Train Drivers

Cab design and ergonomic requirements

Guidance document

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GENERAL INFORMATION

APPROVAL AND AUTHORIZATION OF THIS DOCUMENT

All alterations to this document must be ratified by the ETF.

ISSUE RECORD

Issue	Date	Comments
One	April 2017	First Issue
Two	February 2018	Integrated the feedback from the ETF LDAG meeting of the 24th of April 2017 and subsequent research developments.
Three	April 2024	Updated document in line with industry developments

FOREWORD

PURPOSE

The purpose of this document is twofold. Firstly, this is to provide information to industry bodies (including rolling stock companies, manufacturers, regulatory bodies, and operating companies) of the standards expected by the ETF in new driving cabs and in the driving cabs of legacy rolling stock.

Secondly this should provide guidance to representatives of ETF affiliates when dealing with the introduction of new rolling stock and the refurbishment of legacy rolling stock and thus reflects ETF policy at the time of publication.

This document should be regularly reviewed and updated to consider new developments in technology or research.

INTRODUCTION

The construction and design of the train driving cab is one of the factors highly influencing the performance of the train driver in matters related to safety. As the cab is the daily workplace of the Train Driver, the facilities offered are of great importance to the general well-being of train drivers.

With the varying types of work within the UK rail network it is important for Drivers to have driving cabs that are state-of-the-art and have facilities that reflect the type of work that the train was manufactured for.

SECTION 1: GENERAL REQUIREMENTS

REPRESENTATIVE INVOLVEMENT

1. It should be recognised that successful cab design can only be achieved through agreement with trade union representatives. It should also be recognised that there will be a cost saving benefit to this approach as any subsequent remedial work would be expensive to implement retrospectively.
2. Representatives must be involved with the planning, design, and development of any new driving cab from the earliest opportunity (including ergonomic evaluations and assessments).
3. Representatives must be provided with all information relating to the proposed cab design and also be provided with the results of any assessment or evaluation as the project progresses.
4. Representatives may request further reasonable adjustments after the train has been introduced into service if the design is felt to be deficient in any way.

ERGONOMIC PRINCIPLES

1. Design preference shall be given to the driving task within the cab environment.
2. Ergonomic consideration relating to any secondary roles (those that are not directly related to the driving task) shall not adversely impact on the driving task.
3. The interior layout of the cab should be designed through the application of a user centred approach, taking into consideration the physical attributes of the target user population to ensure the safe and efficient operation of the train.
4. State of the art anthropometric data should be used when designing a driving cab.

EVALUATIONS AND MEASUREMENTS

1. Evaluations and measurements may only be carried out by qualified persons or services.
2. They must have the necessary specialist knowledge and professional experience and must ensure the conscientious and representative performance of the assessments and measurements according to the state of the art at the time.
3. Experts or services must have the necessary and appropriate facilities, depending on the nature of the task.
4. Employee representatives must be consulted and involved in evaluating and measuring exposure to any element or condition referenced within this document.
5. The driving cab must be regularly tested during its lifetime to ensure that the exposure limit value for any element or condition referenced within this document is kept as low as possible.

6. Train testing should be carried out by drivers from the company where the rolling stock is to be introduced. This is to ensure:

    a. That valuable experience is gained by drivers who will eventually be driving them in service and

    b. Access to the testing process (and its data) by representatives is made easier.

SECTION 2: CAB FEATURES

GENERAL

1. The ETF no longer accepts the introduction of “through corridor rolling stock” for the following reasons:
    a. The gangway door restricts the cab design and the ability to apply good ergonomic principles.
    b. The cab design is incompatible with the required installation of the many modern pieces of equipment and controls.
    c. There is technology available that can provide a modern solution to questions that were once only solved by through corridor rolling stock.

CRASHWORTHINESS

1. There must be protection provided to the Driver and any other person reasonably expected to be in the driving cab from collision and external impacts.
2. The inside of driving cab must have no sharp edges or protrusions. If this cannot be avoided, then all instances of this must be covered with a shock-absorbing material.
3. Portable equipment and other components inside the cab must be secured in such a way that they do not come loose after impact or during the normal operation of the train.
4. The driving cab shall be precluded from forming any part of the impact (crumple) zone. Where possible this should always be in rear of the driving cab.

WELFARE

1. On-board toilet facilities must be provided on rolling stock that has its main use in the freight sector or on passenger trains where there is no access to internal facilities.
2. Toilets shall be unisex and provide disposal facilities for sanitary products and should be equipped with a “full door” for privacy and an internal locking mechanism.
3. A drink holder must be provided within reach of the driving position but away from equipment that may become damaged in the event of spillage.
4. Every cab must contain a receptacle for containing refuse. It must be of a suitable size and have a lid to contain odours.
5. Depending on the role, size and design characteristics of locomotives consideration should be given to additional welfare facilities (e.g., fridges and cooking equipment) especially where drivers are expected to work long distances in remote areas where there is minimal or no infrastructure.

STORAGE

1. Where mobile or portable electrical equipment is permitted to be used, an appropriate stowage and sockets for re-charging should be provided.
2. Where possible, storage space shall be provided for the drivers' bag and any associated personal equipment.
3. At least two coat hooks should be provided within the cab.

SEATING

1. The priority for manufacturers should be the ability of the Driver to easily see external signals and signage whilst allowing for comfort and range of movement to operate the controls safely, considering the target users anthropometric measurements.
2. The normal driving position shall be with the driver seated and facing forward. A secondary driving position must be facilitated in a way that the driver can drive in the standing position.
3. Comfortable compressed air suspension seats of an agreed standard should be fitted.
4. Seats should be fully adjustable, and the controls must facilitate easy adjustment on the move.
5. It is preferable that the driver's seat be positioned as close to the centre of the cab as possible whilst allowing enough room for safe egress around and from the second person's seat.
6. The cab seating must not present an obstacle to reaching an exit in an emergency.
7. When considering the seat cushion design to mitigate the effects of vibrations, it is recommended that a simulation, based on a recognized numerical model is used to simplify and reduce the time this procedure takes.
8. It is recommended that the seat cushion is a two-layer, shaped geometry cushion or similar that evenly distributes contact forces.
9. The driver's seat must have a back rest with lumbar support.
10. The second persons seat should, where possible, mirror the functionality and comfort of the Driver's seat. Where this is not possible then the seat should have following features (as a minimum).
    a. Back rest with lumbar support
    b. Fully adjustable with controls that facilitate easy adjustment on the move.

SECTION 3 : CAB ENTRY AND EXIT POINTS

GENERAL

1. All cab access doors (either external or internal) must provide suitable security and protection from unauthorized attempts at entry.
2. All cab access doors must be fitted with lock which must be operated by keys that are not available to the public and where appropriate these locks should be retro fitted.

CAB DIMENSIONS

1. For the purposes of this section the *operational area* of the driving cab is defined as the area which includes the cab desk and the driver's seat from the windscreen to:
    a. the maximum seat reference point for the tallest percentile driver when observing the forward visibility requirements of EN16186-1 or
    b. the furthest extent of the cab desk (whichever is the greatest).
2. There must be a clear space behind the operational area that allows free passage for the driver without impediment. It is recommended that this is in the form of a walkable area that extends from one side of the driving cab to the other.
3. This walkable area must be a minimum unobstructed area of at least 1950 mm height 600 mm width.
4. Side cab doors (if fitted) shall be at either end of the walkable area.

EXTERNAL DOORS

1. The driver's cab must be externally accessible (without risk to safety) from both sides of the vehicle from at least 200 mm below the rail.
2. External access to the driving cab can be provided from an adjacent compartment if necessary.
3. Doors on the sides of driving cabs must only open inwards or be of the plug door or sliding variety.
4. The external doors must have the ability to be opened and secured/remain in the open position to enable safe entry into the cab when the vehicle is standing on an uneven surface.
5. The external doors must have a "soft close" or similar safety mechanism to mitigate against finger-trapping.
6. The external doors that provide access directly to the driving cab must have a minimum unobstructed passage height of 1675 mm and a minimum passage width of 500 mm when accessed by the footsteps.

7. If the cab is to be accessed at floor level, there must be a minimum unobstructed passage height of 1750 and a minimum passage width of 500 mm.
8. There must be a minimum unobstructed area of at least 1950 mm height 600 mm width and 600 mm depth immediately beyond the door passage to allow for the driver to stand upright with personal equipment.
9. Access to the driver's cab shall be possible without any energy supply available on board. External Cab doors should be designed so as not open unintentionally.

INTERNAL DOORS

1. The internal cab exits should measure at least 1950 mm in height, at least 600 mm in width.
2. In through corridor stock the sidewall should be able to pivot away from the driver in order to lessen the feel of claustrophobia and open the cab environment up, this allows proper observation of cab equipment without having to use an awkward body posture.
3. If there is any risk of obstruction (baggage, passengers), the door must be of the swing-type (opening outwards and inwards) or of the sliding type.
4. Internal doors that provide access to engine or maintenance compartments shall also (in addition to the requirements of this section) provide protection against fire, smoke, and noise.
5. Internal doors that that allow access to the driving cab via a passenger saloon should provide suitable security and protection from unauthorized attempts at entry.

EXTERNAL ACCESS STEPS

1. Where the external design permits, the steps to access the cab must be in the same vertical plane and equidistant from one another.
2. The distance between the access steps must not exceed 450 mm. The bottom step must be as low as permitted by the gauge.
3. Where possible the steps must be of equal width. The minimum width should be 300 mm, and the minimum depth shall be 150 mm. The steps must also be slip proof.
4. Appropriate lighting should be provided to illuminate the access steps.

HANDRAILS

1. A handrail must be provided in all cases on each side of the doors and footboards leading to driving cabs.

2. The distance from the top end of the handrail to the driver's cab floor level must be of a suitable length considering the anthropometric measurements of the target user population.
3. The handrails must be rounded and permanently fixed to the side of the locomotive in a way that ensures stability and strength when in use and where possible, recessed into the bodywork to prevent the creation of addition noise.
4. There must be a minimum clearance of 40 mm between the handrails and the vehicle side, and this clearance can be increased to 60 mm at the bottom if the vehicle gauge permits.

DOOR HANDLES

1. At least one handle of every external cab door must be accessible from ground level.
2. The rotational axis of the handles must be at a minimum distance of 80 mm from the lower edge of the door and 50 mm from the side edge. This distance of 80 mm shall also apply for fixed handles.
3. The clearance between the handle and surface of the door must be at least 50 mm.
4. The door handles must be at least 120 mm long and rounded in shape.

FLOORING

1. All walkable floor surfaces must be slip resistant.
2. Any changes in the level of the walkable area within the cab shall be sloping. The use of steps within the cab environment must be avoided.
3. Drivers should be permitted to navigate freely around the cab without obstruction.

WALKWAYS

1. Rolling stock with external walkways shall be equipped with handrails and foot bars (kicking strips) for driver safety when accessing the cab.

SECTION 4: EMERGENCIES

EMERGENCY ACCESS

1. The emergency services must be able to gain access to the driving cab on both sides of the vehicle for the purpose of evacuating Train Crew. This can be achieved by using external doors, side windows or emergency hatches.
2. In all cases, the means of emergency exit shall provide a minimum clearance (free area) of 2000 cm^2 with a minimum inner dimension of 430 mm to allow the release of trapped persons.
3. Emergency hatches can be located on the roofs of vehicles for the purpose of access if it is safe and practicable to do so.

EMERGENCY CAB EGRESS

1. Driving cabs at the ends of vehicles must have at least one internal door or a gangway allowing easy access for staff for use in an emergency.
2. This internal door must open outwards from the driving cab and be very simple to open from the drivers' side and be fitted with a mechanism that can be used quickly in an emergency.
3. It must be possible for all occupants to exit from the driving cab safely and without difficulty into a guaranteed clear space of at least 2000 mm in length.
4. It must be possible for the driver to escape from the seat (in a seated position) to a position beside the seat within 3 seconds.
5. Escape routes must be clearly labelled and identifiable in day and night making use of luminescent labels where required.

EMERGENCY EQUIPMENT

1. Equipment that a driver may be required to use trackside, in an emergency must be stowed in a portable container.
2. The container itself must be durable, light, and easy to handle and be located in an area with easy access preferably close to the cab door.
3. The emergency equipment stowage must be designed in a way so as to prevent the portable container from becoming dislodged in the event of a collision.

SECTION 5: THE CAB DESK

GENERAL

1. The driver's desk and its operating equipment and controls shall be arranged to enable, when in the most commonly used driving position, the driver to keep a normal posture, without hampering freedom of movement, taking into account the anthropometric measurements of the target user population.

2. Through the identification of the task requirements by task analysis, the target user (driver) requirements shall be established. Having established the tasks to be performed, the design of the cab shall be based on the following design principles:

    a. Importance principle – those items of equipment, displays and controls which are most essential to safe and efficient operation should be in the most accessible positions.

    b. Frequency of use principle – those items of equipment, displays and controls, which are used most frequently, should be in the most accessible positions.

    c. Function principle – items of equipment, controls and displays with closely related functions should be located close to each other.

    d. Sequence of use principle – items of equipment, controls and displays, which are used in sequence, should be located close to each other and their layout should relate logically to the sequence of operation.

3. The power brake controller should be suitably positioned and easy to use and use a "notched system" for operation so as to prevent accidental release of the brake and/or emergency brake.

4. The horn and power/brake controller should be placed on opposing sides of the cab desk to ensure ease of use in an emergency.

5. Provision should be made for a flat writing surface for completing paperwork.

ILLUMINATION

1. All indicator lights must be designed and positioned so that they can be read in all variations of natural or artificial lighting especially during periods of bright sunlight.

2. Indicators should be positioned on the desk in such a way that windscreen glare is mitigated during periods of darkness. Indicator lighting behind the driver should be kept to a minimum and shrouded to prevent windscreen glare during periods of darkness.

3. When additional lamps are provided (e.g. a lamp for the second person) these must not dazzle the driver.

4. Desk and instrument lights should be provided with a rotary control dimmer so that the lighting levels within the cab can be kept to a minimum to aid vision during times of reduced visibility and darkness.

SWITCHES AND CONTROLS

1. Operating switches and controls shall be clearly marked, so that they are easily identifiable by the driver.
2. Critical controls should be positioned or designed (e.g., countersunk or covered) to prevent accidental operation.
3. Operating switches and controls shall be positioned in such a way as to enable easy navigation of the cab controls.

DISPLAY SCREEN EQUIPMENT

1. The amount of display screen equipment in the cab must be kept to a minimum. Integration of functions with other display screen equipment is preferable.
2. In cab display screen equipment must be regularly maintained and cleaned with the appropriate cleaning solutions to ensure reliable operation and a clear image.
3. Operators of in cab display screen equipment must be able to fully adjust all aspects the display (including brightness and contrast) to make operation of the equipment as comfortable as possible.
4. The display screen equipment must have a “sleep” mode function that can be operated by the driver to disable the display to prevent distraction when the equipment is no longer needed. This function should be automatically disabled when there is a need for information to be displayed by the system.
5. In cab display screen equipment must have a manually selected “Day” and “Night” mode to mitigate the effect of glare at night and enable the operator to use the equipment effectively during bright sunlight.
6. The number and volume of audible warnings or alerts emitted from the display screen equipment must be kept to a minimum.
7. Any touch screen equipment or driver interface must have clear, user-friendly, intuitive, and responsive controls.

ALARMS

1. The guidance contained in RSSB T326 must be observed.
2. An assessment of the audible warnings, alarms and other audible notifications must be carried out for every conceivable operational task, fault and emergency expected during the driving operation of the train. This is to ensure that:

a The number of audible warnings, alarms and other audible notifications are kept to an absolute minimum.

b The driver can distinguish between each audible warning, alarm, and other audible notification.

3. There should be no more than 12 different auditory alerts that a driver has to learn and remember the meaning of.

4. All audible warnings, alarms and other audible notifications must be prioritised and sounded in order of urgency.

SECTION 6: THE CAB ENVIRONMENT

CAB AIR PRESSURE

1. Driving cabs must be fully enclosed on all sides. The doors, windows, pipe runs and cable runs, inspection traps and any ventilation flaps must be sealed against liquids, exhaust gases and draughts. A slight over-pressure in the driving cab is desirable.
2. Cab occupants must be protected against sudden and major air-pressure fluctuations that might occur - especially at high speeds - when passing other trains and/or travelling through tunnels (both may occur at the same time). This system should also be capable of being adjusted manually by the driver.
3. Pressure variations measured in a tunnel of 90 m^2 cross-section should comply with the following values: [1]
    a. absolute pressure variation ≤ 1 000 Pa,
    b. pressure variation over a given period ≤ 400 Pa in 1 second.
    c. These values also apply when trains cross in a tunnel.

HEATING, VENTILATION & AIR CONDITIONING (HVAC) SYSTEMS

1. HVAC system in driving cabs must meet the requirements of BS EN 14813-1 unless stated below.
2. The temperature controls must be variable, preferably with numbers indicating the corresponding temperature. If this is not available, then a numbered or sliding scale is acceptable. This helps the drivers acquire their preferred temperature as quickly as possible.
3. HVAC systems should only be operable in the active driving cab. Once de-activated driving cabs shall default to the saloon setting.
4. The driving cab, and particularly the floor and roof, shall be provided with heat insulation.
5. The ventilation system must be designed to ensure that at least 30 m^3 of air is changed per hour and per person without causing unpleasant draughts. The driver shall be able to adjust the airflow. Under normal conditions of ventilation, the air velocity must not exceed 0,3 m/sec level with the driver's head.

[1] Ref: UIC code 651

6. To ensure rapid evacuation of accumulated heat, it is recommended that the ventilation system be designed to enable the external airflow to be increased by the driver to at least 300 m3 per hour and per driving cab.

7. A ventilation system shall maintain an acceptable interior CO_2 level under operational conditions and provide an alert to the driver if these levels are exceeded.

8. Driving cabs must have a device fitted that enables the driver to accurately monitor the cab temperature. This device can be a physical piece of equipment or an integrated function within the Train Management System.

9. Air vents must be adjustable so as to enable the driver to direct air flow away from their head and neck if they wish to do so.

NOISE

1. Noise levels in the driver's compartments must be kept as low as possible, by limiting noise at its source through appropriate measures (acoustic insulation, sound absorption) using the ‘State of the art’ technology available at the time of installation.

2. Any assessment of the noise values in Driving Cabs shall be documented and include the type, extent, duration, and frequency spectrum of exposure to noise, including exposure to impulsive sound, as well as to intermittent and repeated vibrations.

3. The continuous noise level in Driving cabs measured over 30 minutes must not exceed 70 dB, the desired limit is 60 dB.

4. A p(peak) maximum noise level of 85 dB should not be exceeded. This peak should not exceed a maximum period of 3 seconds.

5. Measurements shall be effected under the following conditions:

    a. The maximum speed and power (diesel engines) must be maintained for at least 90% of the measurement time.

    b. The measurement time as defined may be subdivided into several short periods to comply with the above-mentioned conditions.

    c. The signal horn must be used for several times in every measurement process.

    d. The measurement shall be made level with the driver's ear (in the seated position), in the centre of the horizontal surface stretching from the front windowpanes to the rear wall of cabs.

6. To ensure accurate and effective testing and to protect the maximum limits, hearing protection must not be used.

7. Measurements should consider the effect of noise on warning signals, which must be considered to avoid accident hazards, especially with regard to the cab radio and the signal horn.

GLARE

1. Sun blinds must be fitted to windscreens enable crew members to protect themselves from being dazzled by sunlight or artificial lighting. These blinds should preferably be electrically powered with a coordinating, simple to use control for its operation.
2. Sun blinds must cover the full width of the windscreen and provide complete protection (cover) at the top of the blind mechanism.
3. All cab equipment and indications (once installed ergonomically) should be fully assessed for the impact of glare from sunlight entering the cab and remedial action taken.

CAB LIGHTING

1. It must be possible, in daylight, for all the details in the driving cab, especially the means of access and escape, to be easily distinguishable.
2. It is recommended that the driving cab incorporate a general lighting scheme guaranteeing 60 Lux continuously at the level of the driver's desk.
3. A reading light should be provided for the drivers writing surface that is focused on the area concerned and does not dazzle the driver during the hours of darkness.
4. After general lighting has been switched off, there must remain sufficient light in the driving cab for the crew to find their way around the cab.
5. Cab lighting should be able to function without the main battery switch being engaged.
6. Cab light switches should be located strategically so that the lights can be switched on from key points within the cab such as entry from track level, entry from platform level, entry from within the train and from the driving seat.

VIBRATIONS

1. Manufacturers must design and construct vehicles and cabs which reduce whole-body vibration to the minimum that can be achieved for example, seats that effectively dampen whole-body vibrations, or armrests that reduce vibrations transmitted to the hand-arm area.
2. Vibrations in the driving cab are to be subjected to an evaluation using the “state of the art” at the time of installation. If, based on such an assessment, an exceedance of the exposure limit values cannot be safely excluded, the assessment must be based on a representative measurement.

3. Measurements to determine vibration exposure must take at least one hour. The state of the track superstructure must be considered.

4. The maximum values for hand-arm vibrations in a particular viewing period are: $a_{hw,8h}$ = 2,5 m/s$^{2.}$ A value of $a_{hw,8h}$ = 5 m/s^2 must never be exceeded.

5. The maximum values for whole-body vibrations in a particular viewing period are: $a_{w,8h}$ = 0,5 m/s^2. A value of $a_{hw,8h}$ = 1,1 m/s^2 must never be exceeded.

ELECTROMAGNETIC RADIATION

1. Manufacturers should design and construct vehicles and cabs which reduce exposure to Electromagnetic Fields to the minimum that can be achieved.

2. The driving cab must be regularly tested to ensure that the exposure to Electromagnetic Fields (EMF) is kept to a minimum.

3. The actual values are to be determined according to the “state of the art” available at the time and may not exceed the limit values defined by the *ICNIRP Guidelines for limiting exposure to time-varying electric and magnetic fields (1 Hz – 100 kHz)*.

4. If individual countries have set stricter limits, then these should be used as maximum values. Exceeding the limits under maximum load are not permitted.

SECTION 7: CAB EQUIPMENT

GENERAL

1. The number and frequency of audible warnings relayed to the driver must be keep to an absolute minimum. The driver must be able to easily differentiate between all audible warnings.
2. In the case of legacy rolling stock, any equipment that is to be introduced into the driving cab must undergo an ergonomic and human factors assessment and
    a. must not obscure the sighting of signals or lineside signage from either the driving or second person's position.
    b. adhere to the crashworthiness and ergonomic principles contained within this document and/or the relevant standard.

SAFETY DEVICES

1. The driver's safety device (DSD) should be on an adjustable footrest to accommodate the different body sizes of drivers and be set at a pressure which provides resistance but not at one which requires too much effort from the driver.
2. Consideration should be given to the provision of a DSD 'holdover' button being located on the desk or within the design of the Combined Power Brake Controller (CPBC) in order to give the driver more options to achieve the most comfortable driving position.
3. Train Protection and Warning System (TPWS) temporary override button should have a latched cover to prevent accidental operation and be positioned in the driving cab of every train or locomotive.

COMMUNICATION DEVICES

1. The amount of telephone handsets should be kept to a minimum. Where there is a requirement for multiple communication options to be provided to the driver the preference is for these options to be separated by technical solution rather than additional handsets. Where multiple handsets are required, these should be clearly distinguishable and be within easy reach of the driver.
2. To avoid distraction, where provided the guard should have the ability to answer Passenger Alarm Units or Call for Aid devices.
3. All communication devices (including In-cab radio equipment) should be positioned to take into account the driving position so as to minimize the amount of movement required by the driver to use the equipment and view any corresponding displays.
4. All communication devices (internal and external) should be able to operate without power.

5. Any in-cab radio equipment (and associated train-borne equipment) should be positioned strategically to ensure that it is not damaged during an impact or collision to allow for communication in an emergency.

DRIVER MACHINE INTERFACE (DMI)

1. As well as the contents of this section, the relevant recommendations contained in *The Display Screen Equipment* sub-section of Section 5 *The Cab Desk* must also be considered.
2. The preference for the type of DMI equipment fitted to driving cabs is the soft key variation for freight locomotives and the touch screen variety for passenger services.
3. When the DMI is incorporated into new builds of traction vehicles, it is expected that the state-of-the-art technology available at the time will be used.
4. When retrofitting DMI equipment into driving cabs a full human factors assessment must be carried out in accordance with the provisions contained the sub-section *Evaluations and Measurements* of section 1 *General Requirements.*
5. If the human factors assessment proves that that there is an increased risk in the safe operation of the train due to the proposed fitment of the DMI then a full cab remodelling process should take place or retro fitment abandoned for that traction type.

ELECTRONIC TIMETABLES

1. If fitted the relevant recommendations contained in *The Display Screen Equipment* sub-section of Section 5 *The Cab Desk* must also be considered.
2. The provision of an additional screen solely for the provision of an electronic timetable should be avoided.
3. The electronic timetable should preferably be integrated into the Train Management system or other similar device as a navigable page.

MOBILE ELECTRONIC DEVICES

This covers the use of tablet PC's and other similar devices where employed.

1. The provision of a docking station is mandatory for cab use.

SECTION 8: ON TRAIN CAMERA / MONITOR SYSTEMS

GENERAL

1. The On-train camera / monitor system must be capable of displaying real time images to the driver.
2. The system shall automatically display images from external cameras on the side of the train on which the doors have been activated / armed.
3. Any camera / monitor equipment that is to be introduced into the driving cab (including legacy rolling stock) must adhere to the "Ergonomic Principles" as detailed in this document.
4. The fitment of any monitor or camera within the driving cab (including legacy rolling stock) must not obscure the sighting of signals or lineside signage from either the driving or second person's position.

EXTERNAL BODY-SIDE CAMERAS

1. External body-side cameras must be capable of showing the areas of risk along the whole length of the train without any blind spots. These areas include (and are not limited to) the entire entry and exit areas of any passenger doors and the gap between the train and the platform edge, including the gap between adjacent vehicles.
2. External body-side cameras must be capable of detecting a person (or any part thereof) that may become trapped in passenger doors including any item of clothing.
3. External body-side cameras must be able to provide the driver with a viewing area capable of showing events or movement whilst not immediately posing a risk to safety may do so in the immediate future e.g., a person running for a train.
4. External body-side cameras must be able to reproduce high quality and high-resolution images down to a level of at least 1.5 lux.
5. External body-side cameras that monitor the entry and exit of passengers should consist of the state-of-the-art technology available at the time of installation.
6. External body-side camera equipment must be regularly reviewed and replaced when necessary to take into account any industry changes or developments in technology.
7. External body-side cameras must be regularly maintained and cleaned so as to be free from dirt and the degrading effects of rain, snow, and foreign objects.
8. External cameras must be equipped with an efficient heating system capable of keeping the equipment free from snow and ice.

IN-CAB MONITORS

1. As well as the contents of this section, the relevant recommendations contained in *The Display Screen Equipment* sub-section of Section 5 *The Cab Desk* must also be considered.
2. In-cab monitors shall be capable of reproducing a colour image that is accurate, free from distortion and able to cope with varying light levels.
3. There must be a method in place whereby a driver can easily determine that the images being viewed are live and not frozen due to a technical fault or other reason.
4. There must be a function available to the driver that enables activation of the monitors without the doors being activated / armed to ensure it is safe to depart when stopping out of course whilst not in passenger service.
5. The monitors should extinguish as soon as the power controller is engaged, and the train is moving.
6. The maximum number of images able to be displayed at any one time shall be 12 (6 per screen).
7. The images must be displayed in way that is conducive to logical and efficient scanning that permits the safest way of detecting obstacles. Guidance as laid out in RIS-2703-RST Issue two, December 2018 should be considered.
8. In-cab monitors must be regularly reviewed and replaced when necessary to consider any industry changes or developments in technology.

SECTION 9 - WINDSCREENS AND WINDOWS

WINDSCREENS

1. Windscreens must not inhibit the drivers view in any way and should fully support the driving task.
2. Windscreens must be able to resist an external impact considering the velocities achieved when the train is travelling at its maximum speed. The minimum impact requirements contained in EN 15152 must be adhered to.
3. All windscreens must be anti-spalling.
4. In the case of legacy rolling stock, the anti-spalling qualities of windscreens must be assessed at regular intervals during a trains lifetime and must be replaced or modified when found not to meet current standards.
5. A windscreen demister must be provided with an automatic cut out to prevent accidental damage.
6. The driving cab shall be designed to allow the driver to easily see external signals and signage on a straight and curved track in line with RIS 0737 without movement of the body from the driver.
7. The location, type and quality of windscreen cleaning and clearance devices shall ensure that the driver is able to maintain a clear external view in most weather and operating conditions and shall not inhibit the driver's external view.

SIDE WINDOWS AND GLAZING

1. Side windows are an asset to the driving cab which allows the driver to have a fuller view of the immediate area at the front of the train can assist in the safe operation of the train including collision avoidance and train dispatch.
2. Driving cabs must be fitted with side windows and must be large enough to allow the driver to have as much vision to the side of the train as possible without reducing structural integrity.
3. Side windows must not be obscured by livery or decals and must be tinted to reduce the effect of heat transfer and glare during extreme sunlight.
4. The use of side of openable side windows must be avoided and only used when the method of operation demands it and there are no alternatives 9e.g. accessible side doors. This is because: -
    a. They can reduce the structural integrity of the driving cab.
    b. Allow the ingress of noise and rain if not maintained properly.
    c. And allow for poor ergonomics and human factors if used as a part of the method of work (e.g. train dispatch).

d. Cause injury during operation if not maintained properly.

e. Can impact on the proper functioning of HVAC systems.

Note: A side window is glazing positioned transversely to a windscreen and to the side of a driver, forward of the rearmost seated position.

SECTION 10: LEGACY ROLLING STOCK

Note: For the purposes of this document the term "legacy rolling stock" is defined as rolling stock listed on the R2 rolling stock library that was registered before the subsequent changes to standards covering all or part of the driving cab areas considered by this document.

1. All rolling stock should have a "lifespan" as per manufacturers guidelines. This is to ensure that;
    a. Legacy rolling stock can undergo a cab environment assessment at regular, fixed intervals until they become "life expired".
    b. Succession plans can be put in place so that rolling stock can be removed from circulation when they become "life expired".
    c. The UK can maintain a high standard of safe and comfortable rolling stock fit for passengers and staff.
2. The cab environment and equipment of legacy rolling stock should be reviewed against this guidance, the relevant standards, and the state of the art applicable at the time as a part of a cab environment assessment.
3. Any equipment that is to be introduced into the driving cab of legacy rolling stock must undergo an ergonomic and human factors assessment and: -
    a. must not obscure the sighting of signals or lineside signage from either the driving or second person's position.
    b. adhere to the crashworthiness and ergonomic principles contained within the relevant standard.
4. Outside of the cab environment assessment process there should be a robust procedure in place for trade unions to raise issues relating to the cab environment.

MAINTENANCE

1. Maintenance programs should be robust enough to ensure that components are replaced before their life expiry and (especially relating to cab equipment) before they impact on the driving function.
2. Therefore, the following components of the cab environment should be assessed for wear and tear and correct functionality during weekly maintenance schedules (as a minimum).
    a Door seals
    b Windscreens
    c Seating

d Flooring

THE CAB ENVIRONMENT ASSESSMENT

1. A cab environment assessment should be carried out at least every 10 years and in the following circumstances:

    a. Where legislated for by government.

    b. When the saloon accommodation undergoes refurbishment.

    c. When legacy rolling stock is introduced or "cascaded" into a different company.

    d. After an accident or injury warrants an assessment.

    e. When recommissioned from a storage facility after 6 months or more.

2. A cab environment assessment must include the following:

    a An assessment of the Driver's seat to conform to the following requirements: -

        i) Comfortable compressed air suspension of an agreed standard should be fitted.

        ii) Seats should be fully adjustable, and the controls must facilitate easy adjustment on the move.

        iii) It is recommended that the seat cushion is a two-layer, shaped geometry cushion or similar that evenly distributes contact forces.

        iv) The driver's seat must have a back rest with lumbar support

    b An assessment of the second person's seat to conform to the following requirements

        i) where possible, the second person's seat should mirror the functionality and comfort of the Driver's seat. Where this is not possible then the seat should have following features as a minimum: -

            - Back rest with lumbar support

            - Fully adjustable with controls that facilitate easy adjustment on the move.

NOTE: If the seat concerned meets the requirements on design and functionality, then only an assessment of the upholstery is required and should be renewed where there is excessive wear and tear.

NOTE: If the seating does not meet the above requirements on design and functionality, then it should be modified or replaced with a suitable alternative that does.

    c. An assessment of internal and structural crashworthiness.

i. The driving cab interior and exterior should be assessed against the applicable standards for crash worthiness and all possible modifications made.

ii. If any driving cab is found to not fully meet the minimum standards on crashworthiness and it cannot (for any reason) be modified, then it should be withdrawn at the earliest opportunity.

d. An assessment of the cab ergonomics - using independent human factors specialists.

i. A general ergonomic assessment should be carried out especially where this has not been done during the fitment of new cab equipment or technology.

ii. A musculoskeletal risk assessment should be carried out using an appropriate assessment tool (e.g. the RSSB's musculoskeletal risk assessment tool (MAT))[2] to assess the risk of injury.

e. A musculoskeletal risk assessment using an appropriate assessment tool (e.g. the RSSB's musculoskeletal risk assessment tool (MAT)).[3]

f. An assessment of Headlight brightness.

i. An assessment of the headlights and marker lights (where fitted) should be carried out to ensure that the brightness levels meet current standards.

ii. Where the headlights fall short of current standards they should be replaced (where possible) with LED lights.

g. An assessment of the air-conditioning or cooling and heating system to ensure:

i. Effective cooling and heating performance

- All driving cabs must be equipped with an air-conditioning or climate control system capable of delivering at least 2.5 kW of cooling capacity.
- The cab air-conditioning or climate control system and associated equipment (air-vents etc.) must be robust enough to ensure that cab temperatures do not rise above 26°C.
- Heating power must be designed to reach a cab temperature at least 18°C in cold weather.

[2] This must also be carried out after a complaint of a Musculoskeletal Disorder is recorded.

[3] This must also be carried out after a complaint of a Musculoskeletal Disorder is recorded.

ii. Effective filtration of airborne contaminants and viruses

iii. Driving cabs must have a device fitted that enables the driver to accurately monitor the cab temperature. This device can be a physical piece of equipment or an integrated function within the Train Management System.

h. An assessment of the windscreen including

i. anti-spall qualities

ii. impact qualities

NOTE: Any windscreen that does not meet the minimum standards contained (as defined in EN 1515) must be replaced. This can be part of a large-scale retro fitment program or as a part of a company's general maintenance program.

i. An assessment of the cab noise

i. Driving cab noise levels should be assessed against the current standards in accordance with the recognised testing methods.

ii. A check of the external door seals and cab windows should be carried out to ensure their integrity and effectiveness in preventing unwanted wind noise. Any door seals that are damaged or worn must be replaced.

iii. A check of the interior structures of the driving cab should be carried out to ensure that they are still close-fitting and do not produce unwanted rattles, squeaks and noises that may distract the driver.

j. An assessment of the lifeguards

i. Lifeguards should be assessed against current standards and replace if necessary.

NOTE: Remedial action should be taken where rolling stock is not deemed to meet current standards in the areas covered by the Cab environment assessment.

APPENDIX 1: GLOSSARY

CEN	European Committee for Standardization
CENELEC	European Committee for Electrotechnical Standardization
CER	Community for European Railways
CPBC	Combined Power Brake Controller
DMI	Driver Machine Interface
DSD	Drivers Safety Device
EMF	Electromagnetic Fields
ETF	European Transport Federation
ICNIRP	International Commission on non-ionizing radiation protection
LDAG	Locomotive Drivers Advisory Group
RSSB	Rail Safety and Standards Board

APPENDIX 3: SOURCES

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3. RSSB T698 Human Modelling of Train Cabs and Train Driver Anthropometrics | 03 September 2007
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2. TSI CR LOC&PAS 2014
3. TSI Noise 2014
4. HSE The Control of Vibration at Work Regulations 2005
5. RSSB RIS-2703-RST-issue 1 – Driver Only Operated On-Train Camera / Monitor Systems
6. Modelling the Human Body/Seat System in a Vibration Environment (Jacob Rosen and Mircea Arcan)
7. RIS-2703-RST Issue two (December 2018)
8. T910 Improvements in the Interior Crashworthiness of Drivers' Cabs (RSSB 2012)
9. RSSB research project T326 Guidance on audible alarms.