OFFICE OF RAIL AND ROAD

Train Protection Systems

Guidance on Railway Safety Regulations 1999 and other railway safety regulations

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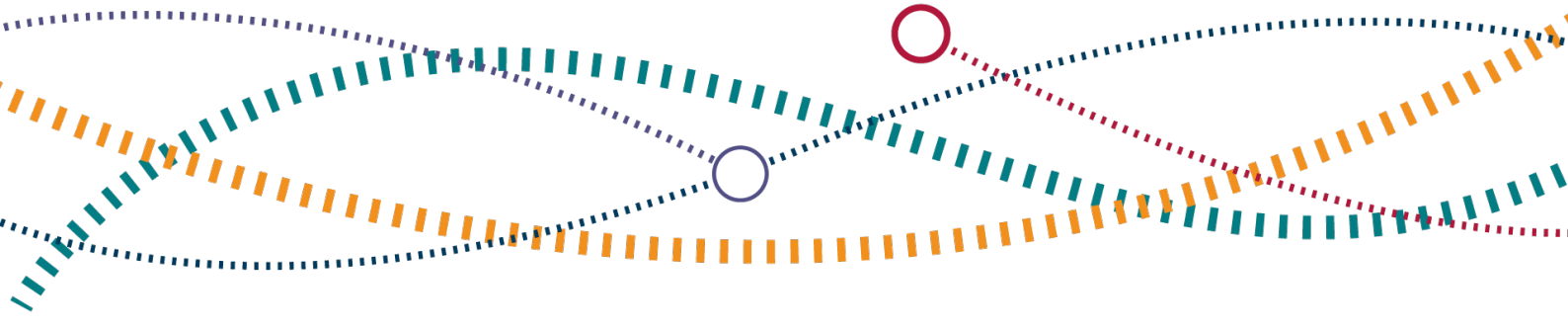

Contents

Executive summary

This document provides guidance on the application of The Railway Safety Regulations 1999 (RSR99) to train protection systems. It replaces the previous guidance in relation to these systems published in 2000 by the Health and Safety Executive (the previous health and safety regulator for the railway). This document also provides guidance on other legal requirements relevant to train protection systems.

This new guidance is intended to assist those who have legal duties (duty holders) in the interpretation of RSR99 requirements as we move towards the increasing deployment of automatic train protection systems. It is relevant to the mainline railway and metro systems. It does not provide guidance to duty holders on detailed technical or system matters, such as information regarding the use of train protection system modes or levels of protection available.

This is one of two guidance documents published by ORR on RSR99. The other guidance document, on Mark 1 type rolling stock and rolling stock with hinged doors, is also available on the ORR website.

This document contains guidance on:

- Interpretation of RSR99 in relation to train protection systems
- What train protection systems are
- Other railway related legal requirements relevant to train protection systems
- Managing the migration towards automatic train protection systems
- Train protection system exemptions

RSR99 also contains requirements which had to be met by a certain date. As these dates are in the past and the requirements have been met, this guidance does not refer to these elements.

This guidance does not place additional burdens on duty holders, introduce new duties, or prescribe how a train protection system should be designed, operated or maintained. All references in this document are to RSR99 as amended.

1. Meaning of train protection system under RSR99

Introduction

1.1 RSR99 was introduced in 1999 to implement the recommendations of the Investigation into the Clapham Junction Railway Accident (the Hidden Report) and following a series of fatal incidents arising from signals being passed at danger (SPADs) and collisions involving Mark 1 rolling stock.

1.2 RSR99 regulated the installation of a form of train protection system on the railway, the staged withdrawal of Mark 1 rolling stock and rolling stock with hinged doors without central locking.

RSR99 requirements

1.3 Regulation 3(1) of RSR99 prohibits the operation of a train on a railway unless a train protection system is in service in relation to both the train and railway. The Regulations place responsibilities on train operators and infrastructure controllers to ensure that no person shall operate a train on a railway, and no infrastructure controller shall permit the operation of a train on a railway, without a train protection system in service.

1.4 Regulation 2(1) defines what a train protection system is, and requires duty holders to ensure that one of two types of train protection system is in place. Where is it reasonably practicable to install it, duty holders should install train protection system equipment which automatically intervenes to control the speed of the train to ensure, so far as possible, that a stop signal is not passed without authority and that the permitted speed is not exceeded at any time throughout its journey.

1.5 Where that is not reasonably practicable, the definition of train protection system creates an absolute requirement for duty holders to install equipment which:

(a) causes the brakes of the train to apply automatically if the train either passes without authority a stop signal of which passing could cause the train to collide with another train, or travel at excessive speed on a relevant approach;

(b) is installed so as to operate at every stop signal referred to in sub-paragraph (a), except a stop signal on the approach to an emergency crossover, and at an appropriate place on every relevant approach.

1.6 In practice, this means that RSR99 requires the use of the Train Protection and Warning System (TPWS), which is capable of intervening and applying train brakes, as a minimum, but where it is reasonably practicable, a higher level of train protection system, known as Automatic Train Protection (ATP), which also controls speed throughout the journey. In this guidance, the term ATP includes systems such as European Train Control Systems (ETCS) and Communications-Based Train Control (CBTC).

1.7 TPWS is an intermittent train protection system as it provides protection at certain locations across the network. RSR99 requires duty holders who operate using TPWS to ensure that train protection is fitted at every 'relevant approach', a term which covers certain signals, speed restrictions and buffer stops. In practice, the 'relevant approach' definition requires train protection systems to be installed at locations determined to pose the most significant risk, such as at junctions where collision risk is higher (due to layout, substantial traffic or speed restrictions).

1.8 Since the introduction of RSR99, TPWS has been installed across the mainline railway at all legally required locations to ensure a minimum level of train protection at higher risk signals and junctions. On some routes, TPWS has been fitted additionally at more locations than required as a minimum. Infrastructure controllers should consider whether it would be reasonably practicable for them to install TPWS at additional locations pending the upgrading to forms of ATP in future. For example, there are locations such as signals at the approach to tunnels, viaducts or long bridges which may not fall strictly within the definition of a relevant approach but where the potential consequences of a collision may be greater than normal, or at other locations where the risk of a collision is greater than normal.

1.9 It is for infrastructure controllers and train operators to decide whether it is reasonably practicable to install ATP to the infrastructure and train and when this will be delivered. We understand that the mainline railway has plans to upgrade to ATP across all routes pursuant to the long-term plan to develop a digital railway and that many non-mainline operations already have ATP in place. To consider what is reasonably practicable, duty holders must make a suitable and sufficient assessment of the risks and compare the cost of implementing risk control measures (in terms of money, time and effort) against the reduction in risk those measures might achieve. Control measures must be implemented unless the costs

involved are grossly disproportionate to the safety benefits. This is a judgement to be made by the duty holder but ultimately, it is for the courts to determine what is reasonably practicable if a breach of the RSR99 requirements is in question.

1.10 For more information on reasonable practicability, please visit our Risk Management webpage.

1.11 There are limitations of relying on TPWS for risk control which is why RSR99 requires the use of ATP where it is reasonably practicable. At a minimum, where TPWS continues to be relied upon for train protection, duty holders must maintain their TPWS systems to control risks as intended. Duty holders must also be aware of the limitations of relying on TPWS and should ensure they take opportunities to continuously improve their TPWS. For example, where it is not reasonably practicable to upgrade to ATP, duty holders should consider and assess opportunities to improve the capability of their TPWS system by upgrading the onboard equipment or by fitting track equipment to more signals.

1.12 There is an additional legal requirement at regulation 5 of the Railway Safety (Miscellaneous Provisions) Regulations 1997, which is relevant to the management of train collision and derailment risks. This regulation requires infrastructure controllers to ensure, so far as is reasonably practicable, that equipment and procedures are in place for the purpose of preventing collisions between vehicles and with buffer stops, as well as derailments resulting from excessive speed or incorrectly set points.

1.13 RSR99 provides a legal defence for duty holders when a train protection system develops a fault (regulations 3(4) and (5)). Without this defence, duty holders would be in breach of their train protection system duties if they operated a train with a defective train protection system. RSR99 provides a defence which applies to train protection systems more broadly (regulation 3(4)) and also an additional legal defence which only applies where ATP is installed (regulation 3(5)). We expect duty holders to operate under suitable measures to mitigate the risk if a fault occurs, including operating trains at a reduced speed, and operating at the most appropriate ATP mode (if relevant). Such modified operations should be informed by risk assessments and be limited to allowing a train to complete its journey or be driven to a depot for repair.

What RSR99 does not cover

1.14 The requirements for train protection systems apply only on 'railways' as defined in RSR99. They do not apply, for example, to railways which have a line speed of 40 kph (25 mph) or less. This excludes most heritage railways.

1.15 Regulation 3(3) also prescribes that trains that were operated by the following companies immediately prior to RSR99 coming into force are automatically compliant with the train protection requirements, but only if there is in service, equipment which causes the brakes of the train to apply automatically if the train passes a stop signal without authority:

- London Underground Limited;
- Tyne and Wear Passenger Transport Executive;
- Strathclyde Passenger Transport Executive; and
- Serco Metrolink Limited.

1.16 Regulation 3(3) does not prevent these companies from upgrading their train protection systems to introduce a higher level of train protection. For example, the above companies are not prevented from upgrading their system to one that automatically intervenes to control the speed of the train to ensure, so far as possible, that a stop signal is not passed without authority and that the permitted speed is not exceeded at any time throughout its journey. If the result of an upgrade in technology is that the system complies with regulation 3(1), the regulation 3(3) exemption becomes redundant.

Required features of a train protection system

Train Protection & Warning System

1.17 The definition of a train protection system requires, as a minimum, that the system should provide automatic braking if a train passes certain stop signals without authority, or travels at excessive speed on the approach to certain signals, buffer stops, and speed restrictions. In practice, the regulations prescribe the functionality of a train protection system and where the system must be located. the system must comprise equipment on the track and on trains, operating in conjunction with each other. On the track, it will be necessary to install:

- ‘train stops' at certain signals; and

- 'speed traps' on the approach to certain signals and speed restrictions, and buffer stops.

1.18 Further legacy information on train stops and speed traps for TPWS, which is from the original guidance on RSR99 published in 2000 can be found at Annex C of this guidance.

1.19 The definition of train protection systems includes the term 'without authority'. This provides for a driver to override the train protection system if they have been given authority to pass a stop signal or for a pre-programmed speed limit to be exceeded.

Stop signals

1.20 Regulation 2(1) of RSR99 defines ‘stop signal’ to mean a signal conveying to the driver of the train an instruction that they should stop the train. This excludes a signal for shunting purposes only, a hand signal or a buffer stop.

1.21 ORR considers that where line-side stop signals are replaced by notifications of the need to stop on an in-cab display such as in modern signalling systems, this will still fall within the meaning of a stop signal under RSR99 and is therefore compliant, so long as it is an instruction presented to the driver of the train.

Automatic Train Protection

1.22 Where it is reasonably practicable, RSR99 requires ATP to be installed. ATP systems continuously monitor the speed of the train and compare the train’s speed with a safe speed which the system calculates on the basis of the train’s distance from stop signals and speed restrictions.

1.23 ORR considers fully-automated train operation systems, such as the Docklands Light Railway, are compliant with the requirements of regulation 3 of RSR99. This is because, despite the absence of stop signals, the system automatically intervenes to control the speed of the train and in doing so ensures so far as possible, that:

(a) a stop signal is not passed without authority; and

(b) the permitted speed is not exceeded at any time throughout its journey.

1.24 ORR considers that train protection systems which incorporate various modes which are integral to the system design are compliant with the requirements of regulation 3 of RSR99 when activated and operated under authority from the relevant controller for the system.

1.25 On the mainline railway, alterations to train protection systems on the infrastructure and trains may be subject to authorisation by ORR under The Railways (Interoperability) Regulations 2011. For more information on interoperability requirements, please visit our online information on interoperability.

Maintenance and upgrading equipment

1.26 Duty holders are required to ensure that their train protection systems are maintained, that the equipment continues to be suitable and sufficient at preventing collisions and derailment and that appropriate procedures are in place to prevent collisions and derailment (regulation 5 of The Railway Safety (Miscellaneous Provisions) Regulations 1997).

1.27 Duty holders should also identify the risks to their operations from known train protection system weaknesses and take appropriate actions to mitigate them. Duty holders should take opportunities to update their train protection equipment to improve the capability of that equipment and avoid obsolescence. Failure to maintain a train protection system is a breach of RSR99. Duty holders must also be aware that what is reasonably practicable can change as technology improves. Such developments may enable costs associated with upgrades to be reduced and deliver a changed risk profile. Duty holders must ensure they have appropriate processes in place to ensure systems are maintained and updated as they reach the end of their design life.

2. Other legislative requirements

2.1 In addition to RSR99, train operators and infrastructure controllers also have concurrent duties under other railway safety legislative frameworks including The Railways and Other Guided Transport Systems (Safety) Regulations 2006 (ROGS) and the Health and Safety at Work etc Act 1974, in relation to train protection systems.

Safety Management Systems

2.2 Under ROGS, transport operators (known as transport undertakings and infrastructure managers) of both mainline railway and non-mainline railways have a duty to develop safety management systems (SMS) that must meet certain requirements. A SMS is a formal arrangement for managing a safe working environment. The SMS must be proportionate to the size and nature of the operations undertaken.

2.3 A SMS is the basis for making sure a transport system runs safely and in accordance with ROGS. Duty holders must keep written records of their arrangements for managing safety risks.

2.4 Transport operators must have a SMS that is capable of controlling all risk arising from the transport system they are operating or managing. This includes train protection system related risks. Under ROGS, even 'lower-risk' operations (such as tramways and transport systems that do not operate at speeds above 25mph) that do not need safety certificates or authorisations from ORR must still have a SMS in place.

2.5 As part of the SMS, transport operators should include detail regarding risk assessments and how they will control new risk. Transport operators must put in place a change-management process to identify and control new risks, including changes relating to train protection systems or upgrades to modern signalling systems.

2.6 For more information on safety management systems under ROGS, please visit our Guide to ROGS.

Safety Certificates and Authorisations

2.7 Under ROGS, a safety certificate (for transport undertakings) and/or a safety authorisation (for infrastructure managers) is required to operate on the mainline railway as well as non-mainline railways such as the London Underground.

2.8 If a transport undertaking or infrastructure manager holds a safety certificate or safety authorisation and there is a 'substantial change' to the nature of the operation, they must apply for an amended safety certificate or authorisation. A substantial change relates to the change of 'type' and 'extent' of the operation, infrastructure, maintenance principles or energy supply.

2.9 Changes to the network and trains, including the installation of new forms of signalling used for train protection systems, constitutes a 'substantial change' which requires an amended safety certificate/authorisation.

2.10 If a duty holder makes a 'substantial change', they will need to apply for an amended safety certificate or authorisation. In addition to a 'substantial change', other changes (organisational, operational or technical), may require a dutyholder to amend their SMS and obtain an amended safety certificate or authorisation before they can take effect. Duty holders should discuss any proposed changes with ORR at the earliest opportunity. More detail on this process can be found at Chapter 3 of this guide.

2.11 For more information on safety certificates and authorisations under ROGS, including how to apply for an amended safety certificate, please visit our Guide to ROGS.

Common Safety Method for Risk Evaluation and Assessment

2.12 The Common Safety Method for Risk Evaluation and Assessment (CSM REA) (Commission Implementing Regulation (EU) 402/2013) applies when any technical, operational or organisational change is being proposed on the UK mainline railway system.

2.13 If the change has an impact on safety, the person making the change must decide whether it is significant or not by using criteria in the CSM REA. This is known as the 'significance test'. If the change is significant, the risk management process prescribed by the CSM REA must be used. If the change is not significant, the person making the change must keep a record of how they arrived at their

decision. In that instance, the change can be managed under existing internal change management and risk assessment processes.

2.14 We consider that a change of control, command and signalling system from physical lineside signals to a cab-based system (such as ETCS) is a significant safety-related technical change that should be assessed in accordance with the risk management process of the CSM REA. These changes will also involve changes to the operation of the control, command and signalling system and changes to the wider operating rules. These operating changes must be assessed together with the significant safety-related technical changes as part of the risk management process of the CSM-REA.

2.15 For more information on the application of CSM REA, please visit our CSM REA guidance.

2.16 Non-mainline railways making significant changes to any technical, operational or organisational aspect of the railway system must undertake 'Safety Verification' of the changes as required under ROGS.

2.17 For more information on Safety Verification for non-mainline railways, please visit our Safety Verification webpage.

3. Managing the migration to Automatic Train Protection systems

Progressive deployment of Automatic Train Protection

3.1 RSR99 was introduced to require a minimum level of train protection on the railways with the expectation that higher levels of train protection would be installed when reasonably practicable to do so. ORR therefore expects train operators and infrastructure controllers to plan upgrades to their train protection arrangements in line with this legal requirement and views the deployment of ATP systems as an important step to drive forward continuous improvement in risk management and to ensure safe operation in the event of human error. For example, we support the mainline railway's long-term plan for a digital railway and will continue to monitor progress of the deployment of ETCS.

3.2 Duty holders who are still reliant on TPWS for train protection should understand its limitations to control risks and continue to assess the risks that remain from operating with a lesser level of protection.

3.3 ORR recognises that the deployment of ATP systems on the railways will reduce many safety risks, however the deployment process itself is complex and often linked to other major upgrade projects. We will continue to work closely with industry to provide support on the regulatory framework and technical concerns regarding the deployment of ATP systems as they arise.

3.4 The migration to modern train protection systems will likely occur in a sequence of progressive upgrades to the lineside infrastructure and rolling stock and the provision of adequate training to staff so they have the competence to operate the new systems. We recognise that this likely will involve a period where there is more than one train protection system being operated. Duty holders must ensure they have clear plans and risk assessments in place for each step of the migration process, including clear timeframes for completion of each element of the migration (such as during a temporary overlay) and the project as a whole. Drivers and any other affected workers must be adequately trained in the new systems, including familiarisation and development of competence regarding different operating circumstances and the functionality of ATP systems.

3.5 Throughout the migration process, duty holders must ensure they operate at all times with a train protection system in place, including at the time immediately before TPWS is formally switched off and ETCS or other updates system becomes the only option to use. Duty holders must not operate on the railway if there are gaps in their train protection system during the deployment of modern train protection systems.

3.6 ROGS requires duty holders to make suitable and sufficient risk assessments (regulation 19) and work cooperatively to achieve the safe operation of the transport system (regulation 22). When the migration to modern train protection systems is being considered, the infrastructure manager and train operator should carry out a joint risk assessment to assess the risks associated with the change and identify measures to control them. Either party may take the lead on this process but the outcomes should be understood and agreed by all parties.

3.7 In addition to risk assessments, duty holders should work together to identify an appropriate forward programme of installation that reflects the considerations of reasonable practicability and the safety benefits associated with upgrading train protection systems. While this may include interim steps towards full ATP functionality, interim systems should not preclude or complicate the migration to full systems in due course.

3.8 Under the CSM REA (see paragraphs 2.12-2.15), duty holders must determine whether such a change would be deemed a ‘significant change’ and if so, carry out a risk assessment in line with the CSM regulation. If the change is determined not to be significant then duty holders should still carry out a ‘suitable and sufficient’ risk assessment as required by ROGS.

What do duty holders need to do to manage change?

3.9 Duty holders who hold a safety certificate or safety authorisation must notify ORR if there are any major changes to the transport system they operate or manage. This includes changes to signalling systems as this is a ‘substantial change’ to their safety certificate or authorisation which they will need to amend. Substantial changes cannot be brought into use until the relevant safety certificate or safety authorisation has been amended and re-issued.

3.10 When applying for an amended safety certificate or safety authorisation, duty holders will need to provide a submission pack containing the following:

- An application form for a mainline safety certificate or authorisation.

- If non-mainline, a covering email setting out what the application is for, the legal denomination of the company, name of the railway undertaking/infrastructure manager, company registration number, VAT number and type of application.
- A document that describes the safety management system and demonstrates compliance with the requirements set out in the ROGS regulations, with cross reference matrix mapping evidence contained in the safety management system against the assessment criteria. Changes should be highlighted in a different colour text so it is easily identifiable what elements of the SMS have changed since the previous application.
- Details of the affected parties consulted.

3.11 Duty holders can contact ORR at any time to discuss their existing safety certificate or safety authorisation and should contact ORR to discuss the renewal of their safety certificate or safety authorisation up to eight months before expiry of their existing safety certificate or safety authorisation. The associated application document must highlight any changes or proposed changes since the previous submission. Aside from this, the application process is the same as when applying for a new safety certificate or safety authorisation and we will issue the duty holder with a new safety certificate or safety authorisation if the application is successful. Duty holders cannot by law continue to operate if their safety certificate or safety authorisation expires.

3.12 For more information on applying to amend a safety certificate or authorisation, please visit our ROGS Assessment Manual guidance.

Operating with limited train protection functionality in place

3.13 We recognise that modern train protection systems may be designed so that the human driver and automatic operations can coincide to varying degrees, in effect creating a variety of ‘modes’ of operation that can be activated. These modes give rise to different configurations of train operations, providing for varying degrees of driver involvement.

3.14 We understand that there may be limited operating circumstances where full functionality of a train protection system is not in operation for a defined period of time. For example, there may be scenarios where the full supervision of the train protection system is not provided during planned operations, such as at the start of

a mission or while shunting. There may also be unplanned circumstances where the train protection equipment is not able to function fully due to external factors and the level of train protection is less than the full protection offered by ATP systems. These planned and unplanned degraded mode scenarios are different to circumstances where the relevant train protection system fails or has been taken out of service because of a fault – this is covered by the legal defence (reg 3(4) and (5) and discussed in more detail at paragraph 1.13 of this guidance.

3.15 ORR expects that train protection systems are designed to function at all times during train operation (notwithstanding exceptional circumstances where train protection equipment fails as set out in reg 3(4) and (5)).

3.16 Duty holders must understand their own system to recognise any limitations in functionality associated with it to ensure that the train protection system is providing full protection for all operations as required by RSR99.

3.17 During planned and unplanned circumstances where full functionality of an ATP system is not in operation, duty holders should assess risks associated with these operations and put in place suitable organisational and operational risk controls before operating, in particular having regarding to the level of protection being provided at the time.

3.18 Regardless of the circumstances that require a degraded mode to be activated, we expect activation of such modes to be limited. In relation to both planned and unplanned circumstances, duty holders should identify and suitably assess all foreseeable scenarios and associated risks which may require train protection system functionality to be reduced for a period of time. Where degraded modes are activated, train operations should be in line with pre-planned arrangements developed in anticipation of operating in the mode.

3.19 For example, activation of any degraded mode during a journey should only be undertaken by a driver with authority from the relevant controller for the system. In this scenario, the signalling controller should give authority to the driver to pass a stop signal or for a pre-programmed speed limit to be exceeded to a given location based on the balance of risk for that degraded mode. The operator should ensure that the train is operated appropriately within this authority, such that the train does not travel too fast or too far according to the equipment on the train. Best practice in these circumstances means that any authorisation from the signaller should expressly limit the extent and duration of the activated degraded mode and ensure all risks associated with the mode and appropriately considered and managed.

3.20 Any duty holder who is considering operating for defined periods of time without their train protection system in full supervision mode should discuss such circumstances and how they plan to use organisational and operational controls to mitigate risks with ORR in advance of introducing this process. We would normally expect this to be discussed with us in preparation for and during the relevant safety certification and/or safety authorisation application process.

4. Exemptions

4.1 RSR99 gives ORR powers to grant an exemption from the requirement to operate with a train protection system in service (regulation 3).

4.2 Exemptions can be subject to conditions and to time limitations (regulation 6(1)). Exemption certificates are issued in writing and may be revoked in writing at any time. Prior to granting an exemption, ORR will consult such persons as it considers appropriate.

4.3 In accordance with regulation 6(3) of RSR99, when considering whether to grant an exemption, ORR will have regard to:

(a) the conditions, if any which it proposes to attach to the exemption;

(b) any other requirements imposed by or under any enactment which apply to the case; and

(c) all other circumstances of the case.

Making an exemption application

4.4 Applications for an exemption from regulation 3 should include the following information:

(a) an operational safety plan which sets out any health and safety control measures that are to be implemented

(b) the specific location which the exemption is required for

(c) the rolling stock and train operators whose operations are affected by the exemption application

(d) the duration of time that the exemption is required for.

4.5 For more information on what to provide to us in your exemption application, please visit our Assessment and Guidance Manual for Exemption Applications under Railway Safety Regulations 1999.

5. Glossary

5.1 This glossary includes some important terms from RSR99 and ROGS which are used throughout this guidance.

5.2 Regulation 2 of RSR99 gives the full legal definitions of most of the terms in the regulations. Regulation 2 of ROGS gives the full legal definitions of most of the terms in the regulations. Readers should note that the below explanations do not replace the full legal definitions in the regulations.

Term	Definition
A person operating a train	'A person operating a train' means persons who operate trains or rolling stock in the course of a business or other undertaking, whether or not for profit.
Communication-Based Train Control (CBTC)	CBTC is a railway signalling system that uses telecommunication between onboard and trackside equipment for train operation and control. CBTC includes an ATP function.
Duty holder	'Duty holder' means the person responsible for carrying out a particular duty under the regulations.
European Train Control System (ETCS)	ETCS was created in the early 1990s by the International Union of Railways as a new standard ATP system for high speed railways. It is one component of the European Rail Traffic Management System, alongside the radio link to the train cab (called Global System for Mobile communications Railway, or GSM-R), and a system that supports decisions made by signallers (called Traffic Management, or TM).

Term	Definition
Excessive speed	'Excessive speed' in relation to an approach to a stop signal or buffer stop means the speed which would prevent the train from stopping at the stop signal or buffer stop. 'Excessive speed' in relation to an approach to a speed restricted area means the speed which would prevent the train from complying with the speed restriction when the train enters the area. Speed restrictions are considered to be complied with if the speed of the train does not exceed the permitted speed.
Infrastructure controller	'Infrastructure controller' means person in control of railway infrastructure. 'Railway infrastructure' includes permanent way, any plant used for signalling and any plant used exclusively for supplying power to the railway for operational purposes e.g. traction. 'Railway infrastructure' does not include stations. Please note that infrastructure controller does not have the same meaning as infrastructure manager in the Railways and Other Guided Transport Systems (Safety) Regulations 2006 (ROGS). While in the majority of cases, the infrastructure controller and infrastructure manager will be the same person/organisation, there will be some scenarios where they are different. For example, where track is owned by Network Rail, they will be the infrastructure controller under RSR99 and infrastructure manager under ROGS. Where tunnels and tracks are owned and maintained by a train operator, but the signalling equipment and power supply is owned and operated by Network Rail, both the train operator and Network Rail would be the infrastructure controller under RSR99 and both would be the infrastructure manager under ROGS. This arrangement can be found on the non-mainline railway, for example the London Underground system.

Term	Definition
Railway	'Railway' means a system of transport employing parallel rails which provides support and guidance for vehicles carried on flanged wheels and form a track which either is of a gauge of at least 350 millimetres or crosses a carriageway (whether or not on the same level). This definition does not include: (a) tramways; (b) any street-running part of a railway; (c) any part of a railway where driving is by line of sight (i.e. the maximum speed permitted is such as to enable the driver to stop in the distance they can see ahead in clear weather); (d) any part of a railway which is not used by fare-paying passengers; or (e) any railway on which the line speed is 25 mph (40 kph) or less throughout.
Relevant approach	'Relevant approach' means – (a) an approach to a stop signal except where a train travelling at the maximum speed it could attain on that approach would be stopped within the distance between the signal and the point where it could collide with another train by reason of the train protection system installed at the stop signal; (b) an approach to part of the railway where there is a speed restriction if – (i) the permitted speed on that approach is 60 miles per hour or more; and (ii) in order to comply with the restriction, a train travelling at the permitted speed on that approach would need to have its speed reduced by one third or more. (c) an approach to a buffer stop.

Term	Definition
Safety authorisation	'Safety authorisation' means a safety authorisation issued ORR in accordance with regulation 10 or 12 of ROGS.
Safety certificate	'Safety certificate' means a safety certificate issued by ORR in accordance with regulation 7 or 9 of ROGS.
Safety management system	'Safety management system' means the organisation and arrangements established by a transport operator to ensure the safe management of its operation.
Stop signal	'Stop signal' means a signal conveying to the driver of the train an instruction that they should stop the train except that it does not include– (a) a signal provided for shunting purposes only; (b) a hand signal; or (c) a buffer stop.
Train protection system	'Train protection systems' means equipment which– (a) causes the brakes of the train to apply automatically if the train– (i) passes without authority a stop signal such passing of which could cause the train to collide with another train, or (ii) travels at excessive speed on a relevant approach; (b) is installed so as to operate at every stop signal referred to in sub-paragraph (a), except a stop signal on the approach to an emergency crossover, and at an appropriate place on every relevant approach; except that where it is reasonably practicable to install it, it means equipment which automatically controls the speed of the train to ensure, so far as possible, that a stop signal is not passed without authority and that the permitted speed is not exceeded at any time throughout its journey.

Term	Definition
Train Protection and Warning System (TPWS)	TPWS is a train protection system designed to stop a train by automatically initiating a brake demand if the train has passed a signal at danger without authority, approached a signal at danger too fast, approached a reduction in permissible speed too fast or approached a buffer stop too fast. TPWS compares a train's speed with a preset value at given points and applies the brakes if the train exceeds that value.

Annex A: Extracts from RSR99

Regulation 3 - Use of a train protection system

(1) No person shall operate, and no infrastructure controller shall permit the operation of, a train on a railway unless a train protection system is in service in relation to that train and railway.

(2) Until 1st January 2004 it shall be sufficient compliance with paragraph (1) if–

(a) a programme for the installation and bringing into service of a train protection system in relation to that train and railway has been approved by the Executive and is being implemented; and

(b) each part of the system which has been brought into service under that programme is maintained in service.

(3) It shall be sufficient compliance with paragraph (1) if the train is being operated on a railway–

(a) which immediately before the coming into force of this regulation was used (exclusively or not) by London Underground Limited, Tyne and Wear Passenger Transport Executive, Strathclyde Passenger Transport Executive, or Serco Metrolink Limited; and

(b) in relation to which there is in service equipment which causes the brakes of the train to apply automatically if the train passes a stop signal without authority.

(4) In any proceedings against a person for an offence for contravening paragraph (1) it shall be a defence for that person to prove that–

(a) at the relevant time the train protection system (or, where paragraph (3) is relied on, the equipment referred to therein) or a relevant part had failed, or had been taken out of service, because of a fault;

(b) in the case where the fault is in equipment on the train, the train had commenced its journey before the discovery of the fault or is being driven without passengers to a place for the purpose of repair;

(c) it was not reasonably practicable to remedy the fault sooner; and

(d) suitable measures had been taken after the discovery of the fault to mitigate the risk of trains colliding or derailing.

(5) In any proceedings against a person for an offence of contravening paragraph (1) in so far as that paragraph relates to having in service in relation to a train on a railway the equipment referred to in the exception in the definition of “train protection system” in regulation 2(1), it shall be a defence for that person to prove that–

(a) at the relevant time the equipment or a relevant part of it had failed, or had been taken out of service, because of a fault;

(b) it was not reasonably practicable to remedy the fault sooner; and

(c) equipment referred to in sub-paragraphs (a) and (b) of that definition was at the relevant time in service in relation to that train and railway.

Regulation 6 - Exemption certificates

(1) The Executive may, by certificate in writing, exempt any person or class of persons, railway, part of a railway or class of railways, train or rolling stock, or class of train or rolling stock from any prohibition imposed by these Regulations and any such exemption may be granted subject to conditions and to a limit of time and may be revoked by a certificate in writing at any time.

(2) Before granting an exemption the Executive shall consult such persons as it considers appropriate.

(3) In deciding whether to grant any such exemption the Executive shall have regard to–

(a)the conditions, if any which it proposes to attach to the exemption;

(b)any other requirements imposed by or under any enactment which apply to the case;

(c)all other circumstances of the case.

Annex B: Extracts from ROGS

Regulation 3 Use of infrastructure on the mainline railway

(1) After 30th September 2006 no person shall operate a train in relation to any infrastructure on the mainline railway unless--

(a) he has established and is maintaining a safety management system which meets the requirements set out in regulation [5(1) to (3)]; and

(b) he holds a current safety certificate in relation to the operation in question,

except to the extent that he is doing so within an engineering possession.

(2) After 30th September 2006 no person who is responsible for developing and maintaining infrastructure other than a station or who is responsible for managing and operating a station on the mainline railway shall manage and use it, or permit it to be used, for the operation of trains unless--

(a) he has established and is maintaining a safety management system which meets the requirements referred to in regulation 5(7);

(b) he holds a current safety authorisation in relation to the infrastructure in question; and

(c) where he is using it or permitting such use, the person who is to use the infrastructure has complied with paragraph (1)(b).

Regulation 4 Use of infrastructure on other transport systems

(1) After 30th September 2006 no person shall operate a vehicle in relation to any infrastructure on a transport system other than the mainline railway unless--

(a) he has established and is maintaining a safety management system which meets the requirements set out in regulation 6; and

(b) subject to paragraph (3), he holds a current safety certificate in relation to the operation in question,

except to the extent that he is doing so within an engineering possession.

(2) After 30th September 2006 no person who is responsible for developing and maintaining infrastructure, other than a station, or who is responsible for managing and

operating a station on a transport system other than the mainline railway shall manage and use it, or permit it to be used, for the operation of a vehicle unless--

(a) he has established and is maintaining a safety management system which meets the requirements set out in regulation 6; and

(b) subject to paragraph (3)--

(i) he holds a current safety authorisation in relation to the infrastructure in question; and

(ii) where he is using it or permitting such use, the person who is to use the infrastructure has complied with paragraph (1)(b).

(3) Paragraphs (1)(b) and (2)(b) shall not apply to the extent that the operation in question is only carried out--

(a) on a tramway; or

(b) on a transport system on no part of which there is a permitted maximum speed exceeding 40 kilometres per hour.

(4) Where the operation in question falls within paragraph (3)(a) or (b), the requirement in paragraphs (1)(a) and (2)(a) shall be read as if the date was, in each case, after 31st March 2007.

Regulation 5 – Safety management system for the mainline railway

(1) The requirements for a safety management system referred to in regulation 3(1)(a) are that--

(a) subject to paragraph (2), it is established to ensure that the mainline railway system--

(i) can achieve the CSTs; and

(ii) is in conformity with relevant national safety rules and relevant safety requirements laid down in NTSNs;

(b) it applies the relevant parts of CSMs;

(c) it meets the requirements and contains the elements set out in Schedule 1, adapted to the character, extent and other characteristics of the operation in question;

(d) subject to paragraph (2), it ensures the control of all categories of risk including new or existing risks associated with the operation in question which, without prejudice to the generality of the foregoing, shall include such risks relating to the--

(i) supply of maintenance and material; [and]

(ii) use of contractors; . . .

(iii) . . .

(e) it takes into account, where appropriate and reasonable, the risks arising as a result of activities carried on by other persons; and

(f) all parts of it are documented.

(2) The requirements in paragraphs (1)(a) and (d) shall be met where the safety management system of a transport operator or of an applicant for a safety certificate or a safety authorisation ("the first operator") taken with that of any relevant transport operator is capable of meeting the requirements of the paragraph in question.

(3) In paragraph (2), "relevant transport operator" means another transport operator whose operation

is capable of materially affecting the safety of the operation carried on by the first operator.

(4) . . .

(5) . . .

(6) . . .

(7) The requirements for a safety management system referred to in regulation 3(2)(a) are the requirements in paragraphs [(1) to (3)] . . . and that--

(a) . . .

(b) it takes into account the effects of operations of transport undertakings; and

(c) it contains provisions to ensure that the way in which the infrastructure manager carries out his operation makes it possible for any transport undertaking to operate in accordance with--

(i) relevant NTSNs and national safety rules; and

(ii) the means adopted by the transport undertaking to meet the requirements referred to in regulation 7(4), of which [the Office of Rail and Road] accepted that there was sufficient evidence upon issue or amendment of its safety certificate pursuant to these Regulations; and

(d) it aims to co-ordinate the emergency procedures of the infrastructure manager or of the applicant for a safety authorisation with those of transport undertakings,

and in each case the requirements in [sub-paragraphs (b) to (d)] shall only apply in relation to transport undertakings that operate or will operate a train in relation to the infrastructure of the infrastructure manager or of the applicant for a safety authorisation in question.

6 Safety management system for other transport systems

(1) The requirements for a safety management system referred to in regulation 4(1)(a) and 4(2)(a) are that--

(a) it is adequate to ensure that the relevant statutory provisions which make provision in relation to safety will be complied with in relation to the operation in question;

(b) subject to paragraph (7), it meets the requirements and contains the elements set out in Schedule 1, adapted to the character, extent and other characteristics of the operation in question;

(c) subject to paragraph (2), it ensures the control of all categories of risk associated with the operation in question which, without prejudice to the generality of the foregoing, shall include such risks relating to the--

(i) supply of maintenance and material;

(ii) use of contractors; and

(iii) placing in service of new or altered vehicles or infrastructure the design or construction of which incorporates significant changes compared to any vehicles or infrastructure already in use on the transport system and which changes would be capable of significantly increasing an existing risk or creating a significant safety risk;

(d) it takes into account, where appropriate and reasonable, the risks arising as a result of activities carried on by other persons; and

(e) all parts of it are documented.

(2) The requirement in paragraph (1)(c) shall be met where the safety management system of a transport operator or an applicant for a safety certificate or a safety authorisation ("the first operator") taken with that of any relevant transport operator is capable of meeting the requirements of the paragraph in question.

(3) In paragraph (2), "relevant transport operator" means another transport operator whose operation is capable of materially affecting the safety of the operation carried on by the first operator.

(4) In paragraph (1)(c)(iii) where such new or altered vehicles or infrastructure are intended to be placed in service, then before that placing in service the transport operator shall ensure that he--

> (a) has an established written safety verification scheme which meets the requirements and contains the elements set out in Schedule 4; and
>
> (b) has appointed a competent person to undertake that safety verification and the competent person has undertaken that safety verification in relation to the new or altered vehicle or infrastructure.

(5) . . .

(6) In this regulation the requirements of paragraph (4) shall apply in the absence of a transport operator to a responsible person as they would apply to a transport operator.

(7) Paragraph 2(c) of Schedule 1 shall apply in relation to transport systems other than the mainline railway as if it read as follows--

> "(c) procedures--
>
> (i) to meet relevant technical specifications; and
>
> (ii) relating to operations or maintenance,

insofar as they relate to the safety of persons, and procedures for ensuring that the procedures in subparagraphs (i) and (ii) are followed throughout the life-cycle of any relevant equipment or operation;".

Regulation 8 Amended safety certificate

(1) Where it is proposed that the type or extent of an operation in respect of which a safety certificate has been issued is to be substantially changed then the holder of the safety certificate shall apply to [the Office of Rail and Road] for the safety certificate to be

amended accordingly and the substantial change shall not be made until the safety certificate is so amended.

(2) An application for an amended safety certificate under this regulation shall--

(a) provide details of the change proposed;

(b) provide details of any consequential changes to any information sent to [the Office of Rail and Road] in respect of the operation in question which remains relevant to that operation; and

(c) if it is a mainline application, clearly indicate in respect of which part of the safety certificate any information is provided.

(3) Where Part A of a safety certificate in respect of which an application is made is deemed to be such a Part A in accordance with regulation 7(2) then [the Office of Rail and Road] shall--

(a) consider whether the Part A in question would still be for an equivalent operation if the change were made; and

(b) if it considers that it would not be equivalent, notify the applicant in accordance with paragraph (4) that it has refused the application and that he should apply for a new safety certificate under regulation 7 if he wants to make the proposed change, except that, in relation to Part B of the safety certificate, he only need provide the details set out in paragraph (2) above.

(4) Subject to regulation 17(7), within four months of the date of receipt of the application [the Office of Rail and Road] shall--

(a) issue a notice making any necessary amendments to the matters set out in the safety certificate; or

(b) notify the applicant that it has refused the application,

and in either case shall give reasons for its decision.

Regulation 11 Amended safety authorisation

(1) Where it is proposed that a substantial change is to be made to--

(a) the infrastructure in respect of which a safety authorisation has been issued;

(b) any energy supply, not falling within sub-paragraph (a), which is used in connection with the infrastructure in question; or

(c) the principles of operation and maintenance of such infrastructure or energy supply,

then the holder of the safety authorisation shall apply to [the Office of Rail and Road] for the safety authorisation to be amended accordingly and the substantial change shall not be made until the safety authorisation is so amended.

(2) An application for an amended safety authorisation under this regulation shall provide details of--

(a) the substantial changes proposed; and

(b) any consequential changes to any information sent to [the Office of Rail and Road] in respect of the operation in question which remains relevant to that operation.

(3) Subject to regulation 17(7), within four months of the date of receipt of the application [the Office of Rail and Road] shall--

(a) issue a notice making any necessary amendments to the matters set out in the safety authorisation; or

(b) notify the applicant that it has refused the application,

and in either case shall give reasons for its decision.

Regulation 13 Notice of changes by holder of a safety certificate or a safety authorisation

The holder of a safety certificate or a safety authorisation shall, without delay, notify [the Office of Rail and Road]--

(a) of any major changes--

(i) to the means by which he meets the requirements relating to the safety management system as set out in--

(aa) regulation 5(1) to (4) in relation to an operation of a transport undertaking on the mainline railway;

(bb) regulation 5(7) in relation to an operation of an infrastructure manager on the mainline railway; or

(cc) regulation 6 in relation to an operation which is not carried out on the mainline railway;

(ii) in the case of a transport undertaking, to the provisions adopted by him to meet any requirements necessary to ensure safe operation on the transport system in relation to the operation in question; or

(iii) in the case of an infrastructure manager, to the provisions adopted by him to meet any requirements that are necessary for the safe design, maintenance and operation of the infrastructure in question;

(b) when persons first commence work directly relating to the operation which is of a type which has not previously been carried out in relation to that operation; or when types of vehicle which are new to the operation in question are first introduced.

Regulation 19 Risk assessment

(1) A transport operator shall--

(a) make a suitable and sufficient assessment of the risks to the safety of any persons for the purpose of identifying the measures he needs to take to ensure safe operation of the transport system in question insofar as this is affected by his operation; and

(b) implement the measures referred to in sub-paragraph (a).

(2) When carrying out an assessment or a review under paragraph (1) or (3), a transport operator shall apply the CSMs to the extent that the operation is carried out on the mainline railway.

(3) Any assessment under paragraph (1) shall be reviewed by the transport operator who made it if--

(a) there is a reason to suspect that it is no longer valid; or

(b) there has been a significant change in the matters to which it relates and where as a result of any such review changes to an assessment are required,

the transport operator concerned shall make them, and implement any changes to the measures identified pursuant to paragraph (1) as a result of the review.

(4) The transport operator shall record in relation to any assessment or review under this regulation--

(a) the assessment process undertaken, the methods of any calculation used and any assumptions made; and

(b) the significant findings of the risk assessment including the measures in place and any further measures the transport operator intends to take to ensure safe operation of the transport system in relation to his operation.

(5) Every transport operator shall make and give effect to such arrangements as are appropriate, having regard to the nature of his activities and the extent of the undertaking, for the effective planning, organisation, control, monitoring and review of the measures identified pursuant to paragraph (1) or (3) and shall record such arrangements.

Regulation 22 Co-operation

(1) Every person to whom this paragraph applies shall co-operate as far as is necessary with a transport operator to enable him to comply with the provisions of these Regulations.

(2) Paragraph (1) applies to--

(a) any transport operator whose operations may affect or may be affected by operations carried out by the duty holder; and

(b) an employer of persons or a self-employed person carrying out work on or in relation to premises or plant owned or controlled by the duty holder.

(3) Every transport operator shall co-operate, insofar as is reasonable, with any other transport operator who operates on the same transport system where that other transport operator is taking action to achieve the safe operation of that transport system.

(4) In paragraph (2) "duty holder" means a transport operator referred to in paragraph (1).

Annex C: Train stops and speed traps for TPWS systems

C.1 While not relevant for the migration to modern signalling systems, to assist duty holders understand their obligations relating to TPWS systems, we have retained the following content from the 2000 HSE guidance on train protection systems.

C.2 'Train stops' and 'speed traps' may be essentially similar equipment which provide activation of automatic braking if they detect a train passing a signal at danger, or a train travelling too fast on an approach, respectively.

C.3 With certain exceptions, train stops must be fitted at those signals which are capable of conveying an instruction to the driver to stop the train, including fixed red signals and stop boards. RSR99 prescribes that train stops are only required at signals where a train passing at red without authority could collide with an oncoming, crossing or converging train (regulations 2(1) and 2(4)). The requirement applies even if the probability of a collision is low - for example at signals where trains are infrequent or because conflicting movements could only occur if a train were delayed.

C.4 Train stops are not required if a train passing at red would always be diverted away from a possible collision by points, or if there is the possibility only of a rear-end collision between two trains on the same track (regulation 2(4)). Signals on the approach to emergency crossovers and signals used solely for shunting purposes, buffer stops and hand signals are also excluded from the requirement for a train stop. However, speed traps are required on the approach to buffer stops - see paragraphs C.7-C.8.

C.5 Emergency crossovers are normally provided to allow for trains to be crossed from one line to another for single-line working under the supervision of a 'pilot' when one line is closed to traffic due to engineering work or an emergency (for example an accident). They are usually worked from an adjacent control point, and are not available for use under the normal signalling controls available to the signaller. They are used in accordance with special operating procedures established by the infrastructure controller.

C.6 Speed traps must be fitted at an approach place on every 'relevant approach'. RSR99 defines 'relevant approach' to include:

- on the approach to signals which are required to be fitted with a train stop (with the exceptions described in paragraph C.7);
- on the approach to any buffer stop at the end of a passenger platform, i.e. any platform which may be used by passengers for boarding and alighting;
- on the approach to those speed restrictions where the permitted speed on the approach is 60 mph or more and the speed restriction reduces that speed by at least one-third (for example from 60 mph to 40 mph). This criterion is based on an existing railway group standard on the automatic warning system. Temporary speed restrictions, which are in place for no longer than three months and are used in accordance with special procedures established by the infrastructure controller, are excluded by regulation 2(2).

C.7 There will be no need to fit a speed trap if the train stop at a signal would alone bring a train travelling at the maximum speed it can attain to a halt before it reaches a position where it could collide with an oncoming, crossing or converging train (see paragraph (a) of the definition of 'relevant approach'). This will apply to certain signals which because of their position cannot be approached at speed; for example, platform starter signals at bay or terminal platforms or signals used only for the reversal of trains through a platform. The maximum attainable speed will have to be low enough and the safety margin beyond the signal large enough, to bring the train to a halt before it can reach the point of danger.

C.8 Speed traps are required to operate when a train passes at a speed which will prevent it from stopping at the signal or buffer stop or from complying with the approaching speed restriction (see definitions of 'train protection system' and 'excessive speed'). For each speed trap, this requires a calculation to be made of the maximum speed at which a train could pass the trap and still stop before passing a red signal, striking a buffer stop, or exceeding a speed restriction by more than a specified margin. The speed trap would need to be set to operate if a train passes at any speed higher than that maximum safe speed.

C.9 The maximum safe speed will depend in large measure on the distance between the speed trap and the signal, buffer stop or speed restriction. This distance is likely to vary from location to location: speed traps are required to be sited 'at an appropriate place' on the approach, which means siting them at a point which maximises the safety benefit, consistent with practicability.

C.10 Infrastructure controllers will need to consider the siting and the speed settings of speed traps as part of the engineering development of train protection systems. In

some cases it may be possible to use a single speed trap to cover a number of closely spaced signals, or for a speed trap on the approach to a speed restriction also to serve as the speed trap for a signal or signals.

C.11 The regulations enable ORR to issue exemptions regarding margins of tolerance over speed restrictions to accommodate practical variations between actual and measured speed of trains. The practical effect of this is to allow a speed trap on the approach to a speed restriction to be set so that it will operate only when it is calculated that the speed of the train, when it enters the speed restriction, will exceed the appropriate margin of tolerance.

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