Requirements for Driving Cabs of Railway Vehicles

Synopsis
This Standard prescribes the requirements for external visibility from inside driving cabs, for control facilities and for other interior arrangements, to ensure a working environment in which drivers of traction and rolling stock vehicles and on-track machines can carry out their operational duties safely and effectively.

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Part A

Issue record

This Railway Group Standard will be updated when necessary by distribution of a complete replacement.

Amended or additional parts of revised pages will be marked by a vertical black line in the adjacent margin.

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Responsibilities and distribution

Controlled copies of this standard shall be complied with by all persons who are responsible for specifying requirements for driving cabs of railway vehicles, including Traction and Rolling Stock (T&RS) and On-Track Machines.

The standard shall be distributed to:
- engineers and managers with responsibilities for vehicles and driving cabs in the fields of technical and operating specification, design, development, procurement, testing, maintenance and Engineering Change;
- all train operators and contractors having T&RS or on-track machines for operation on Railtrack lines.

Implementation

The provisions of this standard are mandatory. The standard shall apply from 8 October 1995 to all new procurement contracts placed for new vehicles. The standard shall also apply from the same date to existing vehicles when they are subject to Engineering Change, insofar as it is reasonably practicable.

Health and Safety Responsibilities

In authorising this standard, Railtrack PLC makes no warranties, express or implied, that compliance with all or any Railway Group Standards is sufficient on its own to ensure safe systems of work or operation. Each user is reminded of its own responsibilities to ensure health and safety at work and its individual duties under health and safety legislation.

Supply

Controlled and uncontrolled copies of this standard must be obtained from The Catalogue Secretary, Safety & Standards Directorate, Railtrack PLC, Floor 2, Fitzroy House, 355 Euston Road, London, NW1 3AG.
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Part B

1 Purpose
This standard prescribes the requirements for external visibility from inside driving cabs, for control facilities and for other interior arrangements, to ensure a working environment in which drivers can carry out their operational duties effectively and maintain safety on Railtrack lines.

2 Scope
The requirements of this standard apply to the driving cabs of traction and rolling stock (T&RS) vehicles and also to On-Track Machines that operate on Railtrack lines outside possessions.

The requirements apply to new vehicles. The requirements also apply to existing vehicles when undergoing Engineering Change, insofar as it is reasonably practicable to incorporate them.

Deviations from the specific requirements of this standard are permissible for driving vehicles in international traffic, providing that it is demonstrated that an equivalent level of safety is achieved.

3 Definitions
For the purposes of this Standard, the following definitions apply.

Auxiliary Driving Position
A driving position for authorised movements which cannot be safely made from the main Driving Position and for which the full range of driving controls and the full viewing requirements cannot be provided.

Colour Diffraction Effects
The spatial separation of colours of light sources or objects into their component spectrum colours, as a result of variations in the refractive properties within a windscreen (or window).

Distortion of Vision
The apparent angular distortion of physical objects when viewed through a windscreen (or window) as a result of changes in Optical Deviation.

Driver Only Operation
Train Operations in which passengers are carried under the sole control of a single driver, without support from any other on-board staff.
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Driving Position
The normal position from which the driver controls the train, by operating the primary controls. It may be seated or standing or both, depending on operational requirements.

Engineering Change
Any alteration or modification to the design of a driving vehicle that affects the layout of a driving cab, its permanent equipment or its facilities.

Multiple Images
The appearance of two or more secondary images, spatially separated from the primary image, of a light source or object when viewed through a windscreen (or window).

On-Track Machine
A rail-mounted machine permitted by the Rule Book Appendix BR 87109/43 to be moved, either self-propelled or in train formation, outside a possession.

Optical Deviation
The angle between the true and the apparent direction of an object when viewed through a windscreen (or window). Optical deviation can be measured in terms of Secondary Image Separation under prescribed test conditions.

Primary Vision Area
The area of windscreen through which prescribed track and signal locations must be viewable from the cab Driving Position.

Secondary Image Separation
The angular separation between the primary and secondary images of a distant light source or object when viewed through a windscreen (or window). The separation is related to windscreen orientation, curvature, thickness, internal construction, and geometric and optical inaccuracies.

Secondary Vision Area
An optical area of windscreen outside the Primary Vision Area through which the driver may be required to look.

Transmittive Colour
A measure of the changes in colour of objects and surfaces when viewed through a windscreen (or window).

Visual Transmission
The proportion of light transmitted through a windscreen (or window). It is expressed as a percentage of the intensity of the incident light under prescribed test conditions.
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4 General Requirements

4.1 The driving cabs of vehicles that operate on Railtrack lines shall be designed and maintained so that they provide safe and efficient working environments in which drivers and other authorised staff can carry out their duties safely and effectively.

4.2 Driving cabs shall meet the requirements of this standard over the full range of variations in vehicle and track conditions that are likely to be experienced. Account shall be taken of:

(a) the influences of cab and vehicle dimensional tolerances, vehicle payload variations and suspension characteristics; normal variations in maintenance condition and wear; and cab and vehicle failure modes and conditions.

(b) the likely routes of operation and the extent and effects of operation in tunnels.

(c) the range of ambient weather, temperature and humidity conditions; daytime and night-time conditions; and any other relevant variables.

4.3 Cabs shall be maintained so that prescribed tolerances for components, assemblies and systems that influence the mandatory requirements for cab performance are sustained over the lives of the vehicles.

4.4 The dimensions of cab interiors, including their fixtures, furniture, fittings, furnishings, equipments, controls, indicators and instruments, shall be appropriate for safely accommodating drivers with a range of physical dimensions as specified in accordance with reference [1]. A source of design data for male and female body dimensions is given in reference [2].

5 The Driving Position

5.1 The driver shall be provided with a Driving Position from which the train can be safely controlled. A seat provided for the driver shall be readily adjustable, to accommodate drivers with a range of body dimensions as specified in Section 4.4. The driving position may be designed to allow the driver to stand whilst controlling the train.

5.2 From the driving position, the driver shall be able to readily operate all primary controls and easily read all primary instrumentation, as defined in Section 7, whilst maintaining the vision requirements of Section 6.1.
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5.3 If it is required, in normal operation, that a driver must have an external view along the train whilst controlling its movement, then the driver shall be able to easily operate the necessary primary controls whilst maintaining an external view along the train. This may be achieved by providing auxiliary driving positions adjacent to openable cab side windows. The required auxiliary primary controls are prescribed in Section 7.3.

5.3.1 If auxiliary driving positions are provided:

(a) there shall be a means whereby a maximum speed limit is automatically imposed when control is exercised from an auxiliary driving position, the limit being appropriate to the nature of the operation being controlled;

(b) the driver shall be able to move easily from an auxiliary driving position to the main driving position whilst the train is moving;

(c) there shall be means to ensure that the train is automatically brought to a halt if a driver becomes incapacitated during the changeover described in (b).

5.4 A driver shall have easy access to the driving position and be able to vacate it rapidly, for operational reasons or for emergency escape.

5.5 The driving position shall be positioned so that a seated person’s eyes are not less than 500 mm from the windscreen. This is required to mitigate the risk of injury from windscreen spalling in the event of impacts from external missiles (reference [3]).

6 Visibility from Driving Cab

6.1 Sighting of Track and Signals

6.1.1 Seated Drivers

The front windscreen of a cab shall provide, as a minimum, the following clear unobstructed lines of sight (views) for the driver seated at the Driving Position, taking into account the variations and tolerances described in Section 4.2 and the requirements of Section 6.2.6.

For each viewing case below, a person’s eyes shall be considered to be at a point contained within an imaginary reference cube. The reference cube shall have 400 mm long sides and have its centre situated 800 mm above the centre of the surface of the driver’s seat cushion, with the seat adjusted vertically and horizontally to its mid-position. The imaginary cube shall be orientated with sides parallel to the longitudinal axis of the vehicle.

Case (a): A view of the track (at rail height) at 5 m beyond the vehicle buffers (or vehicle end) for vehicles subject to frequent coupling and uncoupling activities. For other vehicles, the viewing distance shall be 10 m beyond the vehicle buffers (or vehicle end).
Case (b): For cabs with a central gangway, a view of signals positioned 5 m beyond the vehicle buffers (or vehicle end) at all heights between 1.5 m and 6.0 m above rail level and at all lateral positions between the right-hand rail through to 2.5 m to the left of track centreline. This view together with the view in Case (a) shall be visible from the same point within the reference cube.

Case (c): For cabs without a central gangway, a view of signals positioned 5 m beyond the vehicle buffers (or vehicle end) at all heights between 1.5 m and 6.0 m above rail level and at all lateral positions between 2.5 m to the right of track centreline through to 2.5 m to the left of track centreline. This view together with the view in Case (a) shall be visible from the same point within the reference cube.

Case (d): A view of level track up to 500 m beyond the buffers (or vehicle end) when entering a curve of 1000 m radius. This view shall be visible, whether on a left-hand curve or a right-hand curve, from a common point within the reference cube.

Note (1): The lateral dimensions specified in Cases (b) to (d) above refer to the track on which the vehicle is standing.

Note (2): The above viewing cases lead to three, usually different, viewing points within the reference cube, namely: a point for Cases (a) and (b), a point for Cases (a) and (c), and a point for Case (d).

6.1.2 Standing Drivers
Where the main driving position is designed to permit the driver to stand whilst controlling the train, the four unobstructed viewing Cases (a), (b), (c) and (d) as prescribed in Section 6.1.1 shall continue to apply. For each case, the stature range of the drivers shall be taken into account, in accordance with Section 4.4.

6.2 Windscreen Optical Properties
6.2.1 The windscreen, as orientated and installed in the driving cab, shall have minimal Distortion of Vision over the whole of the vision area.

Simple distortions of vision when measured using a slide projector and grid-based technique as described in reference [4], or other technically equivalent technique, shall not exceed the following values:

(a) 1.5 degrees in the Primary Vision Area;
(b) 2.5 degrees in the Secondary Vision Area;
(c) 5.0 degrees for other areas of the windscreen required for viewing.
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There shall not be any noticeable discontinuities or curving of the projected lines within the Primary and Secondary Vision Areas.

6.2.2 The windscreen when installed in the cab shall not cause Secondary Image Separations that may cause confusion or distraction to the driver.

The windscreen shall not cause Multiple Images.

6.2.3 The primary and secondary vision areas of the windscreen shall have a Visual Transmission of not less than 70%, as measured in accordance with reference [4], or other equivalent standard.

6.2.4 The windscreen shall not cause any Colour Diffraction Effects that are noticeable to the driver.

6.2.5 The Transmittive Colour of the windscreen shall not adversely affect the perceived colours of objects, particularly of colour light signals. Achievement of this requires that the CIE (1931) chromaticity coordinates of the windscreen, with reference to Illuminant A, shall lie within an acceptance box having the following x, y coordinates:

\[
\begin{align*}
\text{x} & : 0.435 & 0.435 & 0.460 & 0.460 \\
\text{y} & : 0.415 & 0.3975 & 0.405 & 0.4225
\end{align*}
\]

6.2.6 Appropriate means shall be provided to maintain the above specified sighting, visibility and optical requirements through the windscreen under all external and internal ambient conditions, including: rain, snow, ice, solar glare, dust and debris, high humidity, etc. Such means may include: windscreen heaters, washers, wipers and rain-flow deflectors, de-misters, de-icers, sun visors, blinds, tinted glass, etc.

It shall be ensured that such visibility aids do not obscure the Primary Vision Area or adversely affect visibility and the optical properties of the windscreen, particularly with regard to the sighting of signals, the imaging of signals, and the colour of signal lights.

6.3 Side Visibility

A driver shall be able to have external views forwards and backwards along each side of the train formation. To achieve this, easily accessible and openable windows of appropriate dimensions, or other easy and reliable means of vision, shall be provided.
6.4 Driver Only Operation
6.4.1 Cabs of driving vehicles required to undertake Driver Only Operations (DOO) of passenger trains shall comply with the visibility requirements of reference [5]. This specifies the viewing requirements through cab windscreens and through cab side windows to enable platform-mounted Closed-Circuit Television (CCTV) monitors or mirrors to be seen, when in-cab CCTV monitors are not fitted.

6.4.2 Where a cab side window is required to enable the driver to view platform-mounted equipment, the window shall be of such an optical quality that it does not cause distortions or loss of visibility that could mislead the driver or affect his judgement.

7 Controls and Instruments

7.1 General
The driving cab shall incorporate appropriate and reliable controls, instruments, and audible and visual warning devices to enable the driver to perform his duties safely and effectively, as defined by the Rule Book (reference [6]) and other working instructions, and in accordance with the requirements for train safety systems as prescribed in reference [7].

7.1.1 Controls and instruments should be arranged and operated in a logical and functional manner, to maximise driver effectiveness and minimise errors.

7.1.2 The designs, locations and modes of operation of controls and instruments should, as far as is practicable, be consistent with proven best practices, or better.

7.1.3 Controls and instruments should be clearly marked with unambiguous descriptions, pictograms, etc. to indicate their functions.

7.1.4 The operation of controls and the viewing of instruments should not be unduly fatiguing, or require physical or mental abilities beyond the competence standards prescribed for train drivers in reference [1].

7.1.5 Controls and instruments should be appropriately graduated and/or illuminated so that the driver can quickly and accurately detect their operating positions and readings, under all ambient lighting conditions. Where controls and instruments are graduated, the graduations should be sufficiently fine and precise to enable the driver to drive the train accurately and within the permitted speed profiles on its permitted routes.
7.1.6 Illuminated controls and instruments should be so positioned, cowled or dimmed that they do not produce excessive levels of illuminance, or produce unwanted reflections off the cab windscreen or off other surfaces, that will mislead or distract the driver.

7.1.7 Controls and instruments should be robust and protected against malfunction as far as is reasonably practicable.

7.2 Primary Controls and Instruments

7.2.1 The following primary controls and instruments, where required and fitted as essential for the safe driving of a train or vehicle, shall be operable and/or viewable by the driver whilst at the main driving position.

(a) Direction of movement control
(b) Traction power controls and instruments
(c) Service braking controls and instruments
(d) Emergency brake control
(e) Speedometer
(f) Warning horn
(g) Drivers’ Safety Device (DSD)/Vigilance reset control
(h) Automatic Warning System (AWS) reset control and visual indicator
(i) Windscreen vision maintenance system controls
(j) Train communications control (including crew-to-crew, Train-to-Shore radio, and driver-to-passenger)
(k) Head/tail/marker/hazard light controls and indicators
(l) Cab environmental controls (heating, lighting, ventilation)
(m) Passenger alarm override and indicator
(n) Fire extinguisher delay system
(o) External passenger door controls for operation by the driver
(p) In-cab Closed-Circuit Television (CCTV) systems for use with Driver Only Operation
(q) Controls for automatic coupling and uncoupling
(r) Controls and indicators for Radio Electronic Token Block (RETB) working
(s) Reminder device for preventing driver from starting against red signals
(t) Other controls and instruments which because of their safety functions must be operated or viewed whilst the driver is controlling the train.
7.2.2 Wherever practicable, the visual field directly in front of the driver, when in the driving position, should be reserved for siting primary controls and instruments vital to the continuing safe operation of the train. Their locations should reflect their importance and the frequencies with which they need to be actuated or viewed. Account should be taken of the amount of drivers' head and eye movements needed, with the objective of maximising the driver's visual concentration on track and signals.

7.3 Auxiliary Primary Controls
Where an auxiliary driving position is provided, as in Section 5.3, the following controls shall be provided:

(a) Direction of movement control
(b) Traction power control
(c) Service brake control
(d) Emergency brake control
(e) Warning horn
(f) AWS reset control
(g) DSD/Vigilance reset control.

7.4 Audible and Visual Warnings
Audible and visual warnings inside the cab shall be distinctive and have appropriate loudness and sound qualities and/or light intensities, according to their functions, urgency and importance (see reference [8]). They shall not distract the driver's attention unnecessarily from his normal driving duties.

7.5 Driver Only Operation
If driver Only Operation requires the driver to move from the main driving position to a side window to view platform-mounted equipment or to look back along the train, then passenger door controls and a Drivers' Safety Device hold-over control shall be located as specified in reference [5].

8 Access and Egress
8.1 The driver, and other staff where appropriate, shall be able to gain safe access to and safe egress from the driving cab, under both normal and emergency conditions, in accordance with reference [9].

9 Cab Environment
9.1 The driver and others shall be provided with a safe and efficient working environment in terms of:

(a) the ergonomic layout of furniture and fittings, controls and instruments, and the general ambience;

(b) air quality, temperatures and lighting levels, in accordance with reference [10];
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(c) ride quality, noise and vibration levels, and aerodynamic pressure pulses, in accordance with reference [8].

10 Structure and Crashworthiness

10.1 The driver, and any other staff in the cab, shall be protected structurally in the event of collisions, derailments, or strikes by missiles, in accordance with references [3], [11], [12], [13] and [14].

11 Emergency and Safety Equipment and Signing

11.1 The driving cab shall be fitted with emergency and safety equipment, supported by emergency and safety signs, in accordance with reference [15].
References

[1] GO/RT3251  Safety Requirements for Train Drivers


[3] GM/TT0122  Structural Requirements for Windscreens and Windows on Railway Vehicles


[9] GM/RT2162  Traincrew Access to and Egress from Railway Vehicles (to be published)

[10] GM/RT2176  Air Quality and Lighting Environment Inside Railway Vehicles (to be published)


[12] GM/TT0123  Structural Requirements for Doors and Gangways on Railway Vehicles


[15] GM/RT2177  Emergency and Safety Equipment and Signs on Rail Vehicles
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Related Documents
(for Information only)

- GK/RT0005  Safety Related Colours of Signalling Equipment
- GK/RT0031  Lineside Signals and Indicators
- GK/RT0037  Signal Sighting
- GM/TT0168  Braking Policy for Traction & Rolling Stock Including On-Track Plant
- GO/RT3410  Train Radio Communications
- BR 566     Specification for High Impact Resistant Windows, 1989
- BS 1376    Specification for Colours of Light Signals
- UIC 625-6  Regulations Concerning Conditions of Visibility from Driving Compartments of Combustion-Engined Powered Stock