

Enhancing System Safety: The challenge of the Sandilands Tram accident

I'd like to say thank you all for coming here this evening.

I'm very privileged to be the Professor of Railway System Safety here at Huddersfield.

I would like to stress that I'm speaking tonight in that capacity drawing on my twenty plus years serving the rail industry in a variety of capacities and offering my own personal reflections on the topic.

I'm going to be talking about how mass transport systems like rail and tramways can effectively respond to the significant challenges that major accidents present and provide the response that they demand.

As well as offering some personal advice to the tram sector at a challenging time, my reflections are intended to also offer a timely reminder of the history of the mainline rail sector during the last 20 or so years, and the need for rail to remember the journey that it has been on and the lessons that it has painfully learned.

Sandilands

On 9th November 2016, Croydon Tramlink Tram 2551 reached its maximum permitted speed of 80 km/h as it entered the first of three closely spaced tunnels. The speed of the tram should have reduced to 20 km/h as it approached the sharp curve round to Sandilands Junction. As we all now know, it didn't. The tram overturned and slid along the gravel, its shattered windows unable to contain its passengers within the relative safety of the tram. Seven people died and sixty-one were injured, nineteen seriously. Significant investigation has been undertaken, and driver fatigue has been cited as a key cause.

When major accidents like this occur, and the horrific, tragic results are so publicly considered, there is a visceral response, and a demand for more to be done. But how should we respond – industry, government, society - to turn this energy into the most beneficial action?

The Challenges

The key is to understand the nature of the challenge, and I think the key aspects can be summed up as follows:

1. Ensuring that the immediate system is safe
2. Ensuring that safety is efficiently and effectively managed going forward
3. Regaining confidence in the wider transport system

All three of these things need to be addressed in parallel, and they don't always drive the same actions.

Ensuring the immediate system is safe

The first priority in the event of an accident is to understand what went wrong, and to implement measures to address the causes in a timely fashion. Quick action will tend to look at the arrangements local to the accident, or the organisation or organisations directly affected.

Where the failures can be readily understood, action can be rapid. Following the Sandilands accident for example, rapid action was undertaken to improve speed warning signs, and to fit a monitoring

system to detect when drivers were fatigued. This immediate action tends to address the obvious and essential fixes.

Beyond immediate fixes, confidence is needed in the underlying safety management approach. The management arrangements need to be reviewed and tested. Given heightened concerns this has to be tested both in practice and on paper: there are clear requirements about how transport safety should be managed, and major accidents serve as a warning for all parties to review their arrangements.

Ensuring that safety is efficiently and effectively managed

In the aftermath of a major rail accident there is the obvious potential for a kneejerk reaction. Those moving hastily, in response to heightened, amplified levels of public concern, can make poor decisions and unwise investments. In addition to these not being effective to address the intended risks in response to the specific accident, resources are stretched and disproportionate focus on one area of risk inevitably means less investment elsewhere, in an area that might be more valuable but unfortunately less newsworthy. The net result of overdriving on one particular area is that there will likely be a sub-optimal safety outcome overall.

Regaining confidence in the wider transport system

Regaining confidence in the transport system is more complicated. If there is no confidence in the railway it cannot be effectively operated. Any business or undertaking only survives on the basis of the confidence in it.

So yes, the immediate measures can be identified and implemented relatively easily, but major accidents of this type generally suggest systemic, strategic failure, and require a commensurate response. But they also demand that response urgently: creating a tension.

The solution: understanding risk

The solution to the challenge pivots on one key principle, and one that is firmly embedded in transport regulation in the UK and Europe. Understand the risks, and act in a risk-based way.

'Risk' is widely understood to relate to both the estimated losses which can be caused by a future event and the probability of occurrence of that event. Using this probabilistic approach, helps to achieve an optimal safety outcome which balances safety, cost and performance.

Acting in a risk-based way allows decision makers to reduce risk in the most efficient and effective way. It also allows the responsible parties to clearly demonstrate that they have done this.

Why is it hard to act in a risk-based way?

So if the solution is that simple, why is there difficulty in applying it?

One of the problems is the understandability and solidity of risk as a concept. As decisions need to be made based on future uncertain events, a degree of uncertainty is involved. And when that uncertainty relates to events with legal implications, including the increasing threat of custodial sentences, confidence in decisions becomes more difficult for those with accountability. After an accident, maintaining a dispassionate, objective view around such issues is therefore difficult.

This is further complicated by certain natural human traits which can hinder good decision making, particularly in an environment of heightened concern. The work of Nobel Prize winning psychologist

Daniel Kahneman and others has shown there are certain traps we habitually fall into in making decisions and judgements, and two of these are particularly relevant to this debate.

One is sometimes referred to as “hindsight bias”. This is the inclination to see past events, such as accidents, as more predictable than they really were. Thinking in a risk-based way means that it is recognised that unlikely events do sometimes happen. The view of risk and its acceptability might not be significantly affected by an accident: risk can never be completely eliminated. But in a post accident environment it is very easy to be seduced by the view that ‘this was an accident waiting to happen’. This can drive a ‘blame’ culture, something which is the very antithesis of good safety management, which is based on open learning.

The other is “narrow framing”. This refers to people’s tendency to view problems in isolation, rather than taking a broader view. Transport systems have to deal with a whole range of issues and a portfolio of risks, and if one particular issue or set of circumstances is focussed on disproportionately, optimal outcomes won’t be achieved. Focussing on single accidents as the justification for strategic decision making is very likely to be flawed: risks and resources must be looked at consistently and holistically to achieve the optimal level of safety performance. For example, you are ten times more likely to be killed by being struck by lightning than when boarding or alighting a train. A genuinely risk-based approach to this topic would have led to significantly more political time and effort being devoted in the last year or two to more significant risks to the railway, like, ironically, the fatality risk to the rail workforce when driving cars. At the risk of changing the subject to a different, topical, area: Those who would play politics with safety and who would selectively amplify certain concerns disingenuously, therefore can actually worsen the problem.

So how do we overcome these challenges to deliver a rational, risk based approach to safety management? Before I come back to Sandilands, I want to talk about the lessons that we can learn from the experiences of the UK railway industry in the late 90s and early 2000s, which I think provide a good case study to explain some of the approaches that have achieved the desired result.

The railway experience

The period from the late 1980s to the early 2000s was marked in the rail sector by a number of fatal accidents. Railway collisions, derailments and level crossing accidents led to the death of people at Clapham Junction, Southall, Hatfield, Potters Bar and Ufton Nervet amongst other places. At the latter part of this period, in 1999, we saw the most catastrophic accident of all of them: the collision of two passenger trains following a signal being passed at danger led to 31 deaths at Ladbroke Grove in West London, and in many cases as a result of the fire, caused dozens more injuries, many of them life changing.

So how were the three key challenges addressed? Ensuring that the system is safe; ensuring that safety is efficiently and effectively managed going forward; and regaining confidence in the wider transport system.

How the rail industry dealt with the challenges

Ensuring the immediate system is safe

As with the train derailment at Sandilands, this was a watershed moment for the sector, resulting in a public inquiry by Lord Cullen, who had previously led the inquiry into the Piper Alpha disaster.

Part 1 of the inquiry was concerned with the investigation of the causes of the crash and the circumstances in which it occurred, lessons which should be drawn from what happened, and

recommendations for the improvement of safety in the future. Issues addressed included things like sighting of signals, driver management and investigation processes.

Ensuring that safety is efficiently and effectively managed

In the immediate aftermath of an accident there is often the public outcry asking what things will be done and declaring that “money is no object” – and these exact words were used in the political aftermath of Ladbroke Grove. But these types of commitment are wrong headed: interventions need to be carefully assessed, and as risk cannot be eliminated, expenditure does have its practical limits. Also, the need to consider affordability challenges the industry and government to identify the most effective places to spend it, ultimately bringing a safer railway.

Following Ladbroke Grove, and other similar accidents at that time such as Southall, a big debate ensued about the fitment of Automatic Train protection systems – systems to stop trains in the event the driver mistakenly fails to. Industry analysis before and after the accident indicated that, according to the decision-making criteria set out in the regulatory framework, fitment of an automatic train protection system was not a legal requirement for railway companies. This analysis required a robust understanding of the risk and used accepted benchmarks for investing in the reduction of risk. Whether you intuitively agree with this decision or not, it was a victory for due process, clarity and risk-based thinking. For companies to function effectively in such an environment, where liabilities would increase, as a result of circumstance, this was essential to bringing some stability to the industry.

In this case, regulation was passed and the government funded the fitment of TPWS – an effective but more basic signalling protection system than the automated ATP system discussed at the inquiry. In effect, the government funding provided recognised the societal tolerance for such accidents had changed significantly as a result of the accident, as the assumptions under which commercial agreements with private companies had been made had now changed. In effect the injection of government money acted as a pressure valve to help the industry deal with the circumstances of the accident without causing liability and a breakdown in the working of the railway. I will show later that this pragmatic intervention has proved to be a very effective one.

This way of working – structured, analysis-based decision making – has been strengthened in the years since, with enhanced guidance and regulation and improved data collection and risk analysis methods. A good entry point for the overview is the document ‘Taking Safe Decisions’ which was published by RSSB initially in 2008. This document sets out the agreed approach for how to go about risk-based safety management in the industry. Importantly it is supported by the industry, government and regulator so the methods to apply are clear: as long as companies are applying them demonstrably and acting in accordance with them, they should have no reason to fear hindsight bias and scapegoating following an accident.

Other key strategic cross-industry decisions have followed, from the implementation of policies to fit laminated windows to trains, to routine, robust risk assessment of level crossings and the setting of rules for when and when not to remove trains from service in the event of the failure of a GSM-R radio.

Regaining confidence in the transport system

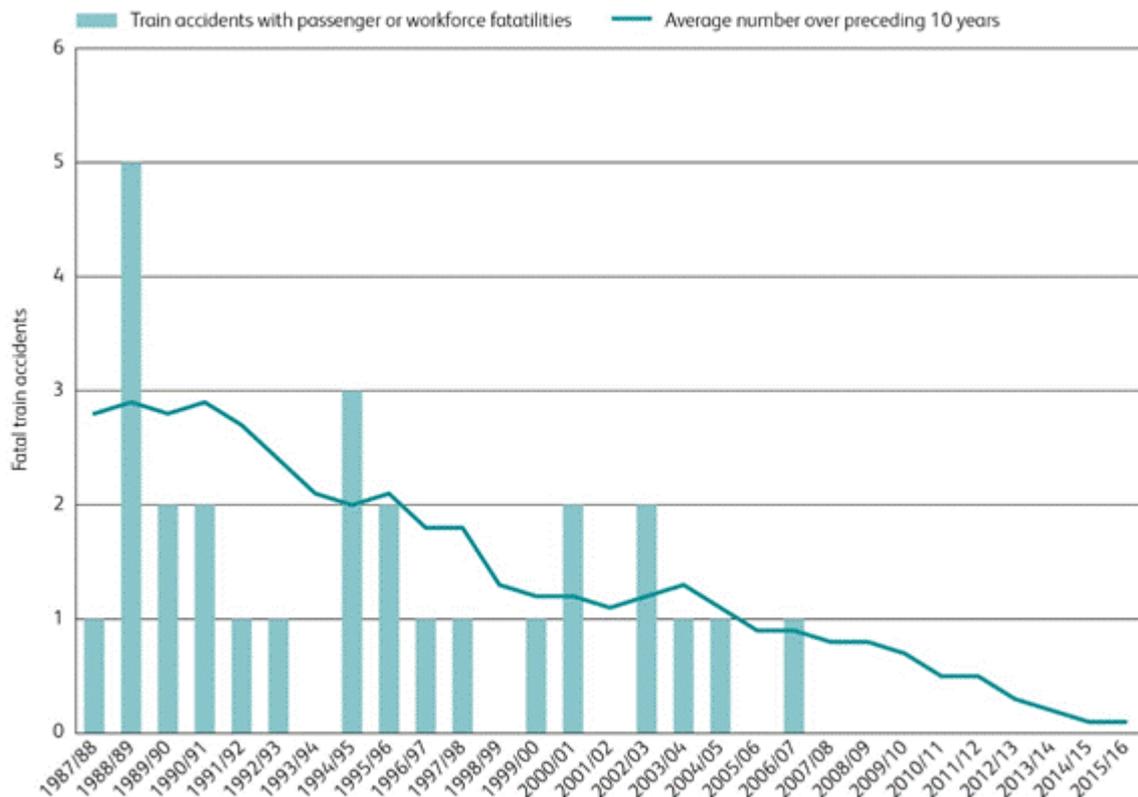
There is an inevitable loss of public trust when a major accident happens. In the case of the Ladbroke Grove railway accident, the holding of the independent public inquiry itself was a key action to regain that trust. To support robust learning and ensure that the right questions are asked,

independent expert views and strong governance are important, and this is not just the case in the aftermath of an accident: there is always a place for such a role. This was recognised in Part 2 of the inquiry report, which made a number of wide-ranging recommendations. These included recommendations for a suitably authoritative 'system authority', central assurance of contractors to the railway and ultimately the setting up of an independent safety and standards body within the industry itself.

The structures were there to provide the assurance that safety management activity was effective and compliant. However, what is ultimately sought is a strengthened safety culture and this takes time, and requires an environment in which there is effective challenge, internal to the industry.

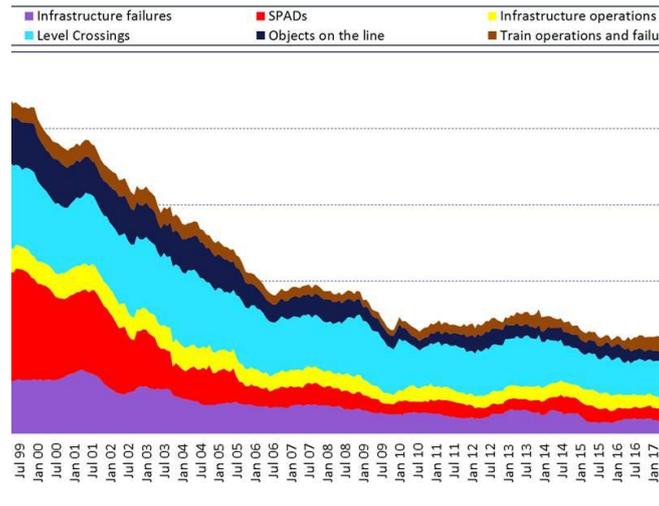
Over time the mainline railway industry has enhanced the extent to which it shares safety related data across separate companies.

So was the approach that was put in place a success? It is always difficult to make firm conclusions on such matters, but what is unquestionably the case is that safety performance of the rail network has significantly improved.



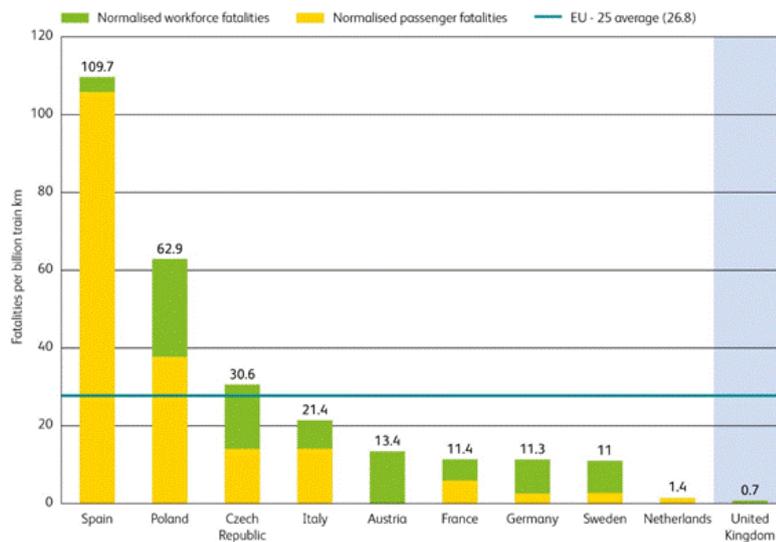
The chart above shows the count of train accidents per year in which at least 1 fatality has occurred. There has been a steep decline and it is now over 11 years since one has occurred.

A similar trend is seen in the Precursor Indicator Model.



This model, which is produced by RSSB, shows an estimate of train accident risk based on a much broader set of data. In the time since the Ladbroke Grove rail accident there has been a clear decreasing trend, although the measure has been relatively stable in recent years.

Another indicator is how our safety performance benchmarks with that of our peers in Europe. The chart shows workforce and passenger fatalities per billion train km across the 10 largest railway networks in Europe.



The UK is now clearly the safest of these major rail networks in Europe and arguably the safest of all EU countries. It is for this reason that any criticism suggesting UK railway companies don't manage safety effectively ring hollow. The culture in the industry is an open one, which supports learning and in my experience is not at all one of complacency.

This culture of continuous improvement has led to significant drives to push harder, not just on safety, but also on health, with the publication of the cross-industry health and safety strategy in 2016. This document sets out the industry's intent to work collaboratively, voluntarily, and often in areas such as suicide and employee lifestyle where the risk is not created by the railway and is therefore outside its scope of legal accountability.

Way ahead for Trams

So what does this all imply as the way ahead for the tram sector in Great Britain, following the Sandilands accident?

Ensuring the immediate system is safe

Initial work has, I'm aware, been undertaken to review local arrangements and deal with local issues. I also believe that with the support of the sector body UK Tram, there have been efforts to share and spread local learning more widely across the sector. This is, of course, absolutely the right approach.

Ensuring that safety is efficiently and effectively managed

I would suggest that the tram sector needs to work closely with its regulator, funders and others, to be clear and explicit about their shared approach to risk management. The approach needs to be effective and also to demonstrably stand up to scrutiny. In particular, clear criteria for safety investment are needed.

To support this, good quality risk information is also needed. This does not have to be strongly tied to data initially as a pragmatic approach can often be undertaken using the judgement of experts. But the sector needs a long-term strategy for data collection, and I would argue that it needs some sharing of such data, so that it can be pooled to support systemic learning, and to make the case for significant investment over time.

Regaining confidence in the transport system

Again, the experience of the overground sector suggests the need for the tram sector to continuously seek to improve collaboration on safety issues and share information and learning. This approach can be uncomfortable but it is a key part of work to drive improvements in safety culture. The governance needs to be in place to strengthen challenge on these issues in a safe environment.

- A strategic, collaborative approach where the industry sets out its intent: this provides confidence that systemic issues are being dealt with systemically but on an appropriate timeline.
- An environment of challenge and support to promote growth – even in the face of difficult issues: this implies strong and independent oversight, internal to the sector, to ensure the regulator does not need to routinely step in.

Ultimately, similar machinery has been built with significant investment in the 20 years since Ladbroke Grove, and is being constantly evolved in the mainline railway. Those of us in the rail sector are here to support our tram colleagues in building or adapting these tools as required.

Ultimately the approach set out:

- delivers the level of safety that the public both expects and is prepared to pay for.
- Provides a basis for clearly accepting or rejecting measures, and clarifying who pays.
- Allows the business to function in a commercial environment

Thankfully....the right answer is also the most cost effective in the long term.

Thank you.