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Guidance on the Fitment and Functionality of Forward and Rear Facing Cameras on Rolling Stock

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Documents

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Guidance on the Fitment and Functionality of Forward and Rear Facing Cameras on Rolling Stock

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Superseded documents

This Rail Industry Guidance Note does not supersede any other Railway Group documents.

Supply

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Guidance on the Fitment and Functionality of Forward and Rear Facing Cameras on Rolling Stock

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Guidance on the Fitment and Functionality of Forward and Rear Facing Cameras on Rolling Stock

Part 1 Introduction

1.1 Purpose of this document

This document gives guidance on fitting forward and rear facing camera systems on rolling stock. It enables railway undertakings to adopt a common methodology in the fitment and functionality of the forward and rear facing camera systems. It does not constitute a recommended method of meeting any set of mandatory requirements.

This document has been developed with the input from duty holders already operating forward and rear facing camera systems. The British Transport Police provided advice on requirements of forward and rear facing camera systems appropriate for evidential purposes. In developing the document the drafting group considered a range of options for inclusion compared to the costs of adopting such options. The guidance included provides information on the most recently available information and it is recognised that technology in this field is constantly developing. However, adopting a closed circuit television camera system set out in this guidance note provides an opportunity to meet the key safety and performance benefits associated with forward and rear facing camera systems.

This document has been prepared on the basis that the forward and rear facing camera systems operate automatically and either independently of each other and any other system on the rail vehicle or as part of any existing closed circuit television camera system. This document also gives guidance on the interfaces with other rail vehicle systems that could be used as trigger inputs to the forward and rear facing camera systems.

Areas covered by this document are:

- a) Forward and rear facing closed circuit television camera systems detailing the visual data to be stored on the rail vehicle.
- b) Interfaces with other rail vehicle systems.
- c) Off-train equipment including reader / download interface requirements.
- d) Management of the recorded data, including the downloading, viewing and access to the data.

1.2 Copyright

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1.3 Approval and authorisation of this document

The content of this document was approved by:

Rolling Stock Standards Committee on 19 March 2010.

This document was authorised by RSSB on 30 April 2010.

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Part 2 **Guidance on the Fitment and Functionality of Forward and Rear Facing Cameras on Rolling Stock**

2.1 **Background**

- 2.1.1 The fitment of forward and rear facing closed circuit television camera systems (FFCCTV) is being undertaken as a means of recording visual evidence for operational use and incident investigation.
- 2.1.2 A number of significant safety and performance benefits associated with FFCCTV camera systems and the images captured by them have been identified. Principally FFCCTV camera systems can be used to assist in:
 - a) Investigation of incidents, accidents and near misses.
 - b) Facilitating train service recovery, for example through confirmation of incidents as non-suspicious, or removing the requirement for extended down time while assets are tested, for example when resolving signalling irregularities.
 - c) Crime prevention, for example prevention of cable theft through identification and arrest of individuals who are involved in trespass and other railway crime incidents.
 - d) Undertaking infrastructure surveys.
- 2.1.3 CCTV camera systems are already fitted on rail vehicles to monitor the interior of passenger saloons and are also used in conjunction with driver only operation (DOO) of multiple units. The specific functional and data recording requirements of these CCTV camera systems are outside the scope of this document.
- 2.1.4 Where capacity exists in the other installed CCTV camera systems it may be appropriate to incorporate the recording of FFCCTV camera system data as an additional input to the existing CCTV camera system.
- 2.1.5 The capability of the existing CCTV system should be assessed against the requirements set out in Section 6.5 which are considered by the British Transport Police as essential requirements for FFCCTV camera systems. It should be noted that the ability to record clear images from a moving train travelling at speed is significantly different to that used to record images in a rail vehicles interior.
- 2.1.6 Where the FFCCTV camera system's requirements are incompatible with the existing CCTV camera systems on the rolling stock then a separate FFCCTV camera system may be more appropriate.
- 2.1.7 This document gives the functionality of the FFCCTV camera system needed to enable the recording, downloading, viewing of and access to the recorded camera data by authorised personnel.
- 2.1.8 The term FFCCTV is used as an abbreviation throughout the document. Whilst specifically referring to the forward facing CCTV camera system it also includes the installation of the rear facing CCTV camera system at the rear of the train.

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Part 3 Forward and Rear Facing Closed Circuit Television Camera System

3.1 General

- 3.1.1 An on-train FFCCTV camera system should be capable of:
- Capturing visual data.
 - Storing data for a minimum period.
 - Downloading data.
 - Immediate playback of data.
 - Accepting inputs from on-train systems.
- 3.1.2 The FFCCTV camera systems at the front and rear of the train should operate automatically and either independently of other systems on the rail vehicle or as part of any existing CCTV system. The FFCCTV cameras should switch on when the driving cab is enabled and remain active during train operation.
- 3.1.3 Where adequate power supplies and video storage capacity are available consideration may be given to keep the FFCCTV system continuously active. The FFCCTV camera system is then able to record instances of trespass or vandalism whilst the rail vehicle is stabled.

3.2 FFCCTV camera system requirements

- 3.2.1 The FFCCTV camera system should have two modes of operation, colour (day) mode and black / white (night) mode. The colour (day) mode should be capable of operating over the light range of 1 Lux to 10,000 Lux. The black / white (night) mode light range should extend into the colour mode light range and operate down to 0.05 Lux.
- 3.2.2 The FFCCTV camera system should automatically switch between day and night modes of operation and also occur during entry and exit of tunnels. The change over between colour (day) and black / white (night) modes should include the camera outputting in both colour (day) and black / white (night) modes. An alternative to the dual mode camera system would be to fit separate colour (day) and black / white (night) mode cameras.
- 3.2.3 The FFCCTV camera system should be fitted with a lens that has an automatic gain control or electronic iris with a fast dynamic response to deal with rapid changes between sunlight and dark conditions, for example entry to / exit from tunnels. An alternative would be to have a camera with a high dynamic range, this type of camera is capable of capturing darker and brightly lit areas in the same image.
- 3.2.4 During daylight operation the FFCCTV camera system should be able to record the colour aspect displayed by line side railway signals and particular attention should be given to the colour resolution of the FFCCTV camera signal output. Avoidance of blooming and blurring is also important and can be achieved by the use of low noise image sensors.
- 3.2.5 The FFCCTV camera system will be recording moving images in contrast to those camera systems used to monitor a rail vehicles interior where most of the images are stationary relative to the camera. The use of high definition (HD) cameras should be considered as these give clear, crisp pictures with vivid colours with up to five times more detail than standard definition camera systems.

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- 3.2.6 The images recorded by the FFCCTV camera system should be capable of being reproduced as still images. This is the preferred means of presenting evidence during investigation or inquiries. (Part 6 gives further information on the management and use of the FFCCTV recorded data.)
- 3.2.7 There are two types of image scanning in HD CCTV camera systems, progressive and interlaced. The camera image sensor should use progressive scanning, which results in a more detailed image on the screen and is less susceptible to the flicker commonly associated with interlaced scanning. Interlaced scanning is not suitable for this application.
- 3.2.8 An example of a typical HD CCTV camera system output is 1920 x 1080p. The suffix 'p' is used to indicate a progressive scan.
- 3.2.9 The downloaded frame rate from the camera to the digital video recorder (DVR) should be selected to suit the maximum speed of the train so that it is possible to view a continuous series of recorded images along the route of the moving train. A minimum frame rate of at least 12 frames per second (fps) should be used. A frame rate of 20 - 25 fps should be considered for trains that operate at speeds greater than 100 mile/h (160 km/h).
- 3.2.10 CCTV cameras capable of downloading images between 20 - 25 fps are also beneficial for lower speed applications. The higher frame rate allows more data to be recorded in the event of an incident or during a line survey.
- 3.2.11 Data connections to the FFCCTV camera should be suitable for their railway applications; it should be adequately protected from the environment and from vibration. The cable should be securely clamped to the camera and DVR enclosure. The cable should not be supported by the connector body alone. A commonly used connection for camera and cable connections is the Ethernet RJ45 connector.
- 3.2.12 If it is intended to source video cameras and FFCCTV camera systems from different suppliers, then it will be necessary to define the system interface. One example to aid compatibility is the use of the Open Network Video Interface Forum (ONVIF) software standard.

3.3 Positioning of the FFCCTV camera and lens assembly

- 3.3.1 The FFCCTV camera and lens assembly should be orientated to record landscape views. As a minimum, the camera and lens assembly should be capable of recording images that include the viewing envelope for a seated driver as derived from GM/RT2161, see Appendix A. The point of focus and depth of field should be consistent with these sighting requirements.
- 3.3.2 The FFCCTV camera and lens assembly should be positioned in the cab behind the windscreen or externally in an enclosure on the end of the vehicle. The camera should be positioned as close as possible to the driver's sightlines to minimise the effects of parallax whilst not interfering with the drivers viewing envelope.
- 3.3.3 Internal cab mounted installations should be positioned:
 - a) In the swept area of the windscreen but not located where the windscreen wiper could be parked.
 - b) As close as practicable to the inside of the cab windscreen to avoid internal reflections.