

MAKING BEST USE OF DATA AND INTELLIGENCE IN DETERMINING REGULATORY ACTIVITIES ON GREAT BRITAIN'S RAILWAYS

Garry Stimpson (lead presenter) *

Head of Capability, Railway Safety Directorate, Office of Rail and Road (ORR), 25 Cabot Square, Canary Wharf, London, United Kingdom, EH14 4QZ. Over 24 years regulatory experience in health and safety, I am now Head of Capability at ORR, leading our professional development and competency teams to ensure our front line railway safety inspectors are trained, current and competent to regulate health and safety on the railways of Great Britain.

*(Email: garry.stimpson@orr.gov.uk, ++447795644420)

BACKGROUND – WHY WE HAD TO CHANGE AND IMPROVE OUR USE OF DATA AND INTELLIGENCE

1.1 The Office of Rail and Road (ORR) regulates health and safety on Great Britain's railways – mainline, trams, light rail (including metropolitan metro and underground systems) and heritage railways. The Railway Safety Directorate (RSD) of ORR comprises the inspector staff of Her Majesty's (HM) Railway Inspectorate (the "Inspectorate") and the Policy and Strategy Division staff who provide strategic direction, operational guidance and support to the Rail Inspectors to plan their regulatory interventions with the industry. RSD's key responsibilities are to:

- provide health and safety guidance and conducting research to promote continuous improvement;
- publish reports on the rail industry's health and safety performance;
- carry out inspections to ensure that the train and freight operating companies and Network Rail (who manage the mainline infrastructure) manage both passenger and occupational health and safety risks appropriately;
- investigate breaches of health and safety regulation on the railways; and
- take informal and formal enforcement action, including improvement notices and prosecutions through the criminal justice system.

1.2 Together the two parts of RSD work towards ORR's strategic objective for a safer railway, with a vision of zero industry caused fatalities and major injuries to passengers, the public, and the workforce.

1.3 RSD protects the health and safety of everyone associated with the rail industry by ensuring railway businesses have mature health and safety management in place. This includes identifying, assessing and controlling risks properly.

1.4 ORR seek assurances across all the sectors RSD regulates by confirming that duty holders are controlling risk. We track these risks and overall health and safety performance using data, industry risk modelling, and intelligence from our inspections, audits, and investigations. This gives us a picture of the risk control and management

maturity of each duty holder, sector and the rail industry as a whole, and how they are changing over time.

1.5 Where we identify that duty holders are not complying with the law, then we can take enforcement action to ensure that employees, passengers and members of the public are protected. [ORR's health and safety compliance and enforcement policy statement 2015 | Office of Rail and Road](#) explains how we will enforce health and safety law.

1.6 Collectively, evidence from our activities helps guide our strategy and priorities so that we can continue to ensure risks are effectively managed. Our ambition is for ORR to be the world's leading health and safety regulator for railways.

1.7 As a public authority we must be accountable for our actions and ensure our actions are transparent and proportionate. We must prioritise our interventions on those health and safety issues which pose the greatest risk to the public, passengers and workers. Having a clear understanding of the whole industry safety risk profile is therefore key to our ability to prioritise appropriately. By identifying and prioritising significant risks helps us to focus our resources where we can make the greatest impact on reducing risk.

1.8 Our [Health and safety regulatory strategy \(orr.gov.uk\)](#) document sets out our approach to regulating health and safety risks created and managed by Britain's railways. It looks at how we drive continuous improvement, deliver cost effective and safe railway, to be amongst the safest in the world.

1.9 We aim to structure our inspections, audits and activities accordingly. When allocating our resources, we take due account of the things we must do which are:

- our statutory activities, including granting permissions, work on level crossing orders, issuing train driving licences, and following up recommendations from the Rail Accident Investigation Branch (RAIB) which is an independent government Agency which conducts no blame safety investigations into incidents on the British railways;
- testing aspects of the safety management systems of major duty holders over the normal five-year life cycle of their Safety Certificate or Safety Authorisation;
- reactive work, such as mandatory investigations and any subsequent enforcement; and
- proactive inspection work is where we have greater flexibility to use our resources. We plan our work and refine our plans to take account of events and other changed circumstances. Therefore, the actual split of our resources can change during the year, particularly as a result of essential reactive work.

1.10 Our health and safety work plan for each work year is guided by the evidence about where the industry, and individual duty holders, are on the journey towards our vision of zero industry caused workforce fatalities.

1.11 We gather evidence from our own and the industry's experiences, including:

- our regular audits, inspections, investigations of incidents, complaints, intelligence from our enforcement activities and monitoring of health and safety performance indicators;
- Rail Safety and Standards Board (RSSB) Annual Health and Safety Reports (AHSRs);
- mainline accident and incident data collected in the RSSB Safety Management Information System (SMIS) and analysed using its Safety Risk Model (SRM), as well as Network Rail’s own internal safety monitoring;
- London Underground’s safety and environment database (LUSEA) and its Quantitative Risk Assessment model;
- information, intelligence and reports received from the light rail and heritage sectors (including outputs from the developing risk model for tramways);
- accident and incident data reported to us under the Reporting of Injuries Diseases and Dangerous Occurrences Regulations (RIDDOR);
- RAIB investigation findings; information received from other stakeholders, such as passengers, workers or trade unions;
- informed, peer-reviewed, opinion from specialist experts; and
- intelligence from European Union data sources and other international developments.

1.12 This evidence helps identify risk areas. ORR has used risk assessment methods for many years to identify regulatory priorities. This risk assessment and risk ranking (RARR) process was an iterative process with modifications made each year to improve the accuracy and relevance of the end product.

1.13 Every year, at the start of the annual business planning cycle, we would hold RARR workshops to determine the risk profile of each of the main sectors of Britain’s railways – the mainline railway, Transport for London (TfL), the heritage railway sector and trams and light rail. The outputs from the workshops would then help the operational planners at team level to determine what topics or areas would have priority over other topics.

1.14 We aimed for a structured method for analysing data and bringing together wider intelligence and expert judgement, in order to prioritise and target our activities. An important part of our risk prioritisation process was to anticipate new and emerging risks and to foresee where our existing risks might change in their importance.

1.15 However it was becoming clear to RSD that there were significant issues with the RARR processes and we could not continue as we were. In particular we were not making best use of the available data and were becoming over-reliant on the professional judgement of our railway inspectors.

1.16 Whilst professional judgement is important, there was often little clarity as to what safety data underpinned their judgement. The railway inspectorate is a dedicated, professional and experienced group of people. The danger was that people may unconsciously prioritise their own biases or opinions without fear of challenge or questioning what evidence lay behind their bias or opinion.

1.17 The processes had lost the confidence of those involved and so they did not trust the results, which meant there was a risk that only professional judgement, unsupported by data or intelligence, would determine our operational priorities. In short, we thought we were probably making the right decisions but at times had little or no explicit link to supporting evidence to justify those decisions.

OBJECTIVE – HOW RSD IMPROVED ITS PROCESSES AND USE OF DATA AND INTELLIGENCE TO BETTER SUPPORT DECISION MAKING ON OPERATIONAL PRIORITIES

1.18 The primary purpose of this paper is to show how since RSD embarked on a 4-year programme of improvements to improve its use of data and intelligence to provide evidence for determining our regulatory priorities and develop a risk profiling lifecycle which was simpler, properly designed, reflected regulatory best practice and most importantly has the full trust of the inspectorate.

METHODS – IMPROVING USE OF DATA IN DECISION MAKING IN RSD RISK PROFILE EXERCISES

1.19 The aim of the programme was to deliver a risk profiling lifecycle which met the needs of the end users (the inspectorate), made effective use of the available data and intelligence and allowed RSD to state with confidence that we were an evidence-based regulator who made transparent and proportionate decisions about operational priorities.

1.20 The diversity of safety hazards and range of factors that must be taken into account to establish the relative size and nature of safety risks is considerable. This and the susceptibility of human beings to cognitive bias makes assessments of risk profiles based on judgement alone vulnerable to error – hence our concern about the influence of professional judgement in the process.

1.21 Furthermore, ORR has a duty to be transparent and accountable and this means that RSD must have a documented process, supporting evidence and a record of its decisions.

1.22 The aim of any strategic risk profiling exercise is to provide both a structured approach to assimilating the complex range of factors and a record of the process and outcome. It supports professional judgement with evidence where available to support, not determine, decisions about priorities.

1.23 The problems with the existing RARR process were as follows:

- The RARR process had developed piecemeal over the years and there was no common understanding or agreed position on exactly what ORR meant by risk assessment and risk ranking or risk profiling. This lack of a common position led to confusion and differences of opinion during and after the process which on occasion corrupted the outputs;
- RSD had access to a significant amount of industry data and intelligence from a wide variety of sources. However too much reliance was placed upon the individual managers to analyse the data themselves and identify trends. In reality their operational workloads prevented them having anything more than a cursory awareness of the detail;

- also, as senior decision makers were not trained analysts, they risked drawing incorrect or misleading conclusions from the data;
- we were becoming too reliant on the recollection and professional judgement of senior managers, without any evidence to check or challenge their positions;
- there was no clear link in the post-RARR record of proceedings to any data or evidence source to support any decisions on priorities;
- RARR assessed a range of known accident scenarios against a set of criteria designed to establish the size of the risk, how well controlled it is, whether it is changing, how much influence we have and how much external pressure ORR was under to act. The range of scenarios assessed were a mixture of hazards and harm that have been developed iteratively over several years. There were a large number of scenarios and they ranged from highly specific to more general and from catastrophic accidents to minor injuries. However, the list was not exhaustive and scenarios were often added to fill perceived gaps. This approach was not sustainable. Changing definitions even slightly every year as to what hazards and risks were being considered as part of the process meant we could not identify trends;
- the scenarios were assessed once a year in workshops attended by senior inspectors. Due to the number of scenarios that need to be individually scored against criteria, the workshops last two whole days each (per industry sector). It was difficult to maintain focus and consistency throughout the whole duration of the workshops;
- the algorithms behind the scoring were not well understood by participants and generated some results which did not match the expectations of inspectors. It was therefore assumed that the algorithm is flawed;
- over-reliance on professional judgement as sole deciding factor was seen by all concerned as a worrying trend; and
- we needed a clear audit trail to explain why we prioritized some topics over others.

1.24 The first priority was to put trained ORR information and analysis (I&A) specialists in charge of assembling the data and intelligence. The I&A team then held a preliminary data and intelligence workshop several weeks ahead of the main risk profiling workshops where they presented analysed feedback from the data to the senior managers. Often this was simply a case of presenting analysed data from trusted sources such as the RSSB Annual Health and Safety Report. I&A colleagues also developed a Power BI tool to allow easier breakdown of large data sets into more presentable and manageable categories. The use of I&A colleagues had several benefits:

- this saved valuable time for the senior managers and allowed them to be better prepared, and ask questions ahead of the main planning workshops;
- it removed the risk of untrained personnel drawing incorrect or misleading conclusions from the data; and
- we now had a list of trusted data sources with which everyone was familiar and restored the link between the risk profiling exercise and the available data and intelligence. We could now explain what evidence supported professional judgement in any given scenario.

1.25 We then made the decision to discontinue with the previous RARR process and develop a new process from the beginning. This included a name change from the RARR process to “risk profiling exercise” to remove any association between the new process and the previous RARR process which by no lacked credibility with most users and

participants. This decision to start again required considerable additional resource but was ultimately the correct decision.

1.26 We consulted widely with the Inspectorate during the development stage, which showed them that we were genuinely interested in their feedback and comments, and that the new risk profiling exercise would address their concerns and requirements.

1.27 We also agreed upon a common definition of risk profiling:

- Strategic risk profiling is a practical tool that assists us with assimilating the various factors that need to be taken in to account to build a credible profile of safety risk, where we believe our intervention is most needed and where we believe we can be most effective.

1.28 We also then developed an agreed list of hazard-based descriptors. They are the most frequently used type of descriptor and were easier to draw comparisons and share data with industry bodies. Hazard based descriptors are the most commonly used in risk assessment. They describe the hazardous scenario (potential to cause harm) rather than harm itself; for example, a rail break or earthworks failure.

1.29 We settled on a list based on RSSB's Safety Risk Model (SRM) descriptors, a trusted external and independent (from ORR) source of data and intelligence for us and the industry. This removed the challenges of the previous list of accident scenarios which were a major source of confusion and debate in previous years.

1.30 The way hazards are described is key to any risk profiling exercise. The descriptions are the basis for the assessments and are the key component of the output. Settling on an agreed list of descriptions which could be quantified or qualified by evidence was key to winning back the confidence of the Inspectorate.

1.31 We split hazards into groups that shared similar risk tolerance characteristics. We adopted the breakdown often used in industry of train accident/workforce/passenger and public which enables us to assess risk in the relevant context.

1.32 Finally we engaged the services of external consultants to help develop the wider supporting framework surrounding the risk profiling exercises. The risk profiling exercises are part of our wider business planning processes which determine resource and budgetary decisions for RSD and the wider ORR. Bringing in an independent body to look at our internal processes, procedures and structures was key to the overall success of the programme. They challenged conventional thinking, brought in their own professional experience and knowledge.

1.33 A key requirement of the contract was that the consultants benchmark our processes against other safety regulators in Great Britain and internationally. This benchmarking exercise showed us that all regulators struggled with how to use and analyse their data, that they have similar challenges in terms of cost/effort, transparency, and balancing professional judgement against incomplete or unreliable data. ORR was reassured that our problems were not unique and that learning the lessons from other regulators would allow us to design a process which was genuinely the amalgamation of best practice from around the globe.

1.34 Importantly the consultancy work confirmed that our ongoing attempts to simplify the risk profiling process and regain the confidence of the inspectors and re-establish the

link between the data and decision making were the right things to do in terms of international best practice. Throughout the contract the consultants worked closely with the project team and several RSD risk profiling champions, drawn from the Inspectorate. The risk champions ensured the new process was built with the needs of the inspectors as a central component, and which allowed the risk champions to spread support and understanding amongst the rest of the inspectorate for the new and improved processes

1.35 Following the recommendations from the consultants' report, we developed newer and simpler processes for each of the main sectors – mainline, light rail and trams, heritage and TfL, which reflect the differing make up of each sector. For example whilst mainline is dominated by Network Rail and a relatively small number of train and freight operating companies, who all have reasonably mature safety management systems and considerable financial resources, the heritage sector in Great Britain consists of several hundred railways often run on a voluntary basis by volunteers with little or no experience of modern railway safety management techniques.

1.36 The simpler approach removed the complicated algorithms or weightings associated with the RARR and instead relies upon a series of binary responses (yes/no) to structured questions to which evidence must be allocated to determine the risk score. The results can then be plotted on a 2x2 grid to compare scores and track changes year on year. Initial feedback from the risk champions and senior managers is that the simple nature of the process, which places importance on professional judgement supported by trusted and available data and intelligence, is appreciated and allows them to make more informed decisions.

RESULTS – A NEW AND IMPROVED PROCESS WHICH MAKES BETTER USE OF DATA AND INTELLIGENCE

1.37 RSD is now confident we have a risk profiling process that draws from all of the credible and trusted sources of data information available to us, gives us a tool that facilitates the methodical assimilation of all relevant factors and provides a record of the deliberation and decisions made relating to proposed operational priorities.

1.38 For the future the new process gives us the potential not just to compare hazards and risk within each sector, but the possibility of comparing the sectors with each other which will allow us to assess how we allocate inspector resources across the whole of the inspectorate.

1.39 As a regulator and public body, we must be seen to be transparent, accountable, consistent and proportionate about how we make decisions and use our resources. We also need to be seen to make explicit the link between data and intelligence and those decisions to avoid accusations of making unfair or arbitrary decisions. Improving our risk profiling processes, benchmarked against international best practice, allows us to be confident that we have a “best in the class” process for making those decisions.

CONCLUSION – BEST IN CLASS

1.40 Through our better use of data and intelligence and ensuring that the link between decision making and the available data is explicit in our risk profiling discussions, RSD has regained the confidence of its staff in the process. We still place a heavy reliance upon the professional judgement of our highly experienced inspectors, as they see the reality of health and safety on Britain’s railways every day of their working lives. However we could not continue with a process which did not make better use of data and intelligence to underpin and support, and when necessary, challenge that professional judgement.

1.41 Our new processes are simpler, reflect international regulatory best practice, have that important buy in from the inspectorate and make explicit the link between the available data and decisions. Ultimately, it is a smarter process which delivers a more reliable output than we have had in the past and allows ORR to state with greater certainty that we are an evidence-based and risk-based regulator.

Keywords: safety; data; regulatory; risk; process