of Safety Cases involves site visits. Previously, the operator may have thought (rightly or wrongly) that the Transport Agency was approving its specific safety activities. However, the Transport Agency visits not as auditors but to gain evidence for a more subjective judgement as to whether the operator's safety argument stands up and it will achieve its safety commitments. Regulatory staff may still observe the adequacy of a rail vehicle or the network control approach, but as part of building a picture of the organisational competence, along with their observations of more general aspects

such as integration, communication and capability.

A framework-based approach also helps the industry understand they have to earn that trust – it's not just a case of "hands-off regulation".

#### *Simplify but don't compromise safety cases*

The Railways Act has imposed a sophisticated regulatory approach over an industry that includes operators with only basic competencies and comparatively low risks. The original users of Safety Case approaches were high risk, heavily resourced and complex operators – such as nuclear, chemical and extractives industry. Parts of the rail industry are, in contrast, hobbyists. This challenge has been observed in other sectors where Safety Cases or similar tools have been applied homogeneously over a diverse industry (Deighton-Smith, 2008).

Some rail operators may have the right approaches and culture in place, but struggle to join them up as a system and demonstrate it on paper. An operator may simply not have the competency to develop bespoke safety solutions and so rely on standard industry practices. It can be argued that a more prescriptive approach should be applied to such operators (Deighton-Smith, 2008).

However, the Transport Agency is confident that, given these operators still

face complex risks, the flexibility and safety-focus of a goal-based approach remains more effective. In essence, a good Safety Case is as simple as proving an organisation can make good decisions.

Focusing its efforts according to risk, the Transport Agency is looking towards pragmatic solutions that simplify requirements without losing the core principles of Safety Cases. This is not about turning the Safety Case back into a safety system summary or providing detailed templates that result in a paint-by-numbers exercise. The Safety Case still has to demonstrate the operator's own safety argument for it to have any value.

#### Conclusions

The move away from prescriptive regulation to the effective use of goal-based tools such as Safety Cases has both empowered and challenged the Transport Agency to better carry out its role in achieving the Government's objectives for rail safety. To be successful it had to recognise that the transition is not just a matter of better regulatory practice, but organisational transformation – for both the regulator and the regulated.

The Transport Agency is still undergoing this journey, but is already recognising important lessons:

1. The move to goal-based legislative approaches is positive for safety, but the cultural shift required should not be underestimated – transformational change approaches should be adopted and a learning environment encouraged.
2. The industry needs to be involved – it is not something the regulator does behind closed doors.
3. As a cultural shift, the change has to be deep but it can be achieved through a focus on the critical regulatory staff, rather than organisation wide.
4. Being a goal-based regulator is an uneasy experience – assurance of safety is based on trust (underpinned with evidence) in the capability and willingness of the regulated party, rather than having the ability to dictate the "right" solution.
5. Goal-based regulatory approaches support the transition towards

risk-based regulation by stressing the operator's overall accountability for their risks and allowing the regulator to focus on the high-level outcomes. Safety Cases and goal-based legislation are not an automatic panacea to organisational safety. Various inquiries,

surveys and the Transport Agency's own experiences have highlighted that a cultural transformation among the regulator and the regulated community is what enhances safety. A Safety Case helps demonstrate this has been achieved – it

doesn't create it. As Lord Cullen commented (Jeffrey 2013):

A Safety Case should reflect the organisation's safety culture. If that culture is sound and healthy – it should show.

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