Strategy for regulation of health and safety risks - chapter 7: Rolling Stock Asset Management

ORR strategy for Rolling Stock Asset Management

How ORR will address this topic:

The industry, regulator and other stakeholders over a period of time have developed a number of protocols relating to the management of rolling stock risk. These include regulations, guidance and standards. With the introduction of new technologies, material developments and changes in operating practices there is a steady evolution in protocols and practices.

The industry faces a number of challenges such as increased passenger demand; the continued service operation of aging rolling stock until such time as replacement fleets are available; managing new fleet introduction and the associated maintenance arrangements; managing and delivering legislative changes and requirements such as the Person with Reduced Mobility Technical Specification for Interoperability (TSI), and greater electrification of the network, all of which will need to be delivered safely. This is complicated by supply chain issues.

The introduction of technological improvements such as the European Rail Traffic Management System (ERTMS) and increasing reliance on software based systems will provide a significant challenge to the industry in terms of developing the skills and competencies required to effectively control and modify rolling stock to accommodate such equipment.

Entities in Charge of Maintenance (ECM) should reduce risks associated with the maintenance of vehicles, particularly in respect of freight wagons where National Safety Authorities (NSA) now have a supervisory and surveillance role.

The heritage sector continues to grow and its rolling stock continues to age well beyond its normal life. Maintaining expertise within the sector will be a challenge as well as the management of antiquated stock.

We will work with industry to encourage:

- safety by design, with identified risks being engineered out rather than exported into operational controls
- consideration and use of emerging technologies where they can improve vehicle asset management
- focus on the risks that engineering change, particularly software modifications which adversely affect the integrity of train borne safety critical systems.
- focus on areas where a lack of awareness of the original design parameters and / or repeated overhauls impact upon equipment that can ultimately compromise the integrity of key safety components, such as final drives.
- development of a strategy in dealing with the supply chain looking at the duty holder acceptance process, for example when vehicles are returned from overhaul but also focussing our attention on the supply chain directly through the requirements of S.6 of HSWA etc. 1974.
- Where issues are identified with existing equipment we expect industry to consider making improvement and, where applicable work as an industry for an industry

Index of issues discussed

Introduction

1. The term Rolling Stock can be defined as; any carriage, wagon or other vehicle used on track and includes locomotives. Different parts of the railway system often have different rolling stock challenges and issues to manage.

2. This chapter is concerned with the rolling stock asset and not operational aspects but does consider design issues.

3. Rolling stock is governed by standards. For the mainline GB railway this is achieved through compliance with the European Technical Specifications for Interoperability (TSIs) and, where necessary, with UK Notified National Technical Rules (NNTRs) and a demonstration of compatibility with the GB rail infrastructure. Under Interoperability GB is required to accept compliant vehicles from other European member states, although these might potentially have lower levels of overall safety in areas like interior passive safety.

4. We have a team of Inspectors dedicated to oversight of train operators and the rolling stock they operate. These Inspectors are supported by a specialist team of (professionally qualified) Engineering Inspectors who do work relating to rolling- stock-specific issues. The

specialist team also influences and provides guidance on new build and major overhaul activities through compliance with standards and the interoperability authorisation process.

5. We review industry monitoring information such as the national logs and National Incident Reports (NIRs) as they are circulated.

6. We undertake specific investigations where wider issues have been identified and work with the duty holders to ensure that appropriate remedial action is taken as well as monitoring those actions.

7. We carry out inspections on all operators using Railway Management Maturity Model (RM3) principles to benchmark the management systems that underpin the safety assurance of rolling stock. This baseline data will inform our future activity.

8. The recent data and trends on rolling stock failures shows a gradual overall decline in incidents from 2010/11 to 2014/5 in most areas but a slight increase in displaced or insecure freight loads:

Train operations and failures	2010-11	2011-12	2012-13	2013-14	2014-15
Trains and Rolling stock (brake/control)	23	33	19	6	5
Runaway trains	6	6	2	5	3
Displaced or insecure loads	27	29	19	27	33
Non-passenger rolling stock defects (other than brake/controls)	6	7	10	5	6
Passenger rolling stock defects (other than brake/controls)	51	42	51	31	41

Mainline

General / maintenance issues

9. Most maintenance of rolling stock is governed by the requirements of a specific vehicle maintenance plan, which prescribes maintenance activities and frequencies or event triggers for the relevant vehicle, although there is potential for variation amongst fleets according to Train Operating Company (TOC) specific requirements / adjustments related to duty cycles operated by the fleets. Any significant revision of Vehicle Maintenance Instructions (VMI) content is required to comply with change control processes. General compliance with these instructions/standards has typically not been a cause for ORR action.

10. Some of the rolling stock on the mainline network is in service at or beyond its nominal design life. General maintenance and life extension are areas that will continue to challenge the mainline industry. Whilst the correct maintenance regime should ensure on-going safety, older vehicles lack the latest, improved safety features such as the enhanced crashworthiness of more modern stock. When considering overhaul and life extension work we encourage industry to take the opportunity to examine the practicability of making improvements to the vehicles, especially where issues have been identified during service.

11. The Railways and Other Guided Transport Systems (Safety) Regulations 2006 (ROGS) require an Entity in Charge of Maintenance (ECM) to manage the maintenance of railway vehicles. ECMs responsible for freight vehicles are also required to be certificated by a Safety Authority. ORR as the National Safety Authority (NSA) for GB undertakes supervision and surveillance of ECMs (see Chapter 10 for more information).

The European Rail Agency (ERA) has proposed that the ECM process should be applied to passenger rolling stock in the future, but the benefits of this have yet to be demonstrated.

12. Modern rolling stock can be dependent on software and this increasingly introduces a new risk to rolling stock, specifically as and when changes are made to this software. There have been examples where changes made have introduced problems to wider train systems. This is an issue which should be managed and we expect that the change management processes should recognise this and be robust enough to identify such risk and control the consequences.

13. Adopting modern technology can also be a benefit, particularly in relation to proactive, predictive technologies that have the potential to remotely identify and detect failing components well in advance of ultimate failure allowing maintenance to be both better planned and implemented such that in-service failures are reduced. There are also systems being introduced that record images of trains that are entering and leaving depots. These images can be used to automatically monitor the condition of components that wear e.g. brake pads and pantograph carbons and also identify other components that are in a degraded state. We encourage duty holders to move beyond traditional maintenance practices and consider implementing such technologies.

14. Despite the industry processes for controlling the supply of components and services, a significant proportion of defects reported on rolling stock arise from issues with supplied components, whether from new or following overhaul. This is an area we are increasingly encouraging duty holders to work more closely with the supply chain to address and jointly formulate a longer term supply chain excellence strategy to improve upon this.

Wheel sets (including axle boxes and axles)

15. Wheel-set systems comprising axle, axle boxes, bearings and wheels, are a safety critical part of the rail vehicle and component failure can result in derailment and a high consequence event.

16. Failures of wheel set systems and final drives can arise for a number of reasons including insufficient lubrication, excessive loading and poor component assembly as well as a failure to appreciate the implications of any modifications to original designs, which can be challenging when no details of the original design parameters are available.

17. Axle boxes can overheat due to a number of issues and can be a precursor to an axle failure leading to a potentially serious event. In order to identify axle boxes that are beginning to degrade, there are on-board axle detection systems as well as line side hotbox detectors or acoustic bearing monitors mounted on some parts of the railway infrastructure that detect axle box temperatures/noise on passing trains. Work is on-going in the industry to increase and improve the levels of detection, which will further reduce risk. Technology is

now being deployed to detect unequal wheel loading across axles, which can be a precursor to derailment.

18. Train axles are subject to periodic examination to detect potential flaws. Although not seen as a significant problem at present, our operational intelligence suggests that there may be a limited number of Non Destructive Testing (NDT) axle inspectors available nationally. The industry (TOCs, Freight Operating Companies (FOCs), Rolling Stock Companies (ROSCOs) and maintainers) needs to ensure that sufficient succession management plans are in place.

19. Work is also taking place, within Europe and the industry, to consider the human factors associated with axle inspection and also whether there is actually a need for the existing arrangements in place for NDT. It is also worth noting, that should it be determined that the current NDT arrangements are excessive then the potential problem of the limited number of axle inspectors is much reduced.

Brakes / adhesion

20. The performance of rolling stock braking systems is critical to the safe operation of the railway. As rolling stock evolves new challenges need to be understood and managed for example, the rail / wheel interface and the effect on adhesion levels of the widespread use of disc, electric and dynamic brakes compared to the traditional tread brake.

21. Brake failure due to equipment/component failure has become uncommon in recent years. Although there have been a number of brake-related incidents which have been mainly caused by issues relating to safety critical components.

22. Reliable braking performance is likely to become even more important in the move towards the introduction of European Train Control System (ETCS) signalling[1]. It is critical that these systems will have predictable braking performance to enable the on-train computer to determine safe speeds and delivery of full automatic train protection. There is further work to be done to optimise algorithms and ensure that the duty holders apply the system intelligently to maximise benefits without compromising service delivery.

23. In response to the need to improve adhesion in both traction and braking the GB rail industry has selected to install on board sanding systems to mitigate the effects of low adhesion. With the desired increase in throughput in some routes and the need for automatic train operation to meet these braking challenges the industry will need to innovate and understand the impacts of new and developing technologies and systems. Electro-magnetic track brakes and eddy current brakes are alternative braking technologies that are now in use in other European countries but are not fitted to GB mainline rolling stock. More work needs to be done to evaluate the advantages and disadvantages of these new systems, to allow further consideration of their application to the GB network in line with the Rail Technical Strategy. The wider implications of low adhesion have been discussed in detail in the interface system safety chapter.

Train doors

[1] See: http://www.rail-reg.gov.uk/server/show/nav.2497

24. The three main issues with external train doors are:

- trap and drag incidents where the detection system has failed to detect the presence of an obstruction in the doors and allows traction to be drawn,
- doors opening and striking passing rail vehicles or fixed structures (open-door collision),
- passengers stepping/falling from incorrectly opened doors

25. Unfortunately there have been a number of trap and drag incidents which have resulted in injury to passengers. There have been issues with obstacle detection systems on some passenger stock which have required modifications to door systems. ORR will press the industry to look at improvements to door systems where it is reasonably practicable to do so. Such work may identify limitations in respect of what improvements can be made and so the final safety check by the driver, guard or platform staff still remains an important control measure in safe train dispatch.

26. There have been few reported instances of passengers falling from train doors since the introduction of central door locking on slam doors, and the withdrawal of older slam door Mark1 rolling stock which were both required by the Railway Safety Regulations 1999.

Passengers may however be able to fall from train doors if they open in between stations. There have been a number of these wrong side door failures with doors opening in traffic from which, fortunately, no one has fallen. This type of event is particularly dangerous as the train may be at considerable speed when the open door incident occurs. Some trains with slam doors require a dispatcher to check that doors are fully closed before the train leaves a station as the on train systems do not detect this.

Freight Wagons

27. The maintenance of wagons, including private wagons, is now the responsibility of Entities in Charge of Maintenance (ECM). The Railways and Other Guided Transport Systems (Safety) Regulations 2006 (ROGS) requires every wagon in operation on the national network, and associated ECM, to be registered on the National Vehicle Register.

28. Freight ECMs (who may be wagon owners and/or keepers) are required to hold a certificate to demonstrate that they are competent to manage and maintain wagons.

29. There has been a slight increase in the number of freight wagon derailments and one of the causal factors has been offset loads within shipping containers that increase the propensity for the wagon to derail on twisted track.

30. A pan industry working group initiated by ORR has been formed to examine this system issue, governing the interaction between wagons, permanent way and wagon loading configuration. We will continue to press for improvements in wagon loading and trackside monitoring equipment is introduced to detect and prevent unequally loaded vehicles form importing risk onto the mainline railway.

Heritage

31. The nature of heritage railways means most of the rolling stock in use is ageing and inevitably predates current standards and therefore needs to be effectively managed to

control associated risks. Whilst most people instantly think in terms of steam locomotives as heritage vehicles, the coaches, wagons and increasingly diesel locomotives can be of an equivalent age. This is complicated by the occasional use by main line operators of heritage traction either for charter or freight operations.

32. The heritage sector is inspected using the same principles as other duty holders operating rolling stock and we have an inspection team to perform this work. We use this team to carry out inspections including specific assessments of duty holders' capability to manage rolling stock.

33. The increasing age of the heritage fleet inevitably means that wear and fatigue will influence the ability to maintain vehicles in service, without significant repair or replacement of components. This is exacerbated by improving detection techniques, with latent defects, existing from manufacture, now capable of being identified. The availability of spare parts and changes to and availability of suitable replacement material(s) complicate the situation further. ORR will encourage and work with the heritage industry to develop robust engineering change approaches to managing these issues, particularly in relation to identifying risks from the changes introduced, to ensure that the resulting repair, modification or replacement are effectively controlled.

34. In contrast, there is a growing trend to build new heritage vehicles. These vary from builds that are completely new to those where parts from existing vehicles are assembled to recreate another class of vehicle. Depending on the intended use, there are a number of routes possible which govern the level of assessment undertaken prior to a heritage vehicle entering service. Whilst ORR has no formal role in approving new build heritage vehicles, we do have a role in approving the operators Safety Management Systems and will maintain oversight of them and engage with them to encourage a level of assessment commensurate with the intended operation. We particularly expect that projects can demonstrate use of approved designs and that changes from the (original) designs are effectively considered and assessed.

Glossary of terms	
Acronym	**Definition**
CoP	Code of Practice
DMU	Diesel Multiple Unit
ECM	Entity in Charge of Maintenance
EMU	Electric Multiple Unit
ERA	European Rail Agency
ERTMS	European Rail Traffic Management System
ETCS	European Train Control System
FOC	Freight Operating Company
FWI	Fatalities and Weighted Injuries
HRA	Heritage Railway Association
NDT	Non Destructive Testing
NIR	National Incident Report
NNTR	Notified National Technical Rule
NSA	National Safety Authority
ORR	Office of Rail and Road
PIM	Precursor Indicator Model
ROGS	The Railways and Other Guided Transport Systems (Safety) Regulations 2006
RM3	Railway Management Maturity Model
ROSCO	Rolling Stock Owning Companies
RSSB	Rail Safety and Standards Board
SRM	Safety Risk Model
TOC	Train Operating Company
TSI	Technical Specification for Interoperability
VMI	Vehicle Maintenance Instruction