Department for Transport

Intercity Express Programme (IEP)

Schedule 1 – Appendix A

Train Technical Specification

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Important Notice

This document constitutes the final form of the Train Technical Specification (TTS). The TTS forms an integral part of the MARA contract which resides within the full suite of IEP contractual documentation; the TTS must not be read or assessed in isolation.

All references in this document to the Department for Transport (DfT) include, where appropriate and unless the context otherwise requires, references to DfT's predecessors and successor(s).

All references in this document to Network Rail (NRIL) include, where appropriate and unless the context otherwise requires, references to NRIL's successor(s).

Any reference to a contract or other document is qualified in full by reference to the entire terms of the contract or document referred to.

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Technical Specification – Intercity Express Programme

1 Definitions

N111 25kV Overhead Electric Supply

Means a system of supplying electrical power to trains by means of a catenary system positioned above the track. The ranges of voltage and frequency of the power supply are as defined in sections 4.2 and 4.3 of 'NR/GN/ELP/27010, Issue 2, December 2005 'Business Process Document – Guidance for compatibility between electric trains and electrical systems'. This definition excludes the power supply system on all parts of the Channel Tunnel Rail Link between St Pancras International and Folkstone. Specific requirements for IEP Units with respect to the electrical characteristics of this supply are defined in section 3.22 of this Specification. N

N074 Adverse Infrastructure Conditions:

Means any of the following events howsoever arising:

- during train acceleration, the rail head is contaminated such that the level of acceleration demanded by the driver cannot be achieved. In considering whether sufficient adhesion is available, it shall be assumed that half the wheelsets on the train demand adhesion and each of those wheelsets demands an equal level of adhesion;
- during braking, the rail head is contaminated such that insufficient adhesion is available to deliver the level of retardation demanded by the driver of the train. In considering whether sufficient adhesion is available, it shall be assumed that all wheelsets demand an equal level of adhesion; N
- when operating from a 25kV Overhead Electric Supply, the supply voltage falls below 24kV or the infrastructure cannot deliver sufficient current for the IEP Train, provided that, the performance of the train is not reduced by more than that implied by the characteristics described in N081;
- when operating from a 25kV Overhead Electric Supply, it can be demonstrated to the satisfaction of the Secretary of State that sufficient contamination (including ice) is present on the overhead contact wire such that collection of the required current cannot be achieved; or
- when operating from a 25kV Overhead Electric Supply, it can be demonstrated to the satisfaction of the Secretary of State that the prevailing wind speeds are such that collection of the required current cannot be achieved.

TS1747 Basic Services:

Means each of the emergency services defined in TS1945, TS1946 and TS1947 (section 3.18.6 of this Appendix A), all systems necessary to allow safe movement of the IEP Train and egress of passengers, saloon ventilation, toilet flushing and Passenger Information System capability. N

N084 Bi – Mode IEP Unit:

Means an IEP Unit where the main power source(s) can be provided by means of a 25kV Overhead Electric Supply and by means of a Self Power Source but only one of these at a time. N

N157 BR-ATP:

Means the ATP system fitted to the Great Western Main Line. N

TS1890 Crush Laden Load:

Means the IEP Train in Tare Condition plus a passenger load of all seats occupied with further standee passenger numbers equivalent to 4 passengers per m^2 of available standing space (in accordance with 'long distance' category as detailed in table 3 of BS EN15663:2009 'Railway applications. Definition of vehicle reference masses'). The mass of each passenger (which shall include that passenger's luggage) shall be assumed to be 80kg (in accordance with 'long distance' category as detailed in table 3 of BS EN 15663:2009 'Railway applications. Definition of vehicle reference masses'). A mass of 300kg/m^2 shall also be assumed for luggage compartments as defined in BS EN15663:2009 'Railway applications. Definition of vehicle reference masses'. N

N071 Delivered Weight:

Means the train weight for the interior configurations defined in Annex D and excluding the following;

a) Emergency equipment that shall be supplied by the Relevant Operator;
b) fuel and fuel additives;
c) toilet water; N
d) toilet consumables;
e) catering consumables (including potable water);
f) passengers, train crew and luggage; and
g) Relevant Operator supplied catering equipment.

For the purposes of this definition toilet retention tanks are assumed to be empty.

N002 Driving IEP Vehicle:

Means any vehicle having a driver's cab and positioned at one end of an IEP Train N

TS1950 East Coast Main Line Track Data:

Means representative track quality provided in Annex E. N

N101 Empty Coaching Stock (ECS):

Means an IEP Unit moved without train crew or passengers other than a driver. N

N085 Electric IEP Unit:

Means an IEP Unit where the main power source(s) are provided solely by means of a 25kV Overhead Electric Supply. N

N141 Electric Mode: N

Means a mode of train operation where the power necessary for the movement of the train and the provision of auxiliary functions is derived only from a 25kV Overhead Electric Supply.

N156 ETCS:

Has the meaning given to it by the relevant TSI. N

N005 Full Functionality:

Means an IEP Train operating in compliance with this Specification without causing damage to the IEP Train. N

TS1889 Fully Laden Load

Means an IEP Train in Tare Condition plus a passenger load of all seats occupied, with further passenger load of 20 standees per vehicle. The mass of each passenger (which shall include that passenger's luggage) shall be assumed to be 80kg (in accordance with 'long distance' category as detailed in table 3 of BS EN15663:2009 'Railway applications. Definition of vehicle reference masses'). N

TS1888 Fully Seated Load

Means an IEP Train in Tare Condition plus a passenger load of all seats occupied. The mass of each passenger (which shall include that passenger's luggage) shall be assumed to be 80kg (in accordance with 'long distance' category as detailed in table 3 of BS EN15663:2009 'Railway applications. Definition of vehicle reference masses'). N

N006 Functional Vehicle Type:

Means one of a set of vehicle configurations which are defined independently of the interior layout and relate to the fitment of cabs, bogie types, traction equipment, Self Power Sources or other equipment necessary for the IEP Vehicle to perform its function within an IEP Unit. N

TS414 Furnishable Space:

Means the length of useable full body width available for use by seating, wheelchair space, luggage, or catering facilities (excluding vestibules and gangways). N

TS1959 IEP Train:

Means one or more IEP Units coupled together so as to meet the requirements of this Specification. This includes one or more IEP Units coupled together and hauled by a Locomotive but excludes the Locomotive in this case. N

N062 IEP Unit:

Means a collection of IEP Vehicles coupled together such that it meets the requirements of this Specification, with two Driving IEP Vehicles, one positioned at each end. N

N001 IEP Vehicle:

Means a single, one piece body together with all supporting running gear and interior, exterior and underframe fittings. N

N007 In Service:

Means, in relation to each IEP Train, the period of time during the Operational Day. N

N003 Intermediate IEP Vehicle:

Means any IEP Vehicle not having a driver's cab at either end and is positioned between Driving IEP Vehicles in an IEP Unit. N

N146 Knee Room:

Means the space available between seats to accommodate the upper part of a passenger's legs. The definition is dependent on whether unidirectional or bay (facing) seating is being considered:

- In the case of unidirectional seating it is the horizontal distance at knee level, from the passenger contacting surface of the seat back to the rearmost section of the seat in front, at knee position; or N
- In the case of bay seating it is half the horizontal distance at knee level, from the passenger contacting surface of the seat back to the corresponding position on the facing seat.

TS1949 Limited Movement:

Limited Movement is defined as the ability whilst with a Crush Laden Load to:

- on level track, reach a speed of at least 30mph from stationary within 5 minutes, N
- start on and climb any gradient encountered on the IEP Network,
- start on and climb a gradient of 1 in 37.

It is accepted that 30mph may not be achieved whilst climbing gradients.

N004 Locomotive:

Means one or more vehicles, other than IEP Vehicles, capable of independent movement, which presents the following interfaces to an IEP Train:

Coupling:	Screw coupling (refer to RSSB web document SD001 'System Data for Mechanical and Electrical Coupling of Rail Vehicles') with the possibility of a drop head or swing head Buckeye attachment, and buffers. N
Brakes:	Twin pipe air brake interface (in accordance with UK national practice, refer to Railway Group Standard GM/RT2045, Issue 2, April 2000 'Braking Principles for Rail Vehicles')
Electric Train Supply:	None.
Through Electrical Controls:	None.

N086 Locomotive Hauled Mode: N

Has the meaning given to it in section 3.18 of this Appendix A.

TS 1957 Maintenance:

Means all activities the TSP is required to carry out on and to the IEP Vehicles under the terms of the MARA and the TARA, which shall include, but is not limited to, maintenance, servicing and cleaning activities. N

TS1951 Midland Main Line Track Data: N

Means representative track quality provided in Annex F.

N088 Multiple Hauled Mode

Has the meaning given to it in section 3.18 of this Appendix A. N

TS1579 Multiple Working:

Means, subject to the limitation set out in section 3.2 relating to train length, having the ability to control an IEP Train, comprising of two or more IEP Units, from a single cab at either end of the IEP Train. N

N116 NR55

Means the curve described by the table below where the frequency in Hz specifies the centre of an octave frequency band and the value in dB specifies a sound pressure level (linear, unweighted) in that band. N

Hz	31.5	62.5	125	250	500	1000	2000	4000	8000
dB	92.9	79	69.9	63.2	58.4	55	52.3	50.3	48.7

N114 Packet 44:

Has the meaning given to it by the ETCS System Requirements Specifications according to the relevant TSI. N

TS1948 Passenger Announcement (PA) system:

Has the meaning given to it in section 4.9. N

N089 Passenger Information System (PIS):

Has the meaning given to it in section 4.9. N

N112 Preferred Speech Interference Level (PSIL)

Means the arithmetic mean of the linear unweighted sound pressure levels centred on the 500Hz, 1000Hz and 2000Hz octave frequency bands. N

N090 Real Emergency Mode:

Has the meaning given to it in section 3.18 of this Appendix A. N

N143 SDO

Means Selective Door Operation, a means to selectively prevent one or more doors from being released when an IEP Train calls at a station. N

N145 Self Power Mode:

Means a mode of train operation where the power necessary for the movement of the train and the provision of auxiliary functions is derived only from a Self Power Source. N

N140 Self Power Source:

Means a device which provides power to the IEP Train, relying on the conversion of a fuel carried on board the train into power in a useful form and making no use of any sources of power external to the train. N

TS1884 Space Saver Toilet:

Means a toilet that is accessible by the User Population, except wheelchair users. N

N091 Standard Mode

Has the meaning given to it in section 3.18 of this Appendix A. N

TS1887 Tare Condition:

Means when the IEP Train is equipped with all the emergency equipment, consumables and occupied by all the staff, which it requires in order to fulfil its function but empty of any passengers, luggage or other payload. The mass of each member of staff (which shall include that member of staff's luggage) shall be assumed to be 80kg. N

N113 $T\gamma$:

Means the energy dissipated in the contact patch per metre between the wheel and the rail, calculated as the product of the creep (friction) force and the creepage (distance slipped per unit distance rolled). N

N102 Train Service Database (TSDB):

Means a database maintained by Network Rail which contains the base data upon which the National Rail timetable is produced. N

N093 TSI:

Means the Technical Specifications for Interoperability issued as decisions of the Commission of the European Communities with respect to European Parliament and Council Directives relating to the interoperability of the rail system within the Community. N

N094 Train Requires Assistance from Another Train Mode:

Has the meaning given to it in section 3.18 of this Appendix A. N

N095 Train Unable to Proceed Under Main Power Source Mode:

Has the mean given to it in section 3.18 of this Appendix A. N

TS1885 Universal Access Toilet:

Means a toilet that is accessible by the User Population including all categories of Persons with Restricted Mobility (PRM) (as defined in the TSI). N

N063 User Population:

Means all users (e.g. passengers, train crew and staff carrying out Maintenance) who shall range from 5^{th} percentile female to 95^{th} percentile male according to 'Adult Data, the hand book of Adult Anthropometric and Strength Measurements: Data for Design Safety, Department of Trade and Industry, 1998 '. N

N139 VTISM:

Means the Vehicle Track Interaction Strategic Model, developed by the Railway Safety and Standards Board, Version 2.0. N

2 Introduction

TS306 The role of this Technical Specification is to define the technical requirements for the Intercity Express Programme IEP Trains. Requirements are expressed in output terms, necessary for the success of the Intercity Express Programme. N

N073 Where practicable and unless otherwise stated herein, all clauses of this Specification shall apply together.

Where a clause specifies particular conditions which must be met before compliance can be achieved it is only necessary to demonstrate compliance with those specified conditions for the purposes of that clause. N

2.1 Standards

N122 Where individual standards are considered appropriate the standard is stated in the relevant part of this Specification. When a standard is declared, the standard shall be deemed mandatory and alternate standards shall not be considered. N

2.2 Infrastructure Compatibility

TS1789 Subject to the relief set out in Appendix C to Schedule 1 the TSP shall be responsible for demonstrating that the IEP Trains are, when performing to the capabilities required of them by this Appendix A, compatible with the infrastructure on the IEP Network without limitation, which compatibility shall be demonstrated through the Compatibility Review Forum in accordance with Applicable Laws and Standards.. R

2.3 Compliance

N118 At the right hand side of each clause in this Appendix A, there are one or more letters which indicate the method of demonstration which shall be used in showing compliance with that particular clause during the Acceptance Process**.** N

N119 The letters shown at the right hand side shall be interpreted as follows:

- N – It is not necessary to show compliance with this clause as it stands alone. The requirements of these clauses shall however be met in demonstrating compliance with other clauses
- R – The requirement shall be deemed to have been complied with when all Relevant Approvals are obtained.
- D – Compliance with this clause shall be demonstrated by the provision of documentation during the Design Process. N
- T – Compliance with this clause shall be demonstrated through test.
- C – Compliance with this clause shall be demonstrated on an ongoing basis through the design and test of the train by showing that there is no impediment to compliance in the design and no failures to comply with the relevant clause occur during the testing carried out to show compliance with clauses identified with an ‘R’ or ‘T’.

Where more than one of the above letters are specified, the means of demonstrating compliance shall be agreed during detailed design with the proviso that each specified

method shall be used as part of the demonstration.

Note that in the case of 'R' and 'T', it is necessary to obtain Relevant Approvals or carry out testing only for the IEP Units being procured (please refer to Annex D).

3 Train Wide Functions

3.1 Train Operation, Types and Flexibility

3.1.1 Train Operation

TS1823 The IEP Trains must be able to operate on the IEP Network at full line speeds as defined in TS261. R

TS1824 The IEP Trains must be able to maintain Full Functionality while operating over the IEP Network under all infrastructure conditions (other than infrastructure failures).

Particular consideration shall be given to operation on canted track.

It is acceptable for acceleration and braking performance to be degraded in the event of an Adverse Infrastructure Condition although the design of the IEP Train shall mitigate so far as reasonably practicable reduced performance in this event. D

The IEP Train shall be designed such that the TSP shall not need to place any restrictions on how the IEP Train may be operated in the event of an Adverse Infrastructure Condition.

N008 The IEP Trains must be able to maintain Full Functionality, subject to the provisions in N073, whilst operating with any passenger load from Tare Condition up to Crush Laden Load. C

TS1825 The IEP Trains must provide Full Functionality on the minimum horizontal and vertical track curvatures of the IEP Network. In addition, as a minimum, the IEP Trains must be able to maintain Full Functionality on the following minimum curvatures during mainline operation at the relevant maximum line speed:

Single Horizontal Curve: 120 m

Reverse Horizontal Curve: 140 m, 3 m straight between curves D

Vertical Curve: 500 m

Note that clauses TS1840, N154, N155 and TS1625 contain the specific requirements for coupling and stepping on curved track.

TS1826 The IEP Trains must be able to negotiate the minimum horizontal and vertical track curvatures within depots and sidings where the TSP is carrying out activities on the IEP Train. It is expected that these curves will be of a smaller radius than the mainline minima defined in TS1825. D

TS1827 The IEP Trains must deliver Full Functionality on all gradients encountered on the IEP Network and as a minimum, on gradients of up to 1 in 37. D

TS1470 The IEP Trains must deliver Full Functionality when operating over the following route types: D R

- Routes with a 25 kV AC Overhead Electrification Supply;

- 1500V DC overhead electrified routes;
  - Note that power shall not be drawn from the 1500V DC supply; and
  - Electric trains are not required to operate in Standard Mode;
- 750V DC third rail electrified routes;
  - Note that power shall not be drawn from the 750V DC supply; and
  - Electric trains are not required to operate in Standard Mode unless a 25kV AC Overhead Electrification Supply is also provided;
- Non-electrified routes;
  - Electric trains are not required to operate in Standard Mode; and
- Routes including any combination of the above either together or separately.

Where the above are not found on the IEP Network then this capability shall be demonstrated solely by means of the following:

- demonstration that there is no gauge infringement between the IEP Trains and the 750V DC third rail where this is present; and
- demonstration that the train design has considered the electromagnetic compatibility between IEP Trains and the infrastructure on the following route which is not part of the IEP Network and that analysis confirms that IEP trains are electromagnetically compatible with that route:
  - The route from Reading to Bournemouth via Basingstoke, Winchester and Southampton.

TS1961 The IEP Trains must be designed so that they are compatible with the operational requirements of the Rule Book (GE/RT8000) in all modes defined in section 3.18 of this Appendix A. | D

3.1.2 Unit Types

TS1832 The design of the IEP Units must allow for the following Unit types; | D

- an Electric IEP Unit; and
- a Bi-mode IEP Unit.

TS1576 A Bi-mode IEP Unit must deliver Full Functionality in any of the following modes; | D T

- Electric Mode; and
- Self Power Mode.

TS1964 A Bi-mode IEP Unit must allow the driver to select any of the modes identified in TS1576. | D

TS1577 A Bi-mode IEP Unit must be able to switch between any of the modes identified in TS1576 whilst at any speed from stationary up to the maximum speed of an IEP Train identified in TS261. | D T

3.1.3 Flexibility

TS1578 The design of the IEP Units must ensure that the IEP Units have the flexibility to allow for train formation changes, changes of power source, and redeployment throughout their life. | D

The design of the IEP Units must minimise the cost and timescales to effect these changes.

TS1965 It is an essential requirement that the number of different Functional Vehicle Types within the architecture of the various trains is minimised and there shall in any event be no more than 13 distinct Functional Vehicle Types. D

TS1968 A Bi-mode IEP Unit must be capable of being readily modified to an Electric IEP Unit at a future date by the removal of Self Power Sources from one or more IEP Vehicles. D

TS1969 Where any of the IEP Units undergoes the modification identified in TS1968, the interior of the replacement IEP Vehicle must, have an interior which matches that in the equivalent IEP Vehicle in an Electric IEP Unit specified in Annex D. D

TS1970 A Bi-mode IEP Unit must be capable of being readily modified (so far as reasonably practicable) to utilise a different type of fuel and/or Self Power Source without the replacement or addition of any IEP Vehicles. D

TS1971 Systems and any associated options which are specified in this Appendix A but not fitted to the IEP Unit on delivery must be capable of being fitted to the IEP Unit at a later date with the exception of:

- the provision of additional catering facilities; D
- the enhancement of a catering facility from one numerical level to a smaller numerical level; and
- the installation of BR-ATP.

TS1972 All IEP Units must be capable of accommodating a change in interior finish, interior layout or fit out, including catering and toilets. D

TS1973 All IEP Units must be capable of accommodating a change in livery and brand identity. D

3.2 Multiple working

TS231 All IEP Trains must deliver full Multiple Working in normal passenger service with other IEP Trains (of any type) within the following constraints;

- Up to a maximum of two IEP Units; and
- Up to a maximum total multiple length of 312m. D T

And when operating in Multiple Working within such constraints, there shall be full control of such systems throughout the train that are capable of being controlled from the cab of a single IEP Unit such that there is no difference in functionality between a single IEP Unit and an IEP Train formed from two IEP Units coupled together.

TS1837 All IEP Trains must deliver Multiple Working with other IEP Trains (of any type) to allow them to be rescued (Train Requires Assistance from Another Train Mode), or for Empty Coaching Stock (ECS) movements, within the following constraints;

- Up to a maximum of four IEP Units; and
- Up to a maximum total train length of 624m. D T

When IEP Trains longer than 312m are formed for ECS purposes, the functionality defined in TS231 shall be provided with the following provisos:

- Systems supporting the carriage of passengers or the indication of non-critical faults which normally require communication throughout the whole train (e.g. TMS,

passenger information, CCTV, door control, SDO) may offer degraded functionality.

- Traction power is not required on all IEP Units but must be provided as follows:
  - on each whole IEP Unit up to a maximum of two IEP Units; and
  - up to a maximum total length of IEP Units providing traction power of 312m

  providing that:
  - when traction is required on two IEP Units, these must be adjacent; and
  - the length of IEP Units providing traction power is the same as or greater than the length of IEP Units without traction power.

When IEP Trains longer than 312m are formed for rescue purposes, the above provisos applicable to ECS operation shall apply to the rescuing IEP Train, only the functionality defined in clause 3.18.5 of this Appendix A is required on the rescued IEP Train.

TS1974 An IEP Unit must be able to haul an IEP Unit formed from the same number of IEP Vehicles or fewer in Multiple Hauled Mode whilst maintaining Full Functionality, subject to the maximum overall length criteria in TS231. D T

TS1975 An IEP Train of any length must be able to rescue an IEP Train formed from the same number of IEP Vehicles or fewer, provided that the IEP Train being rescued is no greater than the maximum length specified in TS231. D T

TS1695 IEP Trains must be able to couple and uncouple with passengers on board in a station environment, regardless of door status on the stationary train portion. The design of the IEP Train must give appropriate regard to the risks presented during coupling and uncoupling although it is acknowledged that it will also be necessary for the Relevant Operator to implement appropriate driving procedures to ensure safety during this process. D T

TS1696 IEP Units must be able to automatically couple or uncouple with each other in no more than 2 minutes.

The coupling or uncoupling time shall be taken from the point at which the original IEP Train (or separate IEP Units, in the case of a coupling operation) cease to be available to operate until the time that the now separated IEP Units (or the coupled IEP Train, in the case of a coupling operation) are available to operate. This shall exclude any traincrew walking time between cabs and the BR-ATP start up time (provided this does not exceed 4 minutes), but shall include all train borne system reconfiguration activities, for example, ETCS, GSM-R, TMS and brake proving. D T

TS1839 IEP Trains must be equipped at each end with an automatic centre buffer coupler in accordance with the requirements in the TSI that relate to high speed rolling stock. D

TS1840 IEP Trains must be able to couple to another IEP Train on all track geometry within the IEP Network and as a minimum, curves of the following radii or greater:

- Single Horizontal Curve: 120 m D
- Reverse Horizontal Curve: 140 m, 3 m straight between curves
- Vertical Curve: 500 m

N154 IEP Trains must be able to automatically couple to another IEP Train on curves of the following radii or greater: D

- Single Horizontal Curve:200m;
- Reverse Horizontal Curve: 325m, 3m straight between curves; or
- Vertical Curve: 500m.

N155 IEP Trains must be able to uncouple from another IEP Train on curves of the following radii or greater:

- Single Horizontal Curve: 120 m
- Reverse Horizontal Curve: 140 m, 3 m straight between curves
- Vertical Curve: 500 m

D

TS1828 IEP Trains must be ready to move under control from a leading cab, within 3 minutes of releasing control from any other cab of the IEP Train.

This cab change time requirement excludes any traincrew walking time between cabs and the BR-ATP start up time (provided this does not exceed 4 minutes), but shall include all train borne system reconfiguration activities such as ETCS, GSM-R, TMS etc.

D
T

N136 IEP trains shall have an operating mode where there is no personnel from the Relevant Operator present on the train but where the IEP Train is ready to move within 2 minutes of a driver entering the cab.

The time quoted excludes the BR-ATP start up time (if fitted, provided this does not exceed 4 minutes), but shall include all train borne system configuration activities such as ETCS, GSM-R, TMS etc.

D
T

In this state it is permissible for the energy saving measures defined in TS1601, TS1602, TS1927 and TS1928 to be employed providing that the passenger environment is fully in compliance with this Appendix A when passengers board the train and the driver's environment is in full compliance with this Appendix A within 1 minute of the driver entering the cab.

3.3 Unit Formation and Length

TS1829 IEP Units must be equipped with a Driving IEP Vehicle at each end and allow the IEP train be driven in either direction from each Driving IEP Vehicle.

D

TS223 IEP Units must be able to operate within the following length constraints:

- Maximum length – nominally 312m (this is the maximum design length of an IEP Unit); and
- Minimum length – nominally 130m, where two minimum length IEP Units coupled together form an IEP Train no longer than 260m.

D

TS1977 It must be possible to add Intermediate IEP Vehicles to an IEP Unit subject to the IEP Unit still being no greater than the maximum length identified in TS223.

D

TS1979 It must be possible to remove Intermediate IEP Vehicles from an IEP Unit from any intermediate position subject to the Intermediate IEP Vehicles being removed being of the correct Functional Vehicle Type and the IEP Unit remaining at least the minimum length.

D

TS1980 The design of the IEP Units must ensure the time to add or remove Intermediate IEP Vehicle is minimised and is in any event no greater than 8 hours.

D

T

TS1589 With regards to IEP Unit reconfiguration it must be possible to reconfigure software and control systems within 15 minutes when Intermediate IEP Vehicles have been added, removed or replaced. D

3.4 Train Gauge

N009 The Swept Envelopes of all IEP Vehicles shall not exceed the Swept Envelope derived from the maximum extent of the combination of the four Swept Envelopes derived from the Four Kinematic Envelopes in Annex A for all cases of cant, curvature and train speed.

For the purposes of this clause, the following definitions apply:

Swept Envelope means a cross-sectional profile, taken at right angles to the track, enclosing all dynamic movements, static deflections and overthrows, of all points along the surface of the vehicle, that can reasonably be expected to occur under the appropriate range of operating conditions as it sweeps past a theoretical track location. R

Kinematic Envelope means a definition of the shape of a vehicle together with a set of rules which can be applied to determine the extent of lateral and vertical movement (including overthrow) which can result as a consequence of the speed of the vehicle and the characteristics of the track (including cant and curvature).

3.5 Driver Only Operation

N012 The IEP Trains must support Driver Only Operation (DOO) across the IEP Network, subject to the platform edge being illuminated to at least 10 Lux. D

TS1981 The IEP Trains must be compatible with DOO dispatch arrangements, where the train driver alone manages control of the doors at stations, as well as driving the train. In this situation, the design of the IEP Train must ensure that the driver is able to safely dispatch the train using images provided on collocated on-board CCTV monitors, the images being provided by on-board CCTV cameras mounted on the body sides. D T

3.6 Interior space & capacity

TS1841 The design of the IEP Vehicles must ensure that the internal cross-section (height & width) of an IEP Vehicle is optimised to provide the maximum interior space. D

TS198 The IEP Units must maximise Furnishable Space. As a minimum the Furnishable Space length shall be 144m for a nominally 208m long IEP Unit. D

TS1564 There must be no structural intrusions, structural partitions or equipment other than interior furnishing within the Furnishable Space. D

3.7 Weight

TS196 In pursuit of the objectives of better energy efficiency, reduced emissions, improved performance and whole life whole system cost savings the Delivered Weights of IEP Units must be no heavier than the following: T

- 233.3 tonnes for a nominally 130m long Electric IEP Unit;

- 249.3 tonnes for a nominally 130m long Bi-mode IEP Unit;
- 352.5 tonnes for a nominally 208m long Electric IEP Unit;
- 376.5 tonnes for a nominally 208m long Bi-mode IEP Unit;
- 399.8 tonnes for a nominally 234m long Electric IEP Unit; and
- 431.8 tonnes for a nominally 234m long Bi-mode IEP Unit.

N097 IEP Trains must meet the requirements of RA1, RA2, RA3 or RA4 according to GE/RT8006 "Interface between Rail Vehicle Weights and Underline Bridges". R

3.8 Performance

TS261 The IEP Trains must have a maximum service speed of at least 125mph and shall be able to achieve that speed on the whole of the IEP Network. The requirement to be able to operate at 125mph applies during operation in Standard Mode and Locomotive Hauled Mode.

It is accepted that 125mph may not be achieved under the following circumstances:

- on adverse gradients;
- in excessive headwinds;
- in the case of an IEP Train containing Bi-mode IEP Units operating in Self Power Mode;
- in the case where more than 312m of the IEP Train length comprises of Electric IEP Units;
- where any hauling Locomotive has insufficient tractive effort or maximum speed to allow 125mph to be achieved; D T
- in the event that the braking performance of an IEP Train is incompatible with the infrastructure at 125mph due to the braking performance of a hauling locomotive;
- under Adverse Infrastructure Conditions;
- where, in the event of failure of the IEP Train, it is not possible to raise two pantographs at the maximum pantograph spacing permitted by the train formation. In this event, subject to the other provisos of this provision, at least 100mph must be achieved if the pantograph spacing is 75m or greater and no less than 80mph shall be achieved for lesser spacings; and
- in the event that it is not possible to show compatibility between the pantograph and the infrastructure, when an IEP Train is operating with two pantographs raised, on any portion of the Great Western Main Line between Paddington and Airport Junction where the line speed is greater than 100mph. In this event, the IEP Train shall be capable of 100mph or the speed at which operation is shown to be compatible with the overhead line, whichever is greater.

TS1982 The IEP Trains operating under electric power shall through modification be capable of higher speeds than 125mph to allow for possible line speed upgrades or new lines with higher speed limits being available. The capability of the IEP Train in this regard, together with a summary of the modifications required shall be detailed through the Design Process. D

TS206 The IEP Trains must be able to achieve the journey times defined in Annex B under the D

conditions defined therein. T

TS1483 Electric IEP Units and Bi-mode (while operating from a 25kV Overhead Electric Supply) IEP Units must be capable of being extended to the maximum length of 312m specified in TS223 whilst still meeting the journey time requirements specified in Annex B. D

N013 The acceleration and maximum speed of IEP Trains operating in Multiple Hauled Mode must not be limited by any restrictions other than those limits identified in TS261 and the available traction capability of the hauling IEP Train. D

N098 The acceleration and maximum speed of IEP Trains operating in Locomotive Hauled Mode must not be limited by any restrictions other than those identified in TS261. D

TS1843 Any IEP Unit shall be able to operate in Multiple Hauled Mode with any other IEP Unit formed of the same number of IEP Vehicles or fewer, over any part of the IEP Network, irrespective of the loading condition of either IEP Unit, provided that the resulting formation does not exceed the maximum length defined in TS231. In addition, in Multiple Hauled Mode, the IEP Train must be able to start at any position on the IEP Network and shall be able to start on and ascend gradients of up to 1 in 37. D T

TS2005 Any IEP Train shall be able to haul any other IEP Train formed of the same number of IEP Vehicles or fewer in Train Requires Assistance from Another Train Mode over any part of the IEP Network, irrespective of the loading condition of either IEP Train provided that if the hauling IEP Train comprises more than one IEP Unit, all IEP Units in the hauling IEP Train are operating in Standard Mode. In addition, such an IEP Train must be able to start at any position on the IEP Network and shall be able to start on and ascend gradients of up to 1 in 37. D T

3.9 Efficiency & Environment

TS200 The IEP Units must deliver, as a minimum, the following energy efficiency characteristics when operating from a 25kV Overhead Electric Supply:

- A 130m Electric IEP Unit on a journey from Kings Cross to Newcastle under the conditions defined in Annex B shall consume no more than 4600kWh;
- A 234m Bi-mode IEP Unit on a journey from Kings Cross to Newcastle under the conditions defined in Annex B shall consume no more than 8180kWh; and
- A 208m Electric IEP Unit on a journey from Paddington to Bristol under the conditions defined in Annex B shall consume no more than 3110kWh. D T

Note that the electrical energy consumption figures above are net consumption figures (i.e. total energy consumed minus total energy returned during regenerative braking).

There is no requirement for Bi-Mode IEP Trains operating from a Self Power Source to achieve a particular level of energy efficiency. Fuel consumption data shall however be provided for the following cases:

- A 208m Bi-mode IEP Unit on a journey from Paddington to Hereford under the conditions defined in Annex B; and
- A 234m Bi-mode IEP Unit on a journey from Edinburgh to Aberdeen under the conditions defined in Annex B.

TS204 IEP Vehicles must minimise auxiliary energy consumption. As a minimum, a 234m Bi- D

mode IEP Train shall consume no more than 522kWh over a period of 3 hours under the following conditions: T

- Train stationary;
- Train in an "In Service" condition with no measures designed to reduce energy consumption when not In Service active;
- 15 degrees C ambient temperature;
- No passengers;
- Train operating from a 25kV Overhead Electric Supply;
- No use of catering equipment (but the equipment shall be in its normal service state);
- UGMS equipment (if fitted) turned off;
- Any passenger WiFi and / or EPOS equipment switched off; and
- No solar gain.
- No engine preheating.

TS1601 Auxiliary energy consumption must be reduced when IEP Trains are not In Service and this reduction must be achieved automatically. As a minimum the means of reducing auxiliary energy consumption must include extinguishing interior lighting and relaxing HVAC set points. D

TS1602 Irrespective of any measure designed to reduce auxiliary energy consumption, the passenger environment of IEP Trains must be fully in compliance with this Appendix A at the point that passengers board the train. D

TS1927 When IEP Trains are not In Service it must be ensured that train interior lighting is not illuminated unless required in order for servicing or Maintenance. The design of the IEP Train must therefore ensure that no interior lighting will be illuminated for a period greater than 15 minutes unless personnel are present on the IEP Train. D T

TS1928 When IEP Trains are not In Service it must be ensured that any Self Power Sources which are not required to provide power are automatically shut down so as not to consume any fuel. The design of the IEP Train must therefore ensure that unused Self Power Sources will be shut down within 5 minutes of becoming unused (unless it can be demonstrated that doing so results in a net increase in energy consumption). D T

TS274 The IEP Trains must be equipped with a system which will assist the driver in driving the IEP Train in the most energy efficient manner whilst still meeting the timetable.

The system shall be developed with the Secretary of State and shall be able to display the following to the driver:

- whether the IEP Train is running on time, early or late based on the position of the IEP Train in relation to the timing points defined in the TSDB; D T
- the next station stop and the scheduled arrival time at that station stop;
- an indication of the energy consumption of the IEP Train, providing that the IEP Train is operating in "Standard Mode" or in the case of hauling another IEP Train in "Multiple Hauled Mode", the energy consumption of the hauling IEP Train only, both since the driver started driving the IEP Train and since the last station stop; and

- an indication of how the energy consumption of the IEP Train compares to other recent use of that IEP Train, providing that the IEP Train is operating in "Standard Mode" or in the case of hauling another IEP Train in "Multiple Hauled Mode", the energy consumption of the hauling IEP Train only.

TS276 All IEP Trains fitted with compression ignition engines as the main power source shall meet the requirements of the Non-Road Mobile Machinery Directive (NRMM) for stage IIIb emissions. Where compression ignition engines are fitted for use other than as the main power source then they shall comply only with the applicable requirements of the NRMM. D R

3.10 Operating Environment

N078 The IEP Trains must, subject to the temperature ranges and specific conditions identified in this section, be able to achieve Full Functionality in all weather conditions specified in sections 4.1 to 4.11 inclusive of BS EN50125-1:1999 "Railway Applications – Environment Conditions for Equipment – Part 1:Equipment on Board Rolling Stock". With respect to clause 4.2, altitude class A2 (up to 1000m above sea level) shall apply. D T

TS344 IEP Vehicles and all their constituent parts must meet the requirements in the TSI that relate to high speed rolling stock within the climatic zone of T1, as specified in BS EN 50125-1:1999 "Railway Applications - Environmental Conditions for Equipment – Part 1:Equipment on board rolling stock". D T

TS1983 Full Functionality of the IEP Trains must be maintained during and after exposure to salt water spray and such exposure must not cause excessive cosmetic degradation of exposed surfaces, components and equipment. D

TS1844 The IEP Trains must maintain Full Functionality during and after running through floodwater up to a depth of 100mm above rail level although speed restrictions may be applied if necessary. D

TS1845 The IEP Trains must maintain Full Functionality during and after running through snow up to a depth of (above rail level): D

- 200mm; continuous operation with no speed restriction; and
- 300mm; continuous operation is required but reduced speeds are permitted.

TS345 The 'Department for the Environment and Rural Affairs – Climate Change Scenarios for the United Kingdom – The UKCIP02 Specific Report, April 2002', and specifically the UKCIP02 'High Emissions' scenario contained therein, must be considered and its potential effects upon the future operating climate assessed. The IEP Trains must maintain Full Functionality in the event of all climate change scenarios stated in such report (including but not limited to the "High Emissions" scenario).. D

TS346 The IEP Vehicle exterior when all doors and windows are closed must prevent the ingress of snow and rain under all ordinary environmental conditions. When the train is in motion at speeds in excess of 25km/h the ingress of snow, rain and dust must be prevented. In the vicinity of externally opening windows and doors, all controls, equipment and enclosures must be designed to ensure continued operation in the event of local ingress of water, dust and snow. D

3.11 Range

TS263 IEP Trains must be able to operate on any of the diagrams identified in Annex H without the replenishment of fuel. D T

3.12 Station Interface & Dwell Time

TS271 IEP Trains must be designed so that the following total number of passengers may embark or disembark (in any combination) within 1 minute.

- An IEP Unit nominally 130m in length = 150 passengers
- An IEP Unit nominally 208m in length = 240 passengers

The applicable dwell time begins at the point that the IEP Unit stops at the station platform and ends when the IEP Unit is ready to depart. D T

Dwell times shall be calculated or measured on the basis that the station platform position complies with Railway Group Standard requirements and that the driver does not interact with the SDO system. Dwell times shall be calculated or measured allowing for a representative mix of passengers in terms of mobility & luggage (please refer to Annex C).

TS272 The design of the IEP Trains must include measures that allow the external passenger doors to be prepared for opening prior to the IEP Train stopping at a platform. D

TS1625 To assist the safe and efficient passage of passengers between station platforms and IEP Vehicles, the stepping distances between the IEP Vehicles and platforms on the IEP Network must be minimised.

On curves of a radius of greater than or equal to 260m, IEP trains shall comply with the requirements of Railway Group Standard GI/RT7016, Issue 4, September 2010, 'Interface between Station Platforms, Track and Trains' and Section B6.3 of Railway Group Standard GM/RT2149, Issue 3, February 2003, 'Requirements for Defining and Maintaining the Size of Railway Vehicles'. D

On curves of a radius of less than 260m, the stepping distance between the IEP Train and all platforms (including those which do not comply with current standards) shall be the same or less than a Mk III passenger coach both when measured horizontally and when measured vertically.

3.13 Fire Safety & Evacuation

TS1468 The IEP Train must meet the Category B fire safety requirements contained in the TSI that relate to high speed rolling stock. D

3.14 Human Factors & Ergonomics

TS422 The IEP Vehicles must present a safe, secure and comfortable environment for their User Population as developed through the "Progressive Design Assurance" process specified in Paragraph 9 of appendix D to Schedule 1 of the MARA. D

N099 Train controls for use by train crew must be designed so that they are intuitive to use. Particular regard must be given to reducing the likelihood of human error. As a minimum the train shall be designed according to the results of ergonomic and human factors studies D

carried out by the TSP.

TS423 The IEP Vehicles must be designed taking into account as a minimum the following factors which might affect the ergonomic interface between the User Population and the IEP Vehicle:

- the range of variability in the User Population with exception of the installation of any coupler adapter necessary to allow rescue by a Locomotive, in which case it is permissible to require one person involved in the fitting of this adapter be to a minimum of a 50th percentile male. D
- all normal, degraded and emergency modes of operation of the IEP Train; and
- all climatic conditions which the User Population may be exposed and consequently their attire (e.g. the wearing of coats and gloves).

3.15 Ride

TS425 The ride comfort of the IEP Vehicles shall be assessed in accordance with DD ENV 12299:1999 'Railway Applications – Ride Comfort for Passengers – Measurement and Evaluation'.

For each measuring location (which may be at any point along the saloon) within the saloon, the arithmetic mean of all Ride Indices (as defined in DD ENV 12299:1999 'Railway Applications – Ride Comfort for Passengers – Measurement and Evaluation') taken at that point when operating at maximum line speed in both the Tare Condition and the Fully Seated Condition must be: D T

- Less than 1.6 when measured on the East Coast Main Line over track with characteristics equivalent to those defined by the East Coast Main Line Track Data
- Less than 1.9 when a simulation is performed, using a dynamic model of the train validated through testing on the East Coast Main Line, of an IEP Unit on track with characteristics as defined by the Midland Main Line Track Data.

TS1846 The maximum longitudinal jerk shall be calculated in accordance with BS EN12299:2009 "Railway Applications – Ride Comfort for Passengers – Measurement and Evaluation" using the parameters applicable to horizontal jerk detailed in table H.2.

The maximum longitudinal jerk experienced on IEP Trains shall not exceed 0.52 m/s^3 except in the following cases:

- loss of an electrification supply, or a substantial instantaneous reduction in supply voltage;
- during operation of APC equipment when the driver is taking power; D T
- during the loss of the regenerative brake as a result of electrification supply over-voltage;
- during application of the emergency brake;
- in the event that the driver fails to progressively release the service brake as the train comes to a stand;
- during coupling (although it may be necessary to impose a limit in order to meet the requirements of TS1695);

- during haulage by a Locomotive;
- during Limited Movement;
- in the event of Adverse Infrastructure Conditions; and
- during transitions from the minimum level of traction to coasting at speeds less than 10km/h, the level of jerk in this event shall be agreed during Detailed Design.

3.16 Noise & Vibration

N054 The interior noise levels within IEP Vehicles must, where reasonably practicable, have a neutral character, with no strongly tonal or impulsive acoustic features. D T

TS1498 The assessment of IEP Vehicles against the interior noise requirements of this Appendix A shall be undertaken in accordance with the conditions described in BS EN ISO 3381:2011 'Railway applications – Acoustics – Measurement of noise inside railbound vehicles', with the exception of rail roughness which shall be as found on the IEP Network.

Where measurements are taken in the saloon of the IEP Vehicle, they shall be taken at a number of positions within the saloon of each IEP Vehicle in accordance with BS EN ISO 3381:2011 'Railway applications – Acoustics – Measurement of noise inside railbound vehicles'. D T

Testing to demonstrate compliance with the requirements in this section 3.16 shall be carried out on a 130m bi-mode IEP Train.

TS192 When the vehicle is running at maximum speed and is not fitted with an operating Self Power Source, the arithmetic mean of the measured un-weighted octave band level spectra must lie below the curve defined in the table below within the saloon of each IEP Vehicle: D T

Sound pressure level dB(Lin)								
31.5 Hz	63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz
93	82	73	68	61	58	52	48	46

N137 In the case of Bi-mode trains operating in "Standard Mode" as defined in clause 3.18 and in Self Power Mode then the arithmetic mean of the measured un-weighted octave band level spectra must lie below the curve defined in the table below within the saloon of each IEP Vehicle fitted with operating Self Power Sources when at 100mph and whilst accelerating to 100mph: D T

Sound pressure level dB(Lin)								
31.5 Hz	63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz
93	83	78	70	63	58	52	48	46

N138 In the case of trains operating in the following modes:

- being hauled in Multiple Hauled Mode; D
- operating in Locomotive Hauled Mode;

- Train Unable to Proceed Under Own Power Source Mode; and
- Train Requires Assistance from Another Train Mode,

then the arithmetic mean of the measured un-weighted octave band level spectra must lie below the curve defined in the table below within the saloon of each IEP Vehicle fitted with operating Self Power Sources:

Sound pressure level dB(Lin)								
31.5 Hz	63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz
93	83	78	70	63	58	52	48	46

TS2001 When the IEP Vehicle is stationary, the arithmetic mean of the measured un-weighted octave band spectrum of interior noise within the saloon of each IEP Vehicle must lie below the NR55 curve. In the 4 kHz and 8 kHz octave bands the interior noise must be at least 2 dB and 3 dB lower respectively than the NR55 curve. D T

TS193 When the IEP Vehicle is running at speed from 50km/h up to the maximum, the arithmetic mean of the measured interior noise levels within the saloon of each IEP Vehicle must be within the range 50 to 57 dB, described using the Preferred Speech Interference Level (PSIL) descriptor. D T

At speeds below 50km/h, the arithmetic mean of the measured interior noise levels within the saloon of each IEP Vehicle shall be below 57 dB, described using the Preferred Speech Interference Level (PSIL) descriptor.

TS1985 The interior noise level within each vestibule and any catering facilities, toilets, crew offices or luggage storage areas (but excluding any gangway between vehicles) of each IEP Vehicle shall not exceed 70 dB, described using the Preferred Speech Interference Level (PSIL) descriptor when the IEP Vehicle is running at speeds up to the maximum. D T

3.17 Aerodynamics & Pressure Effects

TS361 The internal pressure changes within IEP Trains must not exceed 4kPa over a 4 second period under any conditions on the IEP Network, including operation in single bore/track tunnels and 2 single IEP Trains passing in twin track tunnels. D T

TS1994 In addition to complying with the requirements set out in the TSI, the IEP Trains must exert no more than 1.44kPa peak to peak pressure on a train on an adjacent track when the IEP Train is travelling at all speeds on a windless day in open air on open track. D T

TS1995 The IEP Trains shall meet the requirements of Railway Group Standard GM/RT2142, Issue 3, August 2009, ‘Resistance of Railway Vehicles to Roll Over in Gales’ without modifications to the infrastructure. R

3.18 Modes of Operation

TS237 The IEP Trains must be able to operate in a number of modes as follows:

a) “Standard Mode” where the IEP Train meets all the requirements identified in this Appendix A. Standard operating mode includes IEP Units operating in Multiple Working and as required by TS231 where both Units forming the IEP Train have a functioning main D

power source;

b) “Multiple Hauled Mode” where an Electric IEP Unit which does not or can not provide traction capability is operated in Multiple Working with a Bi-Mode IEP Unit consisting of the same or greater number of IEP Vehicles (and may be hauled or propelled by the other IEP Train). Such a train shall operate as required by TS231;

c) “Locomotive Hauled Mode” where any IEP Train composed of one or two Electric IEP Units in accordance with TS231 is operated together with a Locomotive which provides tractive effort and brake control;

d) “Train Unable to Proceed Under Main Power Source Mode” where an IEP Train is unable to proceed under a main power source due to either train or infrastructure failure. In particular, this mode is intended to apply when the train is unable to use the 25kV Overhead Electric Supply or failure of 60% or more of the total Self Power Source capability of a Bi-Mode IEP Train has occurred;

e) “Train Requires Assistance from Another Train Mode” where the IEP Train is unable to proceed under its own main or auxiliary power sources or it is impractical to do so and needs to be rescued by another IEP Train or Locomotive; and

f) “Real Emergency Mode” which includes incidents where damage to the IEP Train may have occurred (e.g. derailments). This may differ from the Emergency case defined in some mandatory standards.

The requirements for each mode are defined in the following sections.

N015 In all the operating modes defined in this section, the IEP Train must be designed on the basis that passengers are on board although the passenger environment may be degraded in the case of Train Unable to Proceed Under Main Power Source Mode, Train Requires Assistance from Another Train Mode and Real Emergency Mode. D

3.18.1 Standard Mode

TS1743 For Standard Mode, the IEP Train must meet all parts of this Appendix A. C

3.18.2 Multiple Hauled Mode

TS1744 For Multiple Hauled Mode, the IEP Train must meet all parts of this Appendix A. C

TS1745 For Multiple Hauled Mode the IEP Train must be able to operate in this mode for a period of at least 6 hours on each diagram. D

TS1986 For Multiple Hauled Mode the IEP Train shall be able to fall back to Train Unable to Proceed Under Main Power Source Mode, Train Requires Assistance from Another Train Mode and / or Real Emergency Mode, if necessary. D

3.18.3 Locomotive Hauled Mode

TS1746 For Locomotive Hauled Mode, the IEP Trains must meet all mandatory standards, the passenger environment must meet all parts of this Appendix A and where reasonably practicable the IEP train must meet all other requirements in this Appendix A, taking into account that there will be no communication between the IEP Train and the Locomotive other than that inherent in the definition of a Locomotive. C

N016 For Locomotive Hauled Mode the IEP Train must be able to be hauled by a Locomotive.

It is permissible for the Locomotive to be prepared for use with an IEP Train in Locomotive Hauled Mode prior to coupling to the IEP Train. If the Locomotive is to be prepared in advance of being coupled to the relevant IEP Train, the design of the adaptor coupler to be used for this purpose must allow any Locomotive that is prepared in advance for Locomotive Hauled Mode to remain able to operate on the railway. D

N017 While in Locomotive Hauled Mode it shall be possible to utilise the full traction and speed capability of the hauling Locomotive, up to the maximum speed of the IEP Train. D

N072 While in Locomotive Hauled Mode the performance of the braking system on the IEP Vehicles must be equivalent to the performance of the braking system when the IEP Train is operating in Standard Mode. D

TS1936 For Locomotive Hauled Mode the IEP Train must be able to operate in this mode for a period of at least 6 hours during any single In-Service period. D

TS1937 For Locomotive Hauled Mode the IEP Train must remain able to fall back to Train Unable to Proceed Under Main Power Source Mode, Train Requires Assistance from Another Train Mode and / or Real Emergency Mode, if necessary. D

TS245 For Locomotive Hauled Mode the IEP Train must be designed such that the IEP Train (and the Locomotive hauling the IEP Train) can be operated by a single driver.

To that end, when the train is operating in Locomotive Hauled Mode, activation of a defined set of alarms will result in an immediate emergency brake application throughout the IEP Train and Locomotive. The set of alarms will be defined during detailed design and will be selected according to a definition of a “critical alarm” during normal (i.e. not Locomotive Hauled Mode) operation. D

An isolating switch, located in the cab of the IEP Train adjacent to the Locomotive, of a type which can be set to either the normal or isolated position by the driver, shall be provided to isolate the brake application functionality described in this clause.

It is permissible for additional traincrew to be required in order to manage passenger facilities (including train door control) on the IEP Train being hauled.

TS1987 For Locomotive Hauled Mode the IEP Train must be designed such that all parts of the procedures necessary to couple and uncouple the IEP Train and Locomotive can be performed by the driver. D

If the Locomotive is prepared in advance for Locomotive Hauled Mode then the fitting of a suitable adapter coupler to the Locomotive is not included in this requirement.

3.18.4 Train Unable to Proceed Under Main Power Source Mode

TS1938 For Train Unable to Proceed Under Main Power Source Mode, the IEP Train must maintain at least Basic Services for a minimum of three hours.

In the case where use has previously been made of the Multiple Hauled Mode or Locomotive Hauled Mode, or in the case of a Bi-Mode IEP Train where it has previously operated in Self Power Mode, in the same In-Service period it is accepted that a shorter period may be provided. D T

TS1939 For Train Unable to Proceed Under Main Power Source Mode, the IEP Train must be able to D

perform Limited Movement while supplying Basic Services for a minimum of one hour following failure of the main power source. In the case where use has previously been made of the Multiple Hauled Mode or Locomotive Hauled Mode, or in the case of a Bi-Mode IEP Train where it has previously operated in Self Power Mode, in the same In-Service period it is accepted that a shorter period may be provided. | T

TS1941 For Train Unable to Proceed Under Main Power Source Mode, the IEP Train must remain able to meet the requirements of Real Emergency Mode and shall fall back to that mode once the time periods specified in TS1938 or TS1939 have been exceeded. | D

3.18.5 Train Requires Assistance from Another Train Mode (Rescue)

TS1942 For Train Requires Assistance from Another Train Mode, the IEP Train must, so far as is possible, meet the same requirements as in Train Unable to Proceed Under Main Power Source Mode. | C

TS1943 For Train Requires Assistance from Another Train Mode, the IEP Train must remain able to meet the requirements of Real Emergency Mode and shall fall back to that mode once the time period specified in TS1938 has been exceeded. | D T

N018 For Train Requires Assistance from Another Train Mode the IEP Train requiring assistance must be able to be hauled by another IEP Train consisting of the same or more IEP Vehicles, provided that if the hauling IEP Train comprises more than one IEP Unit, all IEP Units in the hauling IEP Train are operating in Standard Mode. | D

N019 For Train Requires Assistance from Another Train Mode the IEP Train must be able to be hauled by a Locomotive. | D T

N020 All necessary coupler adaptors, hoses and associated equipment to allow a Locomotive to provide assistance must be stored in or on the IEP Driving Vehicles. It must be possible for this equipment to be installed by a maximum of two people, only one of which is required to be trained in its use. Such equipment must be stored so as to ensure its accessibility when required, in particular taking account of the possibility of station platforms or other infrastructure being present when rescue is required. | D T

TS1944 For Train Requires Assistance from Another Train Mode, the performance of the resulting IEP Train formation must be optimised so as to minimise delay. As a minimum the performance of the train shall be as detailed in N021 and N022 below. | D

N021 Where an IEP Train requires assistance from another train and assistance is provided by another IEP Train then the acceleration and maximum speed of the resulting IEP Train must not be limited by any restrictions other than those limits identified in TS261 and the available traction capability of the assisting IEP Train, subject to there being no system failure on the IEP Train requiring assistance which prevents this. This shall be possible irrespective of whether power is available to the control systems on the IEP Train requiring assistance. | D

N022 Where an IEP Train requires assistance from another train and power is available to its control systems it must be possible for a Locomotive to assist the IEP Train at a speed commensurate with the strength of any coupler adapter provided, and in any event no less than 30mph, subject to the capability of the assisting Locomotive and there being no system | D

failure on the train requiring assistance which prevents this.

N023 In the event that a system failure occurs such that an IEP Train that requires assistance cannot be hauled by another IEP Train or Locomotive from hauling it as specified in N021 and N022 then the IEP Train must be designed so as to allow safe haulage at a lower speed. Such a failure must not occur more than once in every 100 rescues. D

3.18.6 Real Emergency Mode

TS1945 For Real Emergency Mode, the IEP Train must provide interior emergency lighting in accordance with section 4.10. D T

TS1946 For Real Emergency Mode, the train Passenger Announcement system must continue to function so far as is possible. D T

TS1947 For Real Emergency Mode, train operational communication systems (e.g. driver's radio(s)) must continue to function so far as is possible. D T

3.19 Repairability

TS286 The IEP Vehicles must be designed to allow for timely repair, which shall include, but is not limited to, timely repair upon the occurrence of the following scenarios:

- level crossing collision with light road vehicle (family saloon) - up to 50mph;
- low speed buffer stop impacts - up to 15mph;
- minor derailments without vehicle collision - up to 15mph;
- depot side swipes - where the corner of one IEP Vehicle contacts the side of another vehicle due to the IEP Vehicles being left too close to points and crossings causing linear damage down the side of the non-moving IEP Vehicle at up to 15mph;
- running over small obstacles on the track e.g. shopping trolleys - up to the maximum speed of an IEP Train identified in TS261. In this case it shall be possible for repairs to be undertaken in a period of less than 8 hours.

D

3.20 Wheel Rail Interface

3.20.1 Contact Patch Energy

TS1795 The IEP Trains must generate minimum damage to the track, including surface damage such as Rolling Contact Fatigue (RCF) and wear. To achieve this the tangential forces generated at the wheel/rail interface must be minimised.

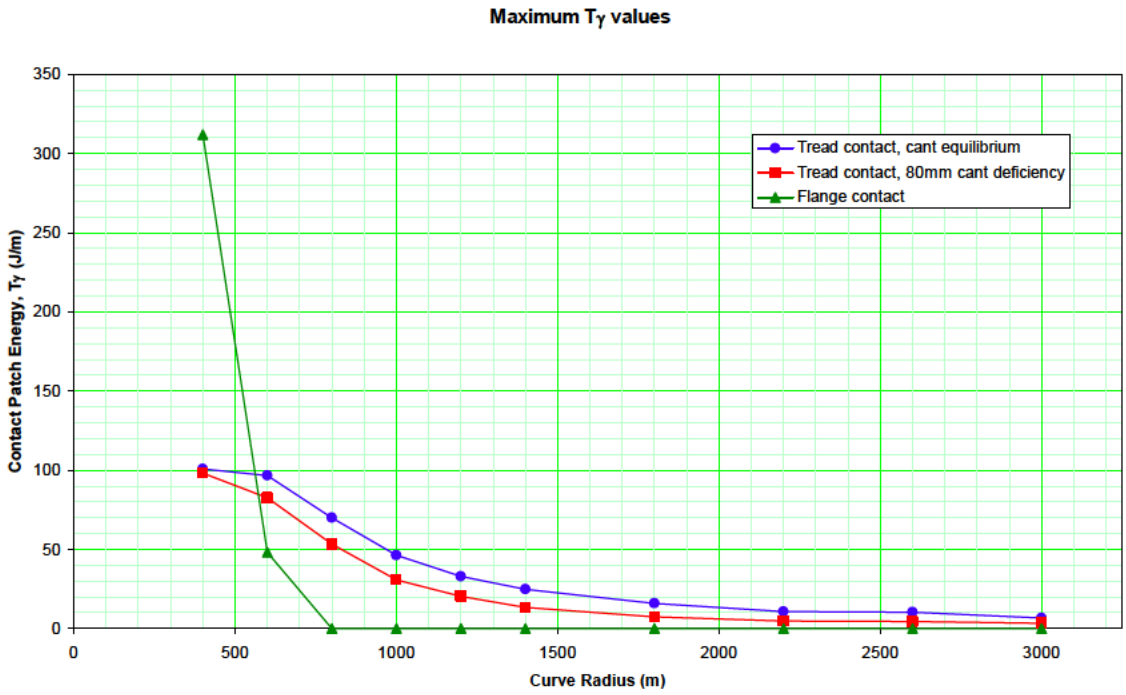
The figure and table below show the maximum permissible value of $T\gamma$ as a function of track curvature. This maximum value shall not be exceeded for any bogie fitted to the IEP Trains unless this is permitted under clause N055. Three curves are given: D

- The maximum value of $T\gamma$ on the wheel tread contact conditions when running at cant equilibrium;
- The maximum value of $T\gamma$ on the wheel tread contact conditions when operating at 80mm cant deficiency; and

- The maximum value of Tγ for flange contact conditions.

The Tγ algorithms used in the VAMPIRE® vehicle dynamics software, version 5.50, build 18 shall be used to demonstrate the compliance of the IEP Trains under the three conditions identified above. The conditions for the calculations shall be as follows:

- calculations shall be performed for the leading wheel on the high rail of the curve;
- calculations to be performed on the basis of a passenger load of 55% seats (rounded up to the nearest whole seat) occupied on each IEP Vehicle;
- calculations shall be performed for the most heavily laden of each bogie type fitted to the IEP Trains (each result shall not exceed the maximum value specified);
- the Tγ values shall be presented as the average over at least 250m of continuous running over each curve radius for each of the cant deficiency conditions;
- wheel-rail friction coefficient of 0.45;
- new (design) wheel profiles; and
- CEN60E1 (design) rail profiles.



Curve radius (m)	Maximum Tγ value (J/m)		
	Tread contact, cant equilibrium	Tread contact, 80mm cant deficiency	Flange contact
400	100.6	98.1	312.0
600	96.5	82.6	48.0
800	70.1	53.2	0.0
1000	46.2	30.9	0.0

1200	32.8	20.2	0.0
1400	24.8	13.4	0.0
1800	15.9	7.4	0.0
2200	10.8	4.9	0.0
2600	10.2	4.3	0.0
3000	6.5	3.4	0.0

N055 In the event that it is not possible to show that each bogie on an IEP Train complies with TS1795 then each IEP Train must have a Total Rail Surface Damage Curve (as defined below) for each IEP Train configuration which is at all points less than the Reference Rail Surface Damage Curve (as defined below) for each of the three conditions defined in TS1795 where:

- The Total Rail Surface Damage Curve for each IEP Train configuration is calculated by taking the Tγ values for each curve radius (calculated as described in TS1795) for each bogie, converting them to a Rolling Contact Fatigue damage index and then summing the Rolling Contact Fatigue damage indices across all bogies in each IEP Train configuration, for each curve radius. D
- The Reference Rail Surface Damage Curve is calculated on the same basis as the Total Rail Surface Damage Curve but using the Rolling Contact Fatigue damage indices obtained from the Tγ values in the graph in TS1795 and the appropriate number of bogies in each IEP Train configuration, for each curve radius.
- Rolling Contact Fatigue damage indices are calculated from the Tγ values using the rail industry Whole Life Cost Model (WLCM) (as defined in the Whole Life Rail Model Application and Development for RSSB – Continued Development of an RCF Damage Parameter, M.C. Burstow, September 2004, AEATR-ES-2004-880 Issue 2).

3.20.2 Vehicle - Track Impact

TS1798 The IEP Units must be designed, taking due account of the impact of the vehicle and bogie behaviour on the track using VTISM, to optimise the reduction of the overall railway system cost to the extent reasonably practicable. The VTISM costs for the trains (including both vertical and RCF components) shall be no greater than those shown in the table below when considering the high friction condition and when considering a passenger load of 55% seats (rounded up to the nearest whole seat) occupied on each IEP Vehicle.

Train Type	Operating Condition	Maximum Track Impact Cost (£ / train.mile)	
		Route A	Route B
234m Bi-mode IEP Unit	Electric Operation	£1.92	£1.60
234m Electric IEP Unit	Electric Operation	£1.79	£1.45

D

- The sample track data files on which the VTISM evaluation will be based;
- Instructions for use and VTISM default settings;
- Matched wheel and rail part-worn profiles; and
- VAMPIRE® file settings including; default gauge, friction, speed profile etc., (the Transient Response Analysis Programme should be used).

Where VAMPIRE® is used in the assessment of VTISM costs, version 5.50, build 18 shall be used.

3.21 Current Collection

N108 IEP Trains (including IEP Trains operating in Multiple Working) must be able to collect current from the infrastructure at all speeds up to at least 125mph, subject to the provisos in TS261. D R

3.22 Power Supply

N024 An IEP Train must draw no more than 300A RMS from the 25kV Overhead Electric Supply when the line voltage is 24kV RMS. D

N064 The maximum current drawn by an IEP Unit must be capable of being limited by staff carrying out Maintenance to a value less than that required to deliver full traction performance. It must be possible to select the maximum current draw in small increments up to the value required to deliver full traction performance. D

N065 The maximum current drawn by an IEP Train must be capable of being limited by staff carrying out Maintenance to a range of values less than 300A. It must be possible to select the maximum current draw in small increments up to 300A. D

N066 The maximum current returned to the 25kV Overhead Electric Supply under regenerative braking must be capable of being limited in the same manner as that described in N064 and N065. D

N067 The IEP Train must incorporate a system whereby the limits as defined in N065 and N066 can be varied automatically according to the location of the IEP Train. This system must not require the installation of any equipment on the infrastructure. D

N025 IEP Units must be compatible with the range of voltages specified in section 4.2 of 'NR/GN/ELP/27010, Issue 2, December 2005 'Business Process Document – Guidance for compatibility between electric trains and electrical systems' and must be able to deliver Full Functionality over the range of 12.5kV to 29kV, subject to the existence of any Adverse Infrastructure Condition. The IEP Units must be designed so that, where reasonably practicable, they will not suffer any damage when operating outside of this range of voltages. D

Note that where time periods are specified, it is permissible for the IEP Unit to operate for a longer duration, or indefinitely, should the IEP Unit be able to do this without damage.

N026 IEP Units must be compatible with the range of frequencies specified in section 4.3 of 'NR/GN/ELP/27010, Issue 2, December 2005 'Business Process Document – Guidance for compatibility between electric trains and electrical systems'. D

N081 The maximum current drawn by an IEP Train must vary according to the line voltage as defined in section 4.4 of 'NR/GN/ELP/27010, Issue 2, December 2005 'Business Process Document – Guidance for compatibility between electric trains and electrical systems' D

N082 The regenerative brake system on the IEP Trains must meet the following requirements:

- initiation of regenerative braking must not occur if the line voltage is less than 16.5kV RMS;
- if regenerative braking has been initiated, and the line voltage then drops below 14kV RMS, then IEP Units shall cease returning energy to the 25kV Overhead Electric Supply in 100ms or less; and D T
- IEP Units shall also cease returning energy to the 25kV Overhead Electric Supply in 100ms or less if the line voltage is higher than 29kV RMS as described in clause 4.1 of BS EN 50163:2004 'Railway applications –Supply voltages of traction systems', or if the IEP Train fails to detect the fundamental power frequency.

N027 IEP Units must be compatible with infrastructure capable of delivering 15000A RMS at 27.5kV RMS as described in section 11.2 of BS EN 50388:2005 'Railway applications – Power supply and rolling stock – Technical criteria for the coordination between power supply (substation) and rolling stock to achieve interoperability'. Fault currents may persist for up to 1 second before being cleared by the infrastructure as described in section 4.5 of NR/GN/ELP/27010, Issue 2, December 2005, 'Business Process Document – Guidance for compatibility between electric trains and electrification systems'. D

In the event that a fault occurs which causes current to bypass the protective equipment (e.g. vacuum circuit breaker) installed on the IEP train, it is permissible for damage to occur to equipment or components carrying the fault current.

TS1864 The IEP Trains must be fitted with APC equipment in accordance with NR/GN/ELP/27010, Issue 2, December 2005, 'Business Process Document – Guidance for compatibility between electric trains and electrification systems'. D

3.23 Signalling Compatibility

3.23.1 Signal Sighting

TS1809 In addition to complying with the requirements set out in the TSI, the IEP Trains must also comply with Railway Group Standard GM/RT2161, Issue 1, August 1995, 'Requirements for Driving Cabs of Railway Vehicles'. D R

3.23.2 Nose Overhang

TS1814 In addition to complying with the requirements set out in the TSI, the IEP Trains nose overhang must also comply with the requirements of Railway Group Standard GM/RT2149, Issue 3, February 2003 'Requirements for Defining and Maintaining the Size of Railway Vehicles'. D

3.23.3 Train Detection Systems

TS1816 In addition to complying with the requirements set out in the TSI, the IEP Trains must also comply with Railway Group Standard GK/RT0011, Issue 3, August 2000 'Train Detection'. D

3.23.4 Train Visibility

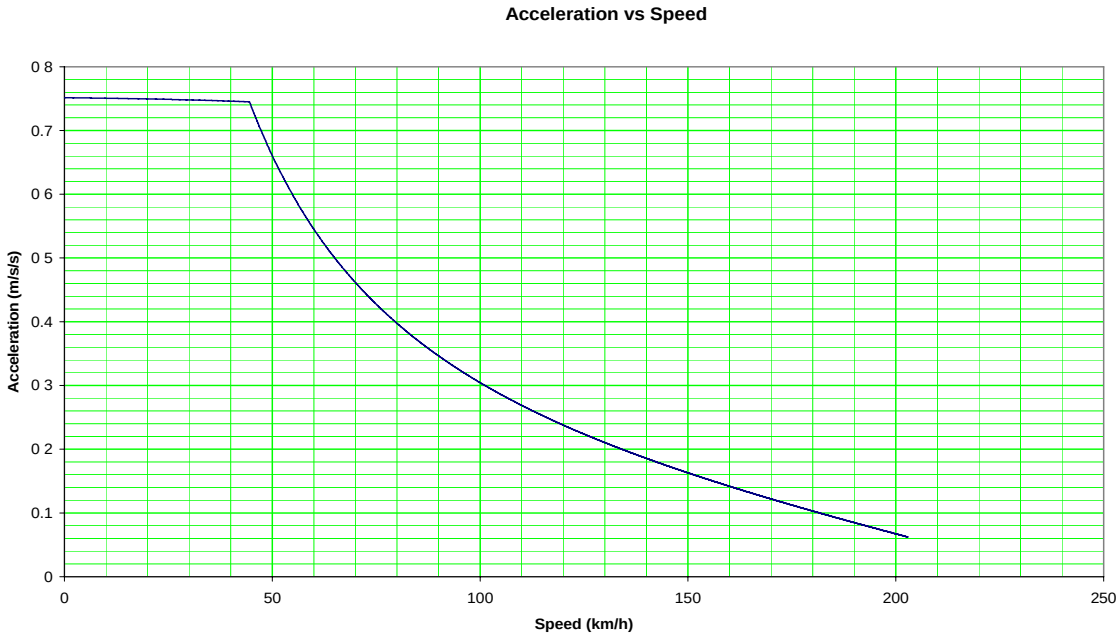
TS1822 The IEP Trains must comply with Railway Group Standard GM/RT2483, Issue 1, June 2004 'Visibility Requirements for Trains'. D

3.23.5 Train Location

TS1997 The IEP Trains must have a train location system which is able to periodically determine and transmit the location of the IEP Trains to the Relevant Operator via the Internet in real time. The location of the train shall be identified using the national Ordnance Survey grid system. The frequency of position updates must be configurable in 30 second increments from 30 seconds to one hour and it must also be possible to disable the transmission of position information. D T

3.23.6 Train Acceleration

N028 The IEP Trains must, at all speeds, accelerate at a rate no greater than that defined in the graph below, unless higher rates of acceleration are demonstrated to be compatible with the infrastructure:



D T

4 Base Systems

4.1 Bodyshell & Structure

TS300 Ripples or distortions in the bodyshell of the IEP Vehicle must be less than 2mm per metre length (excluding roof, underframe and bodyends from the start of the body taper). T

4.2 Windows

TS303 The bodyside window arrangement, including the dimensions of the windows, must be optimised to ensure that the maximum number of seated passengers in the saloon and D

standing passengers in a vestibule can see out of an adjacent window. As a minimum, the saloon shall be fitted with windows of at least 1400 in width and 650mm in height, except in the event that a single smaller window on each side is required so that the window arrangement matches the saloon length.

TS1607 It must be possible to rectify damaged or defective bodyside windows (other than those which are partially blanked) such that the total time the train is not In Service is less than 7 hours. D

N142 It must be possible to rectify damaged or defective windscreens or bodyside windows which are partially blanked such that the total time the train is not In Service is less than 10 hours. D

TS1847 All bodyside windows, excluding windows fitted in the cab but including all those fitted in external doors, must be double glazed and consist of a laminated pane and a toughened pane with the toughened pane being on the exterior. D

TS1848 All bodyside windows including those in external doors must allow the continued operation of the IEP Train at normal linespeeds following the breaking of the external pane of a window assembly. D

4.3 Gangways

TS312 The gangways fitted between IEP Vehicles must allow for the train configuration flexibility requirements described in section 3.1.3. D

TS1617 Inter-vehicle gangways must meet the following requirements;

- gangways shall be of a size such that they allow unrestricted passage for the User Population including when operating on curves as specified in TS1825;
- gangways shall be designed to be as level as practicable to allow the free passage of catering trolleys; and
- there shall be a clear unobstructed sightline through the gangway to suit the User Population.

D

4.4 Brakes

TS314 In addition to complying with the requirements set out in the TSI that relate to emergency braking, an IEP Train's service brake must also comply with the requirements of Figure 3, Curve A3 in Railway Group Standard GM/RT2044, Issue 4, June 2001, 'Braking System Requirements and Performance for Multiple Units'. D

TS1849 The IEP brake system on the IEP Trains must not allow undetected single point failures or likely combinations of failures that could lead to an unsafe event. As a minimum the events to be considered as unsafe shall include the following;

- significant loss of braking capability; and
- dragging brakes on all axles of one or more IEP Vehicles simultaneously.

D

4.5 Motive Power

TS1750 In the case of Electric IEP Units and Bi-mode IEP Units operating in electric mode, the traction system alone must deliver at least the same level of deceleration during braking as is achieved during acceleration, at any speed greater than 20km/h and during the entire D

duration of a brake application bringing the IEP Train to a stand from maximum speed on level track.

TS1989 Where an IEP Unit is supplied from a 25kV Overhead Electric Supply, all the energy recovered by the traction system during braking (less any electrical losses) must, where the infrastructure permits, be returned to the supply (less any used beneficially onboard the train, e.g. in supplying auxiliaries). D

TS348 IEP Units shall deliver Full Functionality when any compression ignition engines fitted are provided with fuel in accordance with either of the following standards (or a fuel consisting of a mixture of fuels to the following standards): D

- BS EN 590:2009+A1:2010 - Automotive fuels – Diesel – Requirements and test methods
- BS 2869:2010+A1:2011 - Fuel oils for agricultural, domestic and industrial engines and boilers – Specification, Class A2.

4.6 Auxiliaries

TS1507 The auxiliary system must be designed such that a further 5kW load can be added to the auxiliary system on each IEP vehicle at a later date. D

4.7 Doors

TS1599 The local control arrangements for internal doors shall include the following functions: D T

- allow passenger and train crew to cause the door to open without using their hands;
- ensure that the doors do not close on passengers while walking through or standing in the aperture; and
- allow train crew only to isolate the door in the open position.

TS1921 Both external and internal doors fitted to the IEP Train shall be designed for the safe evacuation of passengers following a major incident such as a collision or derailment. Consideration should be given to the range of positions and attitudes and states of the IEP Vehicles within the IEP Train following a major incident. D

4.8 Heating Ventilation & Air Conditioning

TS317 Passenger carrying IEP Vehicles must be fitted with Heating Ventilation and Air Conditioning (HVAC) systems which conform to the requirements of BS EN 13129-1:2002, ‘Railway applications - Air conditioning for main line rolling stock – Comfort parameters’ with the following exceptions (reference to clauses below refer to the corresponding clauses in BS EN 13129-1:2002):

- Clause 6.1.1 – at external ambient temperatures below -3 degrees C, it is permissible not to fully comply with the requirement to maintain an internal ambient temperature of 22 degrees C. Instead the ambient temperature in the saloon will be maintained at a minimum of 25 degrees above the external ambient temperature. D T
- Clause 6.1.5 – at external ambient temperatures below 0 degrees C, it is permissible not to fully comply with the requirement for the range of the extreme interior air temperatures in a vertical section. Instead the range of the extreme interior air temperatures in a vertical section shall be a maximum of 3K at heights of more than

200mm above floor level and when the full range of heights is taken into account, the maximum range shall be 9K.

- Clause 6.2.2 – at external temperatures below -3 degrees C, it is permissible not to fully comply with the requirement to maintain the ambient temperature in the vestibule at a minimum of 10 degrees C. Instead, the ambient temperature in the vestibule may fall as low as 13 degrees C above the external ambient temperature. These amended requirements of clause 6.2.2 shall also apply to the luggage storage areas in addition to the vestibule.
- Clause 6.2.3 – at external temperatures below -5 degrees C, it is permissible not to fully comply with the requirement to maintain the ambient temperature in the toilet at a minimum of 16 degrees C. Instead, the ambient temperature in the toilet may fall as low as 19 degrees C above the external ambient temperature. This clause shall also apply to the crew office in addition to the toilets.
- Clause 6.4.3 – at external temperatures below -5 degrees C, it is permissible not to fully comply with the requirement to achieve a minimum floor temperature of 8 degrees C 1 hour after the end of the preheating period and the requirement to achieve a minimum floor temperature of 10K less than the mean interior temperature after three hours. Instead, the minimum floor temperature may be as low as 5 degrees C after three hours with no requirement after one hour.
- Clause 6.6 – it is permissible to exceed the maximum air speed quoted in Annex B of BS EN13129-1, with the maximum air speed being no more than 0.4m/s.
- Clause 8 – there are no specified preheating and precooling times – IEP Trains must meet the requirements of this section 4.8 when In Service with sufficient preheating or precooling carried out prior becoming In Service.
- Clause 8.1 – This requirement shall only be met where an internal temperature of 22 degrees C is required according to the revised requirements of clauses 6.1.1 and 8.2 (see above and below).
- Clause 8.2 – at external ambient temperatures below -3 degrees C, it is permissible not to fully comply with the requirement to maintain an internal ambient temperature of 22 degrees C. Instead the ambient temperature in the saloon will be maintained at a minimum of 25 degrees above the external ambient temperature.

TS1620 The HVAC performance of the saloon of the IEP Vehicle must be calculated on the basis of an interior layout which includes a minimum of 90 seats in the saloon, with a Fully Laden load. Additionally the HVAC system must ensure sufficient air quality for the safe carriage of passengers when loaded to the Crush Laden Condition. | D T

N030 The HVAC performance in the saloon of the IEP Vehicle must achieve the lower bound of the regulation curve defined in Annex A of BS EN 13129-1:2002, ‘Railway applications – Air conditioning for main line rolling stock – Comfort parameters’, subject to the exceptions described in TS317. | D T

TS1621 The saloon HVAC system must be designed so as to accommodate the interior flexibility requirements of the IEP Vehicles. For example the HVAC system should accommodate the addition or removal of toilets, internal partition doors or catering facilities (reduction or removal only) without significant changes to the HVAC system other than in the affected area. | D

TS1619 The cabs of the Driving IEP Vehicles of IEP Units must be fitted with Heating Ventilation and Air Conditioning (HVAC) systems which conform to the requirements of BS EN14813-1:2006, 'Railway applications - Air conditioning for driving cabs –Comfort parameters'. D T

In accordance with BS EN14813-1:2006, 'Railway applications - Air conditioning for driving cabs – Comfort parameters', the cabs of Driving IEP Vehicles shall be designated as a 'Category A' driving cab; all requirements shall be met.

4.9 Passenger Information & Communications

4.9.1 Passenger Information & Announcement System

TS290 The PIS / PA System must have sufficient capacity to store enough messages for any one Relevant Operator, and as such must have at least a 2MB capacity to store text messages within the PIS and at least a 1GB capacity to store audio messages within the PA system. D

TS481 The PIS / PA System must be capable of uploading new timetable/message database information for each individual franchise deployment of IEP Trains.

This upload capability shall, at timetable change implementation, allow the relevant IEP Trains to finish service one day with the previous data, and be ready for the following day's service with the new timetable data from the TSDB. D T

Similarly any short term timetable changes for engineering work, special events, etc, shall be capable of being downloaded from the TSDB within one overnight period.

TS482 In addition to the legislative requirements it is an essential requirement that the PIS and PA systems shall deliver the following functionality:

- it must be possible for real-time messages to be generated by either the train crew or central control;
- the PIS must display journey information and coach identification letters/numbers as follows:
    - inside each IEP Vehicle at all times whilst in passenger service; and
    - outside each IEP Vehicle close to the entrance doors whilst any part of the IEP Train is in a station at which the train will stop;
- the PIS and PA System shall update journey information in real time throughout the journey; D
- the PIS shall identify to passengers which IEP Vehicle they are in, and the PIS and PA System shall explain in the case of a service that divides en route which portion of the IEP Train each IEP Vehicle forms a part. The coach identification shall remain the same throughout the journey even after a division and the possible reversal of an IEP Train or a portion of an IEP Train;
- the PIS and the PA System shall advise passengers of any requirements to alight from specific IEP Vehicles or doors a station ahead of the affected station and this shall be fully integrated with the SDO System;
- the voice PA System shall be available to crew at all staff areas, door control points and catering areas and its function shall be retained if the visual PIS fails and vice versa;
- the PA System must accommodate coded alarms or messages which can be selected

by train crew; and

- the PIS and the PA System must allow for different information to be provided in different parts of the IEP Train.

TS1931 The PIS must utilise the data from the passenger counting system to indicate to passengers within the IEP Train the status of the occupancy of each IEP Vehicle. D

4.9.2 Seat Reservation System

TS636 The IEP Trains must be fitted with an automatic seat reservation system. The system shall use data from a central database to provide an electronic display adjacent to each seat and for each bicycle storage position (the display for each bicycle storage position shall be located outside the bicycle storage area). D

TS1990 The automatic seat reservation system must be fully integrated with the PIS, updating automatically according to the position of the IEP Train. D

TS637 The seat reservation system must accommodate changes in interior layout, such that reservation displays can be moved with the associated seat, to accommodate interior layout changes. D

TS638 There must be a holder suitable for displaying printed reservation tickets adjacent to each seat as a back-up to the automatic system. D

TS640 The automatic seat reservation system must deliver the following functionality:

- interface directly with the Relevant Operator's seat reservation system (which shall be assumed to be the same as the national seat reservation system). The reservation system shall utilise this data to maintain the reservation database for each IEP Train;
- automatic remote download of reservation data via a communications link immediately prior to the start of a timetabled journey within a maximum of 5 minutes after the service to be operated has been confirmed to the IEP Train; D T
- allow on board train crew to load or update seat reservation data for that IEP Train;
- displays for each seat must indicate whether that seat is free, reserved for part of or for the remainder of the journey. The method of display must be easy for passengers to interpret quickly when boarding, and shall seek to convey an overall impression of the extent of reserved and unreserved seats within the saloon; and
- displays must be automatically updated throughout a journey to indicate the current reservation status for the remainder of the journey.

4.10 Lighting

TS550 The lighting system must conform to the requirements for main line rolling stock contained in BS EN 13272:2001, 'Railway applications – Electrical lighting for rolling stock in public transport systems'.

General Lighting (as defined in BS EN 13272:2001, 'Railway applications – Electrical lighting for rolling stock in public transport systems') must be provided under all operating conditions with the exception of Real Emergency Mode, where Emergency Lighting (as defined in BS EN 13272:2001, 'Railway applications – Electrical lighting for rolling stock in public transport systems') must be provided. D T

N057 Lighting of a minimum of 20 Lux must be provided on emergency equipment not contained in cubicles, any cubicles containing emergency equipment and on emergency equipment contained in cubicles when the cubicle door is opened. D T

TS1661 In addition to complying with the requirements for main line rolling stock contained in BS EN 13272:2001, 'Railway applications – Electrical lighting for rolling stock in public transport systems', IEP Trains must be fitted with an Emergency Lighting system (as defined in BS EN 13272:2001, 'Railway applications – Electrical lighting for rolling stock in public transport systems') that meets the following requirements:

- the system must continue to function for a period of three hours continuously in all IEP Vehicles following any event that causes the separation of one or more IEP Vehicles from the remainder of a train formation; D T
- the system must provide sufficient light to allow passengers to orientate themselves within the IEP Train and safely evacuate if necessary; and
- the system must comply with the requirements of section 4 of Railway Group Standard GM/RT2130, Issue 3, December 2010, 'Vehicle Fire, Safety and Evacuation'.

4.11 Radio & Data Transmission

TS248 IEP Trains must be fitted with GSM-R radio equipment. D

TS1922 The number of aerials fitted to the IEP Trains must be minimised. Any aerials must be positioned taking into account the following:

- the effect of the geometry of the installation location on the radiation / reception performance of the antenna;
- the effect of any protrusions from the IEP Train which might affect the radiation / reception performance of the antenna; D
- the effect of any adjacent aerials on the performance of the radio system; and
- the risk of being struck or otherwise damaged.

4.12 Train Control

4.12.1 General

TS255 Train Control systems must be provided as dictated by standards and these systems should be implemented generally in accordance with UK practice and in accordance with the requirements of the applicable TSI. The Train Control systems shall be developed through the "Progressive Design Assurance" process specified in Paragraph 9 of appendix D to Schedule 1 of the MARA

The following examples should not be considered as an exhaustive list but are provided for guidance: D

- Drivers Safety Device (DSD) – General UK Practice is to provide a pedal in the driver's foot well.
- Traction/Brake Controls – General (modern) UK Practice is to provide a Combined

Power Brake Controller (sometimes referred to as a Traction Brake Controller). Moving the controller away from the driver shall apply the brakes and moving the controller towards the driver shall apply traction.

4.12.2 Door Control

TS1567 The IEP Train controls must be designed to allow either Driver Only Operation (DOO) or Driver Guard Operation (DGO). D

N049 The IEP Train controls must be designed so as to allow the following methods of DGO operation:

- the driver releases the doors and the guard is responsible for closing them (DGO-D); and D
- the guard releases the doors and the guard is responsible for closing them (DGO-G).

N050 SDO functionality must be provided in both DOO and DGO modes.

In the case of DGO-G operation, if action from the driver is necessary to allow SDO to function then it is permissible for the driver to be involved in the release of the doors, it must however always be an action of the guard which actually releases the train doors. D

N051 A means must be provided to allow staff to release and close the IEP Train doors when a driver is not present. D

N052 A means must be provided to allow staff access and egress to and from the IEP Train when the doors are not released. Such access must be provided on each side adjacent to each catering facility on the IEP Train with a minimum of one access on each side. D

TS1568 Door controls must be provided at each guard's position, which shall as a minimum be at vehicle length intervals on passenger carrying IEP Vehicles each side of the IEP Train. These controls must allow for guard releasing and closing of the passenger doors. D

4.12.3 System Isolation

TS1571 The design of the IEP Train must take account of the following in the design and location of system isolation devices so as to minimise the effect of system isolation on the operation of the railway:

- who will operate the isolation device;
- the circumstances under which it may be necessary to operate the isolation device; D
- the operational consequences of operating a system isolation device; and
- any operational restrictions which might affect the ability of train crew to operate the isolation device (e.g. there may be restrictions on train crew carrying out isolations on the outside of the train).

TS1786 Where practicable, all system isolation devices must be contained within the cab and the driver must be able to operate them without the driver leaving the cab. D

TS1923 Passenger facing system controls (e.g. Pass-Comm, Call for Aid, HVAC, internet provision, seat power supply, lighting etc.) must be implemented so that all train crew (with basic competence) are able to set or reset these system controls from within the train interior as D

required.

4.12.4 Train Protection

TS1853	IEP Units must be fitted with train protection systems (AWS, TPWS) necessary to operate on the IEP Network.	R
TS1572	IEP Units must be fitted with ETCS, Level 2, meeting the ETCS System Requirements Specification (SRS) version 2.3.0d or later.	R
N144	It must be possible to upgrade the ETCS fitted to the IEP Units to ETCS Baseline 3 by modification of software contained in systems (not limited to the ETCS system itself) on board the train, without any modification to the train hardware.	D
TS1573	Where IEP Units operate on routes currently fitted with the BR-ATP system the IEP Train must operate with this system.	D
TS1870	In the case where an IEP Unit is fitted with the BR-ATP system, it must be possible to configure the IEP Unit to have either ETCS or BR-ATP operational as necessary, when the IEP Unit is stationary and In Service, with the IEP Unit being ready to move within 10 minutes of starting the configuration process.	T
N110	IEP Units must support the following transitions between train protection systems (where fitted and operational) when the train is In Service: • Between AWS/TPWS and ETCS in service at any speed; • Between ETCS and AWS/TPWS in service at any speed; • Between AWS/TPWS and BR-ATP in service at any speed; and • Between BR-ATP and AWS/TPWS in service at any speed. The details of the transition process (including whether operation of AWS/TPWS is suppressed during operation of an alternative train protection system) will be defined during detailed design.	R
TS1872	IEP Trains must contain a 'Train Complete' detection system which shall allow the ETCS on-board system to detect when the length of the IEP Train has changed in service (including through splitting, joining and unintentional parting of couplings) with sufficient integrity to support ETCS level 3 should that be fitted at a future date.	D

4.13 Selective Door Operation

TS296	IEP Trains must be fitted with an SDO system to allow for longer IEP Trains operating in single or Multiple Working formation to stop at short platforms.	D T
N032	The SDO system shall include the facility to enable each power operated door along the length of an IEP Train to be separately included/excluded from the door release pattern at each station.	D
N033	An SDO system able to use SDO data provided by the ETCS system must be fitted to the IEP Train. If the ETCS system provides data which allows the IEP Train to determine on which side of the IEP Train the platform is located, the SDO system must prevent release of the doors on	D

the side of the IEP Train where there is no platform.

N058 An SDO system able to use SDO data provided by Eurobalises using Packet 44 must be fitted to the IEP Train.

If the Eurobalise provides data which allows the IEP Train to determine on which side of the IEP Train the platform is located, the SDO system must prevent release of the doors on the side of the train where there is no platform. D

N059 The IEP Train must be fitted with a GPS based SDO system.

The system shall use data relating to the position and length of the platform (stored in a database on the IEP Train), data related to the agreed stopping position of the IEP Train (stored in a database on the IEP Train) and data on the position of the IEP Train (from a GPS system together with other sources of data including odometry) to determine which doors may be safely released. D

N060 It must be possible to configure the SDO system to make use of data from the following sources:

1. the ETCS system;
2. Eurobalises providing SDO data in Packet 44; and D
3. the GPS based SDO system.

It must be possible to configure which data source should take precedence in the event that data is available from more than one source.

N061 The SDO system must be able to accommodate the following operating requirements:

- the provision of different stopping positions in relation to a station platform for IEP Trains formed of differing numbers of IEP Vehicles. This shall allow the system to cope with circumstances where either the rear of the IEP Train, the front of the IEP Train or some point in the middle of the IEP Train is required to align with a specific point on the platform; and D
- the provision of different stopping positions in relation to a station platform for IEP Trains of the same length (in the event that, for example a signal is positioned at an intermediate point along a platform).

N035 Staff involvement in releasing the doors must be limited to the following (except in the case of failure of the IEP Train or infrastructure equipment or in certain scenarios in the case of GPS based SDO (please refer to N036)):

- the driver shall be responsible for stopping the IEP Train in the correct position, to within an agreed tolerance;
- the driver shall be responsible for viewing an indication from the SDO system which will identify the IEP Train's location and the proposed pattern of door release. This indication shall appear automatically, as the train reaches a stand. Note that the driver will spend a short period of time (less than two seconds) on this activity, commensurate with the desire to optimise dwell times, and this should not be relied on to detect any but the most obvious of defects in the SDO system; and D
- the driver shall be responsible for pressing the door release buttons for the correct side so as to release the doors or in the event of DGO-G operation allow the guard to

release the doors.

The SDO system should require no additional traincrew involvement other than that defined above.

N036 In the case where GPS based SDO is in use and it can be demonstrated that insufficient information is available to the SDO system to allow it to determine the location of the IEP Train to a sufficient level of accuracy to determine the correct door release pattern then staff involvement in releasing the doors shall be limited to the following:

- the driver shall be responsible for stopping the IEP Train in the correct position, to within an agreed tolerance;
- the SDO system will automatically, as the train comes to a stand, invite the driver to confirm, if necessary, the station at which he has stopped and/or, if necessary the specific platform at which he has stopped;
- the driver will briefly review the information that the SDO system displays to him and confirm his location to the SDO system. This process shall take no longer than 3 seconds; D
- the driver shall be responsible for viewing an indication from the SDO system which will identify the IEP Train's location and the proposed pattern of door release. Note that the driver will spend a short period of time (less than two seconds) on this activity, commensurate with the desire to optimise dwell times, and this should not be relied on to detect any but the most obvious of defects in the SDO system; and
- the driver shall be responsible for pressing the door release buttons for the correct side so as to release the doors or, in the event of DGO-G operation allow the guard to release the doors.

The SDO system should require no additional traincrew involvement other than that defined above.

N034 The SDO system and PIS must operate together so as to give passengers information regarding the operation of the SDO system. In particular the system must, as a minimum, identify to passengers whether SDO will operate and which doors will open, subject to this information being available to the systems on the train at the time the announcement is made. D

If the necessary information is not available at the time an announcement is made then the system shall be designed so that a less detailed announcement can be made at that time with a second announcement made once the information becomes available.

N037 The SDO system must provide a means for the driver to manually select a door release pattern so as to allow the doors to be released at platforms where operation of the IEP Trains has not been anticipated or to accommodate failures in the system used to determine the IEP Train's position. D

4.14 Energy Metering

TS297 IEP Units must be fitted with on-board metering which measures the total energy consumed for IEP Units. The system shall log data on board the IEP Unit and make it available to the Relevant Operator via the Internet when required. T

The metering used must be able to determine separately in the cases where the IEP Unit is In

Service and when the IEP Unit is not In Service:

- the total energy consumed; and
- the total energy returned to the network under regenerative braking (where applicable).

Note that the conversion of input energy should be measured in the form it is delivered to the IEP Unit (e.g. in the case of a fuel, the volume or mass of fuel used and in the case of electricity the number of kWh consumed from, or returned to, the supply).

TS1854 The electrical energy consumption logging must be of a sufficient quality to meet electricity supply industry requirements for billing purposes. The IEP Units must comply with BS EN 50463:2007 'Railway applications – Energy Measurement on board trains. D

TS1855 IEP Units must deliver the energy data logged, as and when required, to the Relevant Operator via the Internet. D

4.15 Train Management System

TS298 The IEP Trains must be fitted with a train management system (TMS) that is able to generate and receive information on the IEP Train status and location, providing fault information to the driver, identifying repair work required, and storage of IEP Vehicle data. The system shall provide data to enable performance indicators to be compiled. The system shall be operated by various levels of user, e.g. train drivers, other train crew, service controllers, train maintainers or system specialist.

The TMS shall, as a minimum, be able to do the following:

- automatically reconfigure when IEP Trains are split or joined together;
- monitor status and fault data from the IEP Train's intelligent subsystems, safety systems and service critical systems (for example, motive power, HVAC and braking); D T
- generate status and fault messages from monitored data and providing the relevant alerts in real time to train drivers, train crew, train maintainers and control centre. The messages should advise what action to take and apply any necessary constraints on the subsequent operation of the IEP Train; and
- display relevant status and fault information in the driving cab and the crew office.

The IEP Train must incorporate suitable connections in each cab so as to allow the download of TMS fault data.

TS1718 A subset of TMS indications and OTMR data must be accessible remotely from the control centre and operating depot. The data must be available in a fashion commensurate with the communication facilities used to transmit it. D

N079 The IEP Train must incorporate suitable connections in each cab so as to allow the download of OTMR data from that cab. D

TS1932 The TMS must provide a single integrated interface for fault indications across train sub-systems. D

TS1992 The TMS must provide a unified means of communication for operation and maintenance data from the IEP Train to off-train control and maintenance facilities. D

4.16 Passenger Counting System

TS299 Each IEP Vehicle must be installed with a system that automatically records the number of passengers boarding and alighting the IEP Train at each station. The system must record the individual journey, time and date for which this information applies. The system must provide data which shows for each IEP Vehicle: D T

- the number of passengers aboard the IEP Train on approach to each station;
- the number of passengers which alight the IEP Train at each station;
- the number of passengers which board the IEP Train at each station; and
- the number of passengers aboard the IEP Train on departure from each station.

TS1993 The passenger counting systems must, in addition to the requirements of TS299, automatically record the number of people moving between IEP Vehicles to facilitate the calculation of the number of passengers per IEP Vehicle. D

TS1857 The system must be able to record the passenger numbers to within 5% or one person (whichever is the greater) of the actual number of people on board the IEP Train between each station stop. D T

TS1859 Recorded data for the entire IEP Train must be downloadable via the TMS D

TS1860 All passenger count data must be accessible remotely and in real time from a control centre and operating depot. T

4.17 Infrastructure Monitoring Systems

TS2002 IEP Trains must monitor the railway infrastructure as detailed in the subsections below, on a continuous basis during the time the IEP Trains are In Service. The data that is recorded shall be collected, stored and provided to the Relevant Operator and Network Rail at the intervals specified.

The system(s) provided must enable each item of infrastructure equipment being monitored/recorded to be identified. The recorded data shall, in addition to the data identified in the relevant subsections below, include: D

- unique identities for each IEP Train;
- the journey/diagram;
- IEP Train position in real time;
- the route(s) travelled over including position and direction; and
- date, and timestamp data to the nearest second.

4.17.1 GSM-R Monitoring

TS2003 Subject to the capabilities of the hardware and software of the GSM-R voice radio fitted to the IEP Trains, the GSM-R voice radio shall monitor the state of the GSM-R network as follows: D

- the GSM-R system must allow the GSM-R voice radio in unoccupied cabs to be remotely instructed to generate call traffic in specific geographical areas to support

GSM-R network performance monitoring; and

- The loss and re-establishment of GSM-R coverage shall be recorded by the TMS or on the train data recorder.

In order to meet this requirement, the IEP Trains shall make provision for either the TMS or the train data recorder to record the loss and re-establishment of GSM-R coverage; subject to the GSM-R voice radio hardware having the necessary functionality this will be indicated to the IEP Train either by means of a volt free contact in the GSM-R voice radio or by means of a data link from the GSM-R radio.

N127 IEP trains shall be designed so that the data recorded in the TMS or train data recorder is made available to the Relevant Operator or Network Rail within 36 hours of it being recorded. D

4.17.2 Forward Facing CCTV (FFCCTV)

TS1907 To support incident management each IEP Train must be fitted with Forward Facing CCTV that shall record the following:

- the track;
- lineside signals;
- overhead catenary; and
- the lineside.

D

The camera must be positioned so that, so far as is practicable, the recording is representative of what is seen by the driver.

TS1911 The FFCCTV system must be able to:

- operate in Standard Mode and Multiple Hauled Mode;
- record images under all lighting conditions including night time when the light source will be the IEP Train headlights;
- use progressive, not interlaced, scanning;
- record at a minimum resolution of 1920 x 1080 pixels;
- record at a minimum frame rate of 20 frames per second;
- record detailed images without interruption under all lighting conditions including darkness and rapid changes between sunlight and dark conditions;
- record a minimum of 560 hours of data;

D
T

- provide drivers with a pushbutton that allows them to flag a feature worth noting for further investigation;
- provide an automatic means of reporting to the control room in real time when a driver presses the button identified above;
- provide data download capability for image data to a laptop PC;
- record images which may be required to be used as evidence in a prosecution. To facilitate this the system must be capable of supporting a clear evidential trail so as to allow the integrity of the recording to be demonstrated; and
- be capable of being operated so as to comply with the legal requirements with regard

to data protection.

N123 The FFCCTV system shall record images in both the forward and rearward facing cabs in an IEP Train. D

N128 IEP trains shall be designed so that the images recorded by the FFCCTV system are available to the Relevant Operator on demand (subject to appropriate mechanisms to prevent unauthorised access to that data). IEP Trains shall be designed so that operation of the drivers' push button is notified to the Relevant Operator within 24 hours of its operation. D

4.17.3 Unattended Track Geometry Measurement System (UGMS)

TS1899 A proportion of IEP Units must be fitted with an operational UGMS on delivery. D

N053 UGMS equipment must be capable of being fitted to any type of IEP Unit of any length (from 130m to 312m). D

TS1903 The IEP Unit's UGMS system must require no operator intervention and shall monitor and record the following track data geometry parameters:

Parameter	**Repeatability of geometry signal**	**Repeatability of statistical data (1/8th mile Standard Deviation)**
35m top (left and right rail)	+/- 1mm	0.1mm
70m top (mean)	+/- 1mm	0.1mm
35m alignment	+/- 2mm	0.2mm
70m alignment	+/- 2mm	0.2mm
Gauge	+/- 0.5mm	0.1mm
3m twist	+/- 1.5mm	0.15mm
Curvature (versine from a 20m chord)	+/- 1mm	0.1mm
Cross level	+/- 1.5mm	0.15mm
Cyclic top	N / A	N / A
Dip angles	N / A	N / A

D

In addition to the track data geometry parameters above, the following parameters must also be recorded:

Parameter	**Accuracy**
Train Speed	+/- 2mph
Train Position	By differential global positioning system (DGPS).

TS2006 The UGMS must deliver the data to the accuracy described in TS1903.

In addition to this the location of the geometry signals must be repeatable to 1m (run-on-run) with absolute location of the network being determined to within 3m in terms of miles and yardage. All data must be attributed with the correct Engineers Line Reference ELR / Track D T

ID (TRID)

The accuracy and repeatability of the UGMS outputs shall be determined as follows;

- by comparison to Network Rail's fleet of calibrated infrastructure monitoring trains;
- by run-on-run UGMS comparison; and
- for a range of IEP Vehicle speeds to demonstrate the UGMS outputs are invariant with speed and vehicle orientation.

TS1900 The data acquisition rate of the UGMS system must allow the Network Rail reconstructed track geometry to show data at intervals of at least every 0.2m along the track being monitored. D

TS1902 The IEP Trains must be able to transmit the captured data to remote sites. The data gathered must be automatically down loaded to ground based receivers provided by the TSP. The data must be provided in a format compatible with Network Rail's analysis tools. D

N129 IEP trains shall be designed so that the data recorded by the UGMS system is provided to the Relevant Operator or Network Rail within 48 hours of it being recorded. D

4.17.4 Pantograph Camera System

N147 IEP Units shall optionally be fitted with a pantograph camera system. Fitment of a pantograph camera system shall not reduce the provision for UOMS equipment specified in section 4.17.5. D

N148 IEP Units fitted with a pantograph camera system shall record images which include the following:

- images of all pantographs fitted to the Unit;
- the full width of the pantograph head over the full range of vertical movement; and
- images of equipment up to a distance of 500mm above the contact wire (e.g. catenary and droppers) over the full range of wire heights.

D

N149 The pantograph camera system shall record images when the train is in motion. D

N150 The pantograph camera system must:

- operate in Standard Mode;
- use progressive, not interlaced, scanning;
- record at a minimum resolution of 1920 x 1080 pixels;
- ensure that the images specified in N148 occupy the largest possible portion of each recorded frame, in particular, the full range of pantograph vertical movement shall occupy a minimum of 50% of the vertical height of the frame; D T
- record at a minimum frame rate of 20 frames per second;
- record detailed images without interruption under all lighting conditions including darkness and rapid changes between sunlight and dark conditions;
- record a minimum of 560 hours of data;
- permit drivers to view the image from any of the pantograph cameras fitted to an IEP Train;

- provide drivers with a pushbutton that allows them to flag a feature worth noting for further investigation (it is permissible for this to be the same push button as referred to in clause TS1911);
- provide an automatic means of reporting to the control room in real time when a driver presses the button identified above (it is permissible for this to be the same mechanism as referred to in clause TS1911);
- provide data download capability for image data to a laptop PC;
- record images which may be required to be used as evidence in a prosecution. To facilitate this the system must be capable of supporting a clear evidential trail so as to allow the integrity of the recording to be demonstrated; and
- be capable of being operated so as to comply with the legal requirements with regard to data protection.

N151 The pantograph camera system must include a means of illumination so as to permit the pantograph to be seen in darkness (either in tunnels or at night). This illumination system shall provide a minimum of 40 lux at the pantograph head over the full range of vertical movement of the pantograph, including when stowed. D

N152 IEP trains shall be designed so that the images recorded by the pantograph camera system are available to the Relevant Operator or Network Rail on demand (subject to appropriate mechanisms to prevent unauthorised access to that data). IEP Trains shall be designed so that operation of the drivers' push button is notified to the Relevant Operator or Network Rail within 24 hours of its operation. D

4.17.5 Unattended Overhead Line Measurement System (UOMS)

TS1914 Provision must be made for the fitment of an Unattended Overhead Line Monitoring System (UOMS) in the future. D

N075 IEP Trains must be able to accommodate UOMS equipment comprising the following items of equipment:

- a 19" rack of 12U height and 300mm depth, weighing no more than 20kg. This is to be located on the IEP Vehicle fitted with a pantograph;
- an antenna, located within 10 metres of the pantograph. It shall be assumed that the antenna will not operate at frequencies in any of the following ranges: 876-960MHz, 1710-1785MHz, 1805-1880MHz, 1920-1980MHz, 2110-2170MHz, 791-821MHz and 832-862MHz. The antenna location shall be positioned so as to avoid compromising transmission / reception performance between the antenna and equipment mounted on the pantograph; D
- a cable conduit between the antenna position and the 19" rack, the length of this cable run shall be minimised and in any event shall be no greater than 15m.

N076 IEP Trains must make provision to supply power to UOMS equipment in the future. This shall consist of the provision of power at 110V DC at a maximum of 3A to the location selected for the 19" rack. Provision must be made for the TMS to detect failure of this supply (e.g. the operation of a protective device) and provide an appropriate notification. D

4.18 Automatic Vehicle Identification (AVI)

TS2004 An AVI system must be fitted to all IEP Units. This will consist of two tags per IEP Unit (one on either side) and shall be based on Radio Frequency Identification (RFId) technology.

The particular RFId system selected must be compatible with Network Rail's requirements, subject to it being possible to meet those requirements within the constraints described below:

- each AVI tag shall weigh no more than 100g;
- each AVI tag shall be of a maximum dimension of 300mm long x 100mm wide x 50mm deep; D
- each AVI tag shall be mounted such that it is not shielded or obstructed by any bodyside fittings, vinyl livery film or bodyside sacrificial coatings;
- each AVI tag shall be mounted between 500mm and 1100mm above rail level; and
- each AVI tag shall be mounted on the driver's left hand side (when in the driving position) of the Driving IEP Vehicle and longitudinally within 2m of the leading bogie centre.

5 Custom Systems

5.1 Saloon Closed Circuit Television

TS604 Passenger carrying IEP Vehicles must be fitted with a Closed Circuit Television (CCTV) Monitoring System. D

TS605 The Saloon CCTV system must incorporate the following functionality:

- each IEP Vehicle shall contain sufficient CCTV cameras to view all public accessible areas (excepting inside toilets) and to minimise blind spots. The passenger areas to be covered shall include vehicle saloons, doorways, vestibules, gangways, publicly accessible catering areas and other public spaces;
- cameras fitted shall, so far as possible, be resistant to tampering and vandalism;
- the CCTV system shall record, without overwriting, for a minimum of 1 months IEP Train service operation;
- the recorded picture shall be in colour and shall be of sufficient clarity to enable the Identification of individuals to the same standard as that defined in clause 7.6 of BS EN 50132-7:1996 'Alarm Systems – CCTV surveillance systems for use in security applications – Application guidelines'; D T
- recorded images may need to be used as evidence in a prosecution. To facilitate this the system shall be able to support a clear evidential trail so as to allow the integrity of the recording to be demonstrated;
- the system shall be able to be operated so as to comply with the legal requirements with regard to data protection;
- the CCTV picture capture frame rate shall be sufficient to allow the visible actions of persons within all public accessible areas to be identifiable. Consideration shall be given to increasing this frame rate after an 'emergency event' trigger, such as a

passenger alarm handle being actuated; and

- the CCTV system shall allow the following to be viewed in a secure train crew area:
  - live (i.e. a delay of no more than two seconds) images from any CCTV camera; and
  - recorded images from any CCTV camera.

5.2 Operation of Mobile Telecommunications Devices

TS1475 IEP Trains must be designed so as to allow mobile phones and other similar devices accessing GSM and 3G communications networks to operate without excessive impediment. In particular, such signals passing through the side windows perpendicular to the rail on straight track shall be attenuated by less than 3dB. This may be demonstrated by a test on the window material independently of the train. D T

5.3 Wireless Internet Access

TS1691 The IEP Units must make provision so as to allow the Relevant Operator to install equipment to allow passengers to wirelessly access the internet from their seat. D

TS1693 IEP Units must make provision for the installation of one wireless internet server supplied by the Relevant Operator on each IEP Unit. This provision must include the following:

- The provision of space in a 19" rack. As a minimum a height of 3U, a depth of 400mm and a weight of 15kg must be accommodated;
- The provision of a power supply of up to 1A at 110V DC which is not subject to interruption whilst the IEP Train is carrying passengers and is powered, so far as is practically possible, at all times; and
- Connections to the aerials referred to in N117.

D

N117 IEP Units must be fitted with four aerials on the roof to allow the wireless internet server referred to in TS1691 and TS1693 to communicate with ground based systems. The type and quantity of aerials required will be determined during detailed design. D

N124 IEP Units must make provision for the installation of a router supplied by the Relevant Operator on each IEP vehicle (including that fitted with a wireless internet server), This provision must include the following:

- The provision of space in a 19" rack. As a minimum a height of 3U, a depth of 400mm and a weight of 15kg must be accommodated; and
- The provision of a power supply of up to 1A at 110V DC which is not subject to interruption whilst the IEP Train is carrying passengers.

D

N125 IEP Units must include provision for the installation of one wireless access point of dimensions of approximately 230mm x 200mm x 80mm and weight of approximately 5kg in each vehicle saloon. This provision must be located in the ceiling approximately half way along the length of the saloon. A flat surface shall be provided at the mounting location which can be drilled to allow the access point to be secured. D

N126 IEP Units shall include provision for the installation of up to two wireless internet antennas in each saloon. The antennas will be mounted within 3 metres of the access point described in N125. The exact size, weight and mounting arrangements for the antennas will be D

determined during detailed design.

N130 IEP Units must include cabling between the equipment identified above as follows:

- Cabling shall be provided between the antennas specified in N117 and the wireless internet server detailed in TS1693. This cable shall have a loss of no more than 3dB at 2GHz (including any loss at the connection between the cable and the antenna);
- Four cables meeting EIA/TIA "Cat5e" standards and suitable for use for 1Gbits/sec Ethernet shall be provided between the wireless internet server defined in TS1693 and the router defined in N124;
- Four cables meeting EIA/TIA "Cat5e" standards and suitable for use for 1Gbits/sec Ethernet shall be provided between the wireless internet router defined in N124 and the wireless internet router fitted to the two adjacent vehicles; and

D T

- Two cables meeting EIA/TIA "Cat5e" standards and suitable for use for 1Gbits/sec Ethernet shall be provided between the wireless internet router defined in N124 and the access point defined in N125 in each IEP vehicle.

In addition to the above, a cable route with no bend radii less than 10cm shall be identified to allow a cable between the access point defined in N125 and each of the antennas defined in N126 to be easily installed.

N131 Where IEP trains are fitted with a crew office, provision shall be made in each crew office for a crew interface to the Wireless Internet Access system. This shall as a minimum include:

- The provision of space in a 19" rack. As a minimum a height of 6U, a depth of 300mm and a weight of 10kg must be accommodated;

D

- The provision of a power supply of up to 1A at 110V DC which is not subject to interruption whilst the IEP Train is carrying passengers; and
- The provision of two cables meeting EIA/TIA "Cat5e" standards and suitable for use for 1Gbits/sec Ethernet between the wireless internet router defined in N124 and the space provided in the 19" rack for the crew interface.

5.4 EPOS Equipment

N132 In each location where level 1, level 2 or level 3 catering is provided (please refer to section 6.2.6), provision shall be made for an Electronic Point of Sale (EPOS) system which is to be fitted by the Relevant Operator. This shall include provision for the following:

D

- EPOS Server;
- EPOS Printer; and
- EPOS Display

N133 IEP Units shall include the following provision for the EPOS server in each catering facility fitted on the IEP Unit:

- The provision of space in a 19" rack. As a minimum a height of 5U, a depth of 500mm and a weight of 15kg must be accommodated;

D

- The provision of a power supply of up to 1A at 110V DC which is not subject to interruption whilst the IEP Train is carrying passengers and is powered, so far as is

practically possible, at all times; and

- The provision of two cables meeting EIA/TIA “Cat5e” standards and suitable for use for 100Mbits/sec Ethernet between the wireless internet router defined in N124 and the space provided in the 19” rack for the EPOS system.

N134 IEP Units shall include the following provision for the EPOS printer in each catering facility fitted on the IEP Unit:

- The provision of space to accommodate the printer of approximately 200mm (high) x 200mm (wide) x 400mm (deep) and 8kg in weight, conveniently located so as to allow catering staff to remove printed material and replenish paper by accessing the top of the printer; D
- The provision of a power supply of up to 1A at 110V DC which is not subject to interruption whilst the IEP Train is carrying passengers and is powered, so far as is practically possible, at all times; and
- The provision of a cable route between the printer and the server. The cable route shall be no greater than 4 metres in length.

N135 IEP Units shall include the following provision for the EPOS display in each catering facility fitted on the IEP Unit:

- The provision of mounting surface which can be drilled to accept a bracket to support the EPOS display of approximately 5kg in weight and approximately 400mm (high) x 400mm (wide) x 80mm (deep), conveniently located so as to allow catering staff to view and touch the display whilst not obstructing their work in the catering facility; and D
- The provision of a power supply of up to 1A at 110V DC which is not subject to interruption whilst the IEP Train is carrying passengers and is powered, so far as is practically possible, at all times.

The provision of a cable route between the display and the server. The cable route shall be no greater than 4 metres in length.

5.5 Livery

TS324 The livery of the IEP Trains must be capable of being customised for each franchise deployment. D

6 Passenger Environment

6.1 Train Interior and Elements

TS1508 The IEP Train interior must be made up from a number of “building blocks” as listed below. These “blocks” must be capable of being combined together in different combinations to produce a range of different interior arrangements. D

- entrance areas;
- litter collection;
- seated areas;

- toilets;
- luggage storage;
- catering;
- interior partition doors;
- interior information and frames to hold advertising; and
- crew office.

TS1552 Further elements or an alternative "building block" structure may be proposed, provided that the minimum elements listed in TS1508 are accommodated. D

TS1553 The interior elements must follow a common style which when combined as an interior layout shall present a cohesive overall interior style in accordance with the Design Vision Style Guide. The required interior style must be defined by the TSP and shall be subject to approval by the Secretary of State. D

TS1554 The interior of the IEP Train must accommodate a range of features that complement its overall ambience. The following features shall be included and additional items may be proposed to form part of the interior design solutions. D

- carpets / floor covering appropriate to interior area; and
- magazine/newspaper racks.

6.2 Interior Element Requirements

6.2.1 Entrance Area

TS1556 The area between entrance doorways and seating must be able to act as a buffer area where passengers may gather whilst they wait for the opportunity to alight or move to seats. D

TS1557 The area may also be used as a waiting or conversation area. Its ambience must be welcoming and not utilitarian, but must take account of the high traffic level through it and consequent potential for high wear and tear. D

TS1558 The area must have a facility for the display of items such as maps, notices and tariffs to the choice of each Relevant Operator. This provision is in addition to statutory and functional signage. D

6.2.2 Litter Collection

TS1559 The collection of litter within the IEP Vehicle interior shall be considered in the interior design. IEP Vehicles must include a range of litter bin solutions, which shall meet the following requirements;

- litter bins shall be fitted in entrance areas;
- litter bins shall be fitted in the saloon where this does not conflict with the requirement to provide seating or the minimum specified luggage storage (refer to section 6.2.4 and Annex D); D
- the litter bins shall be as large as possible, with a minimum capacity of 36 litres for a single bin, and ensure their contents are securely contained, preventing escape of odours into the surrounding areas;
- it shall be possible to remove the bin liner and its contents safely and easily without

the use of special tools other than a key; and

- the range of litter bin solutions shall include the option to provide a means for passengers to segregate different litter types so as to facilitate recycling.

6.2.3 Seated Areas

TS1560 A range of solutions must be provided for seating areas, which will provide a style and density of seating to suit the requirements of the service for both Standard and First class. Each solution must allow for applications where passenger saloon space may vary in length depending on the other amenities selected for each IEP Vehicle. D

TS1509 The seat arrangements must, as a minimum, accommodate the User Population.

The following factors must be considered for the seat arrangements;

- seat spacing - the distance between the base of the seat back and the front of the knees (the “knee space”);
- seat pitch - the distance between the same points on successive seats; D
- seat width;
- seat access/egress;
- the overall personal space available to each passenger when seated; and
- the activities that passengers may reasonably undertake when seated.

TS1511 At each seat position, the following features must be accommodated. Each of these features must be capable of being incorporated or not as required for each deployment of IEP Trains (different features may be incorporated for different classes in the same deployment);

- seat recline feature (on first class seats only);
- magazine, menu or information holder;
- seat headrest anti-macassar fitment;
- support of passenger arms when seated; D
- use and support of laptops;
- use and support of cups, meal plates and utensils;
- sufficient lighting level to be allow reading when seated
- coat hooks; and
- sun shading.

N039 The range of seating arrangements must include 2+2 seating, suitable for standard class passengers, in both bay and unidirectional forms. D

N040 The range of seating arrangements must include 2+1 seating, suitable for first class passengers, in both bay and unidirectional forms. D

N041 The seating arrangements within the IEP Train must be capable of being selected so as to give any desired ratio between first and standard class, and between bay and unidirectional, seating. D

N042 The seat pitch for both bay and unidirectional seating must be capable of being selected so as to allow the seating density to be adjusted to optimise the balance between adequate seating capacity and space for seated passengers. D

TS1512 A means of providing power to passenger's low power electrical devices (laptops & mobile phones) must be provided.

Each seat must be adjacent to a socket with a minimum of one socket per two seats. Where bay tables are provided, the facing rows must each be provided with a minimum of one socket. D

A socket must be provided adjacent to each wheelchair position.

In addition to the minimum requirement above, it must be possible to provide a socket per seat in first class accommodation if required.

6.2.4 Luggage Stowage

TS1265 IEP Vehicles must incorporate a range of luggage stowage solutions. Each solution must ensure that the luggage is securely and safely stowed. The solution design must facilitate the ease of loading and unloading the luggage for the User Population. D

TS1664 Luggage stowage solutions must maximise the ability of passengers to view their luggage while seated to address their concerns about the security of their luggage. D

TS1665 Luggage stowage solutions must ensure that items cannot be concealed and that their presence can be easily identified by train crew. D

TS1666 Luggage stowage solutions and their application must ensure that the following additional factors are achieved;

- minimise the use of interior space and hence maximise the available seating capacity;
- maximise the available luggage stowage capacity within the available interior space;
- minimise station dwell times though suitable design and location; and
- shall not obstruct the movement of passengers or train crew during normal or emergency service conditions.

D

TS1667 The range of luggage stowage solutions must accommodate the following luggage types;

Luggage Type	**Size & Definition**
Small Bag	300x345x420mm
Large Bag	800x570x300 mm
Bicycle	Full size 'road' bicycle with 25inch frame
Pushchair	Full size single foldable pushchair 950x500x300mm (folded)

D

N083 Provision must be made for an excess luggage storage area which, as a minimum, is capable of accommodating two bicycles or luggage up to a minimum total volume of $2m^3$. D

N043 Provision must be made for the storage of a Small Bag (as defined in TS1667) for each seated passenger, within 1.5m of the seat. D

N044 The IEP Train must be capable of being configured with different levels of provision for larger luggage, allowing the balance between luggage provision and other interior features to be varied. D

6.2.5 Toilets

TS1282 The passenger carrying IEP Vehicles must be capable of accepting both Space Saver Toilet systems and Universal Access Toilet systems in the following configurations:

- Intermediate IEP Vehicles shall be capable of accepting one Space Saver Toilet or two Space Saver Toilets; and
- Driving IEP Vehicles with passenger accommodation shall be capable of accepting one Universal Access Toilet.

D

TS1671 All toilet modules, irrespective of quantity or type, must operate as intended throughout the IEP Train's entire daily duty cycle. Designs shall conserve the use of and minimise the misuse of, consumables, without impeding the performance of the system.

D

TS1672 Both Space Saver Toilets and Universal Access Toilets must be compliant with the Trans-European Conventional and High-Speed Rail System Technical Specification for Interoperability – Scope: Subsystems Infrastructure and Rolling Stock – Aspect: Accessibility for Persons with Reduced Mobility'. In addition the passageway and doorways between the wheelchair space and the Universal Access Toilet must not be less than 850 millimetres wide at any point and provide a space adjacent to that toilet for the disabled person in the reference wheelchair to turn the wheelchair around through one hundred and eighty degrees.

D
R

TS1673 Both Space Saver Toilets and Universal Access Toilets must include hand washing and drying facilities, a mirror, and a means of retaining personal possessions (e.g. coat, handbag etc) while using the toilet. The hand washing facility must utilise hot water. These facilities must be positioned at appropriate heights and locations in both the Space Saver Toilets and the Universal Access Toilets with respect to the User Population (which shall include persons with reduced mobility).

D

TS1862 Further facilities to suit a range of other user amenities must be included in the toilet solutions, including:

- a nappy changing table (this is optional on Space Saver Toilets);
- a litter bin; and
- a sanitary waste bin.

D

TS1674 In the case of an emergency, the toilet's access door, for both Space Saver Toilets and Universal Access Toilets, must be capable of being overridden and opened by train crew when in its 'locked' state. This must also still be possible with an incapacitated passenger behind the door. The overriding device must be tamper resistant.

D

TS1675 The toilet system shall limit the presence of odours within the toilet cubicle and prevent their escape into surrounding passenger areas including vestibules when the toilet door is closed. The passenger saloon must be free from toilet odours at all times.

D

TS1676 A toilet module must be capable of being removed and replaced by other interior features, without the need for major structural changes. Likewise the installation of one or two toilets must be possible, up to the limits in TS1282.

D

TS1863 Toilet waste retention tanks must be sited in the underframe area of the IEP Vehicle, to facilitate ease of cleaning if required.

D

6.2.6 Catering

TS1630 IEP Trains must be capable of providing a range of catering services. The catering solutions provided must be capable of providing catering services at four levels:

- Level 1 - Full restaurant service or at seat first class service with meals cooked on board;
- Level 2 - Servery that provides hot and cold snacks and drinks which may be delivered by either of the following methods: D
  - an at seat first class service together with the replenishment of trolleys for standard class service without the provision of a Café-Bar counter service; or
  - the replenishment of trolleys and the provision of a Café-Bar counter service combined together;
- Level 3 - Hot and cold snacks and drinks through a 'Café-Bar' style outlet; and
- Level 4 - A trolley service.

TS1631 For any one application of IEP Trains it must be possible to select any of these catering solutions. The range of potential combinations (A to H) of IEP catering services for any one IEP Train are described in table 1 below:

Catering Facility Combinations	Level 1	Level 2	Level 3	Level 4
A	✓		✓	✓
B	✓		✓	
C	✓			✓
D		✓		✓
E		✓		
F			✓	✓
G			✓	
H				✓

D

TS1632 Catering solutions must allow catering areas to be adapted to meet changing services and demand. To meet this requirement the following is required; a flexible arrangement for the accommodation of cooking equipment, power and water services, environment control, food preparation, refrigerated and ambient storage and waste handling. D

TS1633 The catering solutions must be capable of servicing the following minimum capacity of services:

- Level 1: On-board kitchen to be equipped to deliver 100 full cooked breakfasts and a further 70 lighter breakfasts, or 100 luncheons or dinners within a two-hour journey time. (Examples: Mk4 Mallard, Virgin Pendolino).
- Level 2 (Servery) and Level 3 (Café-Bar): capacity shall permit storage, preparation and sale of goods to a scale typical of a two and a half hour journey time. The facility shall be equipped to deliver up to 250 hot and cold snacks and for the replenishment of trolleys when combined together. D
- Level 4: Trolley capacity shall permit the storage of saleable goods and the ability to vend cold snacks and hot and cold drinks as required. The overall capacity shall allow up to 100 separate sales/transactions to be performed; the service shall be capable of making a single pass through the vehicles/service without the need to replenish its stock. Facilities for the replenishment of hot water shall be provided independently of any other catering provision.

TS1634 Catering facilities must minimise the use of Furnishable Space, without compromising safety or functionality, and will be compatible with the building block principle for the selection of interior layouts appropriate to each franchise operation. D

TS1635 The construction of the catering facilities should use durable, stain resistant and approved materials that are easily cleaned and maintained to applicable laws and standards relating to food hygiene. D

TS1636 Suitable security measures must be provided to ensure safety of the staff, takings, stock, equipment and prevent unauthorised access into catering areas. D

TS1637 The design of catering trolleys and IEP Vehicle interiors shall be co-ordinated to, so far as is reasonably practicable, ensure damage to interior components is avoided while using the trolley, taking into account that the interior design shall be developed through the "Progressive Design Assurance" process specified in Paragraph 9 of appendix D to Schedule 1 of the MARA D

6.2.7 Interior Partition Doors

TS1598 IEP Vehicles must allow the fitting of interior partition doors within the IEP Vehicle interior at a range of positions to allow for different interior layouts. D

6.2.8 Interior Information and Advert System

TS1934 IEP Vehicles must allow the installation of interior information and advertising display material. D

6.2.9 Crew Office

TS1781 IEP Vehicles must allow the fitting of a crew office for carrying out customer liaison tasks if required. This facility must have access to all functions as specified in TS1563 (section 7.2), together with storage for printed items. Provision must be made to allow the fitment of such a crew office to any Intermediate IEP Vehicle as part of the selection of interior elements. The crew office must be sized to allow a minimum of one train crew to be accommodated. D

6.3 Interior Customisable Features

TS1536 IEP Vehicles must allow for a menu of customisation measures, for application at franchise change or redeployment. These measures are separate from the main building block interior elements, although the configuration of the latter may influence the scope and nature of customisation. D

TS1537 IEP Vehicles must allow the following minimum customisation:

- interior colours (including handrails, for contrast);
- trim materials;
- soft furnishings;
- seat types, quantities and pitch;
- toilet/passenger ratio;
- First Class/Standard Class ratio;

D

- luggage capacity ratio;
- replace a catering area with another of the other catering options of a lower catering level as per TS1630; and
- replace a catering area with seating.

TS1539 The above customisation must be possible without alteration to load bearing structures and must not dictate the need for bodyshell variations. D

6.4 Interior Scenario Definition

TS1038 IEP Trains must be able to support a range of service requirements.

Please refer to Annex D for the specific requirements for the interior configurations of IEP Trains. D

6.5 Signage

TS1374 IEP Vehicle data must be displayed in accordance with Railway Group Standard GM/RT2459, Issue 1, December 2000, 'Data to be displayed on Rail Vehicles'. D

TS1678 Safety and emergency signage must have priority over all other bespoke signs (for example, posters, advertisements and promotions) Bespoke signage must not interfere with, distract from, or contradict safety and emergency signage and must be secured in a manner that allows its successful removal without specialised techniques, significant effort, or damaging the attachment surface(s). D

TS1679 All signage must be, as far as practicable, resistant to forced removal and deliberate defacing activities. D

TS1865 A range of additional signs must be capable of being applied as agreed with the Relevant Operator. D

TS1866 Signs must be capable of being removed if required without damaging the substrate, using a method specified by the TSP. D

6.6 Security & Resistance to Vandalism

6.6.1 Vehicle Security

N080 The IEP Train must be fitted with a suitable range of locks to protect specific areas of the IEP Train from unauthorised access. This range must include locks making use of standard keys (for example, the "BR driver's key" and the "square key") together with more secure locks using keys specific to the IEP Train. It must be possible to implement a hierarchical key strategy with a range of keys at different levels giving access to different areas of the IEP Train. D

TS1640 The IEP Vehicle's doors must be capable of being locked out of use to secure against unauthorised entry; suitable tamper resistant designs and mechanisms must be incorporated. Particular attention must be paid to the catering IEP Vehicle's security and stock storage areas. D

TS1641 The IEP Vehicle's systems must be protected from unauthorised access or tampering and therefore suitable tamper resistant designs and mechanisms must be incorporated. D

TS1642 As far as practicable, all fasteners in passenger areas must be concealed. Any visible fasteners inside the IEP Vehicles shall require special tooling. D

TS1643 All equipment cupboards, cubicles or lockers must be protected with suitable tamper resistant locking mechanisms. D

6.6.2 Vandalism and Misuse

TS1644 The IEP Vehicle's exterior surfaces, exterior fittings and interior fittings must to the extent reasonably practicable resist damage from the following:

- foreseeable vandalism, accidental damage and misuse;
- scuffing or abrasion damage from contact with wheelchairs, passenger luggage, catering trolleys, catering modules, or other foreseeable items; and
- damage caused by cigarettes or other smoking materials.

in meeting the above requirement, due consideration may be given to:

- the reasonably anticipated operating environment; D
- the deployment of the IEP Units;
- the benefits of being able to effect any necessary repairs quickly and cost effectively;
- the Design Vision Style Guide;
- the requirements of the PRM-TSI;
- mandatory crashworthiness requirements; and
- all other requirements of this Appendix A.

TS1647 Gaps and crevices in the IEP Vehicle's interior where litter, sharp objects such as needles or cigarette ends or any other items could be concealed or lodged must, where reasonably practicable, be eliminated. If this is not possible the gap between adjacent interior panels (excluding any gap between passenger operated doors and their surroundings) must be approximately 3mm, with no gaps being less than 1mm and no gaps being greater than 5mm. D

TS1648 Any soft furnishings must be reasonably resistant to damage and be easy and economical to replace when necessary. D

TS1649 The interior bodyside windows and glazed surfaces must incorporate a means to mitigate damage as a result of vandalism by etching or scratching. D

6.6.3 Graffiti Removal

TS1650 The internal and external finishes must where reasonably practicable facilitate the removal of graffiti and not readily degrade as a result of the removal process. D T

6.7 Cleanability

6.7.1 Interior Cleaning

TS1652 The interior design and styling must enable effective and efficient cleaning using normal railway and industrial cleaning methods and equipment. In particular flooring areas must avoid crevices, abrupt changes of section and intrusive internal features to avoid the accumulation of dirt and debris and to aid the cleaning process. D

TS1653 Panelling and other surfaces must be durable, smooth, stain resistant and easy to wipe clean after normal soiling. D

TS1654 Panelling, floor covering (entrance mats & carpets) and seating items (cushions, covers and squabs) must be capable of been easily replaced when heavily soiled or deemed necessary. D

TS1655 Ventilation and extraction ducts/grills, and other such features, must be accessible and readily cleaned using standard cleaning equipment. D

TS1656 The interior finishes must be capable of withstanding the effect of detergents and abrasive materials used in the cleaning process and must not degrade as a result of the persistent use of such cleaning method. This shall include no loss or change in texture or colour of the interior finishes. D

TS1868 All areas of the IEP Vehicle interior must be capable of being cleaned. D

6.7.2 Exterior Cleaning

TS1657 The IEP Vehicle's overall exterior length, width and body styling must allow effective automatic cleaning or washing. D

TS1658 The IEP Vehicle's exterior must be designed such that, as far as practicable, it does not contain crevices or abrupt changes of section, to avoid the accumulation of dirt. D

7 Crew Environment

7.1 Cab

TS1405 The driver's cab shall incorporate the following functionality over and above the mandatory requirements contained in the TSI;

- the second person's seat inside the cab shall be positioned so that it is possible for a second person to:
  - adequately view the line ahead, including signals and signage, through the part of the windscreen swept by the windscreen wipers; D T
  - when on straight track, view, through the part of the windscreen swept by the windscreen wipers, the portion of both running rails that are any distance greater than 10m from the front of the IEP train;
  - when on straight track, view, through the part of the windscreen swept by the windscreen wipers, all signals located more than 10m from the front of the train providing that they are located to the left of the right hand running rail;

- monitor critical cab desk instruments and controls (for example, the speedometer and the power / brake controller); and
- monitor the behaviour and performance of the driver; and

- it must be possible for the second person to be able to operate an emergency brake control while seated.

7.2 Crew Areas

TS1562 IEP Trains must accommodate the operational equipment and personal effects for the train crew appropriate to the service. D

TS1563 Interfaces with the PA system, the PIS, CCTV, seat reservations, and the TMS must all be available together at a designated area secure from passengers. D

N153 An interface to allow the passenger WiFi system on that IEP Vehicle to be reset (e.g. by interrupting and restoring the power to the system) shall be provided on each IEP Vehicle. D

7.3 Driver Egress

TS1996 To facilitate driver egress the design of the IEP Train must take cognisance of walkways provided for existing Network Rail line side equipment such as signal post telephones and plungers that require driver interaction. The IEP Train shall be designed such that the longitudinal distance of the centre line of the driver's door from the front face of the coupler is no greater than 5 metres. D

7.4 Emergency Equipment

TS335 IEP Vehicles must carry all necessary emergency equipment required for the service route and operation. The exact scope of this equipment shall be established in conjunction with the Secretary of State. D

TS1685 Emergency equipment must, as a minimum, comprise the following:

- all emergency and safety equipment, required by Railway Group Standard GM/RT2130 Issue 2, 'Vehicle Fire, Safety and Evacuation' and Railway Group Standard GM/RC2532 Issue 1, "Recommendations for Rail Vehicle Emergency and Safety Equipment";
- First Aid equipment shall be provided within all train crew areas (cab, office, catering) in accordance with the requirements of GM/RC2532 Issue 1, "Recommendations for Rail Vehicle Emergency and Safety Equipment";
- "Other equipment" as detailed within Appendix A.2 of GM/RC2532 Issue 1, "Recommendations for Rail Vehicle Emergency and Safety Equipment", where demonstrated as being required by the Relevant Operator; D
- equipment for the verification of axlebox temperatures following a hot axlebox indication;
- a method of providing ventilation on each IEP Vehicle when the IEP Train is stationary and the HVAC system can no longer maintain an acceptable interior environment;
- foil blankets - quantities equal to 65% of passenger capacity;

- high visibility jackets (2 per passenger IEP Vehicle), stored in each IEP Vehicle;
- light sticks (5 per passenger IEP Vehicle), stored in each IEP Vehicle;
- ability to store bottled water. Quantities based upon a 330ml bottle for each of 75% of seated passenger capacity;
- ability to store a DNA “Spit Kit”;
- ability to store a Bio-Hazard body fluid kit for on train incidents;
- ability to store additional first aid material (in addition to mandatory requirements) for addressing minor cuts, minor burns and sprains. Required storage space of 290x130x50mm; available within each catering facility and crew office;
- ability to store emergency forms and lists - For issuing information and traceability of passengers and crew. Required storage space of 750 sheets of A5 paper in pad form; at a single location;
- ability to store a Network Rail Mobile Operations Manager (MOM) box of approximately 600x600x410mm; and
- ability to store a megaphone.

TS1686 IEP Vehicles must incorporate the secure storage of all emergency equipment. The following are to be considered in the design of emergency equipment stowage;

- where applicable, emergency equipment and supplies must be located in a common stowage facility that affords sufficient capacity to store the items securely and safely;
- the accessibility of the emergency equipment;
- the main storage facilities shall be accessed by the train crew only and incorporate a tamper proof marking system to ensure their contents can not be disturbed without this being apparent to train crew; and
- the main storage facilities shall be in close proximity to the cabs. Emergency equipment deemed accessible and useable by passengers will be appropriately situated throughout the train.

D

Annex A Kinematic Envelope Data

Please refer to the following attached files:

Filename	File Size	SHA256 Checksum
Annex A - KE Data\IEP Driving Pantograph Trailer Car\DPT-BOG.MCO	595	a6a4b0991fc9292d55e67fdbd7c2b4e3bbd6f5b47fa7f9c1244532e972e9faff
Annex A - KE Data\IEP Driving Pantograph Trailer Car\DPT-Bog MSK	299	45fc76975e72dfa8d8049cfd9df87652779efc19dee56dcd53adf0b855ce8848
Annex A - KE Data\IEP Driving Pantograph Trailer Car\DPT-C.MCO	595	89881bb1a505f871ba1dd22402125f1f774b5745bc6c54a991bf21662ff3ffbd
Annex A - KE Data\IEP Driving Pantograph Trailer Car\DPT-C.MSK	299	851799ea131370b3aec6c81e736dcb936f3c65dbae400b2d6a66a9f789e3dc37
Annex A - KE Data\IEP Driving Pantograph Trailer Car\DPT-E.MCO	515	997df19f704b5c1dfb10c8b2ade29f72c25c64da77409b34e6a0ad6d4221658c
Annex A - KE Data\IEP Driving Pantograph Trailer Car\DPT-E.MSK	299	91624990161c0201c0f3fdd57c8ec071c7c601dff842fc74ca269651baf7e7d2
Annex A - KE Data\IEP Driving Pantograph Trailer Car\DPT-EOT.MCO	715	ab461b00ff2c8f93c6a610f6724b91272a94edfb02044fbba0d89efd7de8e10a
Annex A - KE Data\IEP Driving Pantograph Trailer Car\DPT-EoT MSK	315	b84b4d635e282b01db440a9b1ef44e2b35d7d15c6797d2ee637e460a7caa08e1
Annex A - KE Data\IEP Driving Pantograph Trailer Car\DPT-F MCO	83	e4594749661fa0fbb49d6ecf23cb14ba060c042a91a022b6a0ac6b2ca5506981
Annex A - KE Data\IEP Driving Pantograph Trailer Car\DPT-FC.MCO	91	40f5841b25ffdbb081c4f7ebfe622068934495db97ec837b11d1daabba3ea702
Annex A - KE Data\IEP Driving Pantograph Trailer Car\DPT-FFC.MSK	299	dc33265d2a32ad2ee915ddfc9b7d6092ee9913bc2316b51fc794596089d61c71
Annex A - KE Data\IEP Driving Pantograph Trailer Car\DPT-FFI.MCO	595	0c998c24e4b3aa859879c60784c6637c1c4e1d48f84f35d1581ff733adce49d8
Annex A - KE Data\IEP Driving Pantograph Trailer Car\DPT-FFI.MSK	315	f22e22e83291eedb7f5d56a6736db4038c8484d0911dffdff49fb328005f18d0
Annex A - KE Data\IEP Driving Pantograph Trailer Car\DPT-FFIB.MSK	331	f13772815dc8c8eda12db641d0167603f1b0053107aad695e135046b08bd928b
Annex A - KE Data\IEP Driving Pantograph Trailer Car\DPT-FFO MSK	299	04653bf5511bfed40e70fd9a238372d5070ed1080f2a343d9972674dc007d65a
Annex A - KE Data\IEP Driving Pantograph Trailer Car\DPT-P.MCO	267	c767a5c45a93aef58a4801b9f34d06f5acdbe656994ab75e55af5ccaa90de680
Annex A - KE Data\IEP Driving Pantograph Trailer Car\DPT-P.MSK	299	1457d85f579a9bfa24e570208c4a6aa9460179349d18dba4dde08c73ec0d3fb4
Annex A - KE Data\IEP Driving Pantograph Trailer Car\DPT-RFC.MSK	299	ea0910a1c2ff5236ce73e83f5469efebfe1a2b0e74131f78aa6d0750d9b5d806
Annex A - KE Data\IEP Driving Pantograph Trailer Car\DPT-RFI.MSK	299	855227b7fde4ecfbf55f5684cdaba7204aeedc84e7fc8118f104c5c25efe644b
Annex A - KE Data\IEP Driving Pantograph Trailer Car\DPT-RFO.MSK	299	511c923341d8289617a7591ee9986c35a087fe06691c1e8e2152f70f5de99bcd
Annex A - KE Data\IEP Driving Pantograph Trailer Car\DPT.MKE	432	022619f18169236037f443f421694ad831627fff6125e0ecc05130861ed8593e
Annex A - KE Data\IEP Driving Pantograph Trailer Car\DPT.MSV	251	6d560ebaa510ed6a9cffd87c52e349edec037671441292b38bc50d74f73eb12c
Annex A - KE Data\IEP Driving Pantograph Trailer Car\HIEP.BMP	40430	0a84bbacdc4b86788bd38bd8af5d986d030a67d729edb44de9e18ca1573b642c
Annex A - KE Data\IEP Driving Pantograph Trailer Car\HIT05DPT.G01	731	dee51cdc04f7ca960adfb4a5aad4e60b509702ef268854402a93b3c86621b25a
Annex A - KE Data\IEP Driving Pantograph Trailer Car\HIT05DPT.G02	731	7e3220413f6b1f0f486c58a5224b27f7620e7f7629f69d077d46fe32d7cbdbb3
Annex A - KE Data\IEP Driving Pantograph Trailer Car\HIT05DPT.G03	731	838a4236cae2efe6cefaa544aa2632166fd44eafbe26d7b957c247b99a2e30ab
Annex A - KE Data\IEP Driving Pantograph Trailer Car\HIT05DPT.G04	731	8901a10ac07762bf966739e9108b4f18121125490f70217ad0528f7c2a36a5bd
Annex A - KE Data\IEP Driving Pantograph Trailer Car\HIT05DPT.T11	2595	dddba6bb7d2b4da287277d11eef06c1f549b4d57e03b9e72b9ce44cbc4a722d8
Annex A - KE Data\IEP Driving Pantograph Trailer Car\HIT05DPT.T12	2587	c46900058da013311701298fbc60338fb9b90dd6b2fe22f44c5cc46cafe9dbb9
Annex A - KE Data\IEP Driving Pantograph Trailer Car\HIT05DPT.T13	2587	3f67d343f96d17e0d02cc7164edc878f204b5b675458dd6a257c6f7977e21134
Annex A - KE Data\IEP Driving Pantograph Trailer Car\HIT05DPT.T14	2587	200a0d06542ff99c49657d1975fa5ce9eb8dffb4faa24806c4de26d06047b804
Annex A - KE Data\IEP Driving Pantograph Trailer Car\HIT05DPT.T15	2595	e26d98cac838576ef6b2abfd2abceee05215b2e07ab2799f0f249fc725c2188c
Annex A - KE Data\IEP Driving Pantograph Trailer Car\HIT05DPT.T16	2587	7b3992f85ca30bd1f5b23b21ac9f4bfdb52cb0889a545509a7c7b590887c0819
Annex A - KE Data\IEP Driving Pantograph Trailer Car\HIT05DPT.T17	2587	4e18fa3d79eccd03b9513d26245fff158c8ae9194fbd2b58e23af202cfb0160b
Annex A - KE Data\IEP Driving Pantograph Trailer Car\HIT05DPT.T18	2587	5c2ddd23c7be90b1167ab458028b897b2b57a9cd781fa8756e95f0beada7f0ff
Annex A - KE Data\IEP Driving Pantograph Trailer Car\HIT05DPT.T21	2587	58268eaff164774e9e9fdbb0aedc88a11634640ce09a21d8448228c5b2323436
Annex A - KE Data\IEP Driving Pantograph Trailer Car\HIT05DPT.T22	2587	04c99f6d552dbcb8d35cce26cdc39cfb711a35a8ed77a184f291907db90228e2
Annex A - KE Data\IEP Driving Pantograph Trailer Car\HIT05DPT.T23	2587	d175f24d087f793784b2ee7386a56b3236f7ac7190c9beb51c65c51283ca8023
Annex A - KE Data\IEP Driving Pantograph Trailer Car\HIT05DPT.T24	2595	c0363985be8a61cedccb89767c3988ffa3695b7e6d83972ada794577a931588e
Annex A - KE Data\IEP Driving Pantograph Trailer Car\HIT05DPT.T25	2587	589fd63e3d19e8b199f2006d99e0742dc7f15b3bdba538d9fbe6a0563f445766
Annex A - KE Data\IEP Driving Pantograph Trailer Car\HIT05DPT.T26	2587	dc7cc0138012f862ca98e8b19a0f5701772228d6b33436ce8e618f236e736496
Annex A - KE Data\IEP Driving Pantograph Trailer Car\HIT05DPT.T27	2587	b93dee33e448e55beb446053e78522c4bf2a4d853d0dddee52fd01ac360a0c37
Annex A - KE Data\IEP Driving Pantograph Trailer Car\HIT05DPT.T28	2595	016852d1b0c8c14d854f4315366dd2271c57f863b91a6cf6e5ed466e11a89bd9
Annex A - KE Data\IEP Driving Pantograph Trailer Car\HIT05DPT.T31	2587	65947ef4067f004f4ad26eff2de077ce14c4f6eda7e87764bfe24e547d445c8c
Annex A - KE Data\IEP Driving Pantograph Trailer Car\HIT05DPT.T32	2603	6adcae32db295ee61e90e961bebc71b08ffff96e4fb400e2b259ba99fc7ef33a
Annex A - KE Data\IEP Driving Pantograph Trailer Car\HIT05DPT.T33	2587	e4ef823b85307b1332fbbb3ddf0169d3627aa2b4b9ac2151ab90e99156986f06
Annex A - KE Data\IEP Driving Pantograph Trailer Car\HIT05DPT.T34	2587	3c00ff35ccea8c5e6d0a7801b2a8ae9100d971ecc25bb49187380e2b140a1e26
Annex A - KE Data\IEP Driving Pantograph Trailer Car\HIT05DPT.T35	2587	9f8b73df3ac89287765aa0c308805a30268ec412f8174e94680a594ed53f9e69
Annex A - KE Data\IEP Driving Pantograph Trailer Car\HIT05DPT.T36	2603	fe9d62e48cffb6afe78584ffd4b9eec26834443b7a9951cffbef01de0d1b0841
Annex A - KE Data\IEP Driving Pantograph Trailer Car\HIT05DPT.T37	2587	eb38ec79eb8e818ff76dc137efc1a1d33836ad08bff3ba5aca5ea88d80e84dc2
Annex A - KE Data\IEP Driving Pantograph Trailer Car\HIT05DPT.T38	2587	b185e1595d9d32d95497a919167b7dd6f37823e85326c7296c51ca5d5aaae079
Annex A - KE Data\IEP Driving Pantograph Trailer Car\HIT05DPT.T41	2587	27781528fefb2a45d664567cdf8a58f1c45e4071594730836ae38d5002b551e0
Annex A - KE Data\IEP Driving Pantograph Trailer Car\HIT05DPT.T42	2587	2da0d920892de887bedab720bd01d0e253c97ba9e2dbb90b5ec8fabd75cf59dc
Annex A - KE Data\IEP Driving Pantograph Trailer Car\HIT05DPT.T43	2579	a3ce912ba9584e8b2c76d88c5c5d0848e7a1581c33030b47349e553f062217c4
Annex A - KE Data\IEP Driving Pantograph Trailer Car\HIT05DPT.T44	2587	7a6e68c22556cbf32b273911242aff2705045aa931d61681bec85809f8ec9612
Annex A - KE Data\IEP Driving Pantograph Trailer Car\HIT05DPT.T45	2587	8ecd2a8aca87ab693267d82f610254818ff66c9aa9d225c23da20e9bcc6d1a8f
Annex A - KE Data\IEP Driving Pantograph Trailer Car\HIT05DPT.T46	2587	74e77fdf46e372508e62da5d6e2ff0dba79e7d43fbd1d1fb759792cf008858be
Annex A - KE Data\IEP Driving Pantograph Trailer Car\HIT05DPT.T47	2579	1a1a8d74ed725f0ae98c3cb251773e97c6b9bfaf3c659714ae61e0940ff36e53
Annex A - KE Data\IEP Driving Pantograph Trailer Car\HIT05DPT.T48	2587	8b7519d3d889cd606c81ee1317a7c38ce502bd6a96c52e181fd24544b195f95c
Annex A - KE Data\IEP Driving Pantograph Trailer Car\VLIB Hitachi IEP Driving Pantograph Trailer Car.MSS	24	8ea260ecf3233056a40d5a9b7ab1d2ce939373ecbc5bc1c5bb9cec266627f531
Annex A - KE Data\IEP Motor Car\H EP.BMP	40430	0a84bbacdc4b86788bd38bd8af5d986d030a67d729edb44de9e18ca1573b642c
Annex A - KE Data\IEP Motor Car\HIT05M.G01	723	c6a4d933345ab4d02f67fad5f60641cdd8bb878ae1c61d3afd98c3f1e55da43c
Annex A - KE Data\IEP Motor Car\HIT05M.G02	723	6f75f1e47de4e554eeed7270c1a533c51d6551234c8dea68ae3a87023f61a5a5
Annex A - KE Data\IEP Motor Car\HIT05M.G03	723	8d0558e2b7377813e19c00d7353e53ac5709762403f2f3446f7c29c5dc5f5416
Annex A - KE Data\IEP Motor Car\HIT05M.G04	731	fb0af64ebaa26ed4c09ee5d685d8149dd953920addeedf734728f63345273 57f
Annex A - KE Data\IEP Motor Car\HIT05M.T11	2595	b470c123f613c17fe3b48f8d44765634ddcfa8f19bfd2ea3b8d7a446b04ae8bc
Annex A - KE Data\IEP Motor Car\HIT05M.T12	2595	72accc3e1f7df2b3af9320ee789ddd379ab5534afe56cd0a11330482214b71d1
Annex A - KE Data\IEP Motor Car\HIT05M.T13	2587	33e78cbfc86485b944ee50c942dca7bc9b5c95d4cee92dc06ebc123ff9d27bf0
Annex A - KE Data\IEP Motor Car\HIT05M.T14	2587	087aca222d61b78fd9167a4ebe5393020a6fffe49de536810b031c7352677866
Annex A - KE Data\IEP Motor Car\HIT05M.T15	2595	6ae7f670d98204238282e87bccf6efc34f743fdafdb833ff9398da61a0e330a5
Annex A - KE Data\IEP Motor Car\HIT05M.T16	2595	d3e48307ccb6473c4afeca24100d37017775336bafcde67388cc7961e805edab
Annex A - KE Data\IEP Motor Car\HIT05M.T17	2587	b40d7739e2a130927d6d49c15cf07f5fc3613fdd41494b0b188176402c05109c
Annex A - KE Data\IEP Motor Car\HIT05M.T18	2587	7853777802504945 52d48719c115fe47fe5215c9b2d685f7af5fbf208f96f16f
Annex A - KE Data\IEP Motor Car\HIT05M.T21	2587	1142caf34e420ee37180815d7130eff139e338776550aaddf0c588f2cefd9aa6
Annex A - KE Data\IEP Motor Car\HIT05M.T22	2587	4cbddac1c0b270474d86fbe0a0f9aa80c46729246847fc2d588a8faa071a46ca
Annex A - KE Data\IEP Motor Car\HIT05M.T23	2587	a8c9d83173f013f5e0d350fdb39e0725d3841dd723ff3687b5ba7344ada3c5ae
Annex A - KE Data\IEP Motor Car\HIT05M.T24	2587	87054d6f1a2ee13b6b8bb61b1ac7c07f059ef184d670b7a16db8c7b5ca7f7246
Annex A - KE Data\IEP Motor Car\HIT05M.T25	2587	6f8044ab60548cdd013feb243f3e6807ad873f5bd056a3b0e942c3dadde62b4a
Annex A - KE Data\IEP Motor Car\HIT05M.T26	2587	b5a2acb3341931ce7428a1c259d5c4bc46f46182bae35e1bca54407a22406b4b
Annex A - KE Data\IEP Motor Car\HIT05M.T27	2587	4a834600b81187a253090297353c43eff8ededbaf7001168a5e4afea57da8a82
Annex A - KE Data\IEP Motor Car\HIT05M.T28	2587	15364825c06734399847a0817f06fed60eb983c9ca239967fb8de36df5a0d68c
Annex A - KE Data\IEP Motor Car\HIT05M.T31	2587	2d1087859d20716911d5511f0cc56f565cbc8e06081637ce4c4549ec1b0efb35

Annex A - KE Data\IEP Motor Car\HIT05M.T32	2587	aa2f2e55de1472e05b6c5d941bab6043accf0365618286c9e25d3ba1d08b68f1
Annex A - KE Data\IEP Motor Car\HIT05M.T33	2579	16792e4327d0fcdc5aa5132e501eb1733ef9965640896f898e934081ac5fb336
Annex A - KE Data\IEP Motor Car\HIT05M.T34	2595	973b321e29263372d47f88ac6879822803bc18d0e3ca6e9abcf40b7bf3233deb
Annex A - KE Data\IEP Motor Car\HIT05M.T35	2587	e79d5e219dd73b63338d5db4c3603f9b271d161bae69b7bdaa1a27f47f14c1f8b
Annex A - KE Data\IEP Motor Car\HIT05M.T36	2587	b4e1a48ab558ca2c5d72aa409218f532597e09ee3b0e06238ce0b21fb29d9579
Annex A - KE Data\IEP Motor Car\HIT05M.T37	2579	7a202e124ce0f208284bce1a9a431a9481464ef79efe5dc8e5221bce0debef7b
Annex A - KE Data\IEP Motor Car\HIT05M.T38	2595	33ea3dcca107112689ea6a0ff4c6d7865c31cfd2191111a4a7abc803cd00117a
Annex A - KE Data\IEP Motor Car\HIT05M.T41	2587	a4908519231090ac4bf2dfe7c7fd08b5bcb05ab9a7355c6c9d86c2f9690157a5
Annex A - KE Data\IEP Motor Car\HIT05M.T42	2587	27bf0ef88f1f1be4e8a18b7e47e7d405e9b0fc47af24be44b4bea204c3f1dda8
Annex A - KE Data\IEP Motor Car\HIT05M.T43	2587	b485cdc87e7c009b2bbe227e0c021e7f28ae49071c257eb7b8c45b7a2dcada8c
Annex A - KE Data\IEP Motor Car\HIT05M.T44	2595	7268dd26dae2a4cbfbf05d151102f91a85aba073ea31244566b999bec2b963f6
Annex A - KE Data\IEP Motor Car\HIT05M.T45	2587	2d18ff293b4f9f4be71c000334f3c6166c4e67ca47eb813109d7f8996b132241
Annex A - KE Data\IEP Motor Car\HIT05M.T46	2587	3f8de2ffd00140947d19ef22ffd6aba31f03e76e1566e2092730cf9ce0238b7f
Annex A - KE Data\IEP Motor Car\HIT05M.T47	2587	537bbbf04beae6f5de7e949a7927717463d7dda7e169a36633281a77cd714b72
Annex A - KE Data\IEP Motor Car\HIT05M.T48	2595	91fa3a56a12768e8bbc3bbbe162a7dcaee73315985910d188450abc2089695e0
Annex A - KE Data\IEP Motor Car\M-BOG.MCO	595	9e129ce6c048681f9f0bb46e647c9047344198d93bda3a2ee031212761ef270d
Annex A - KE Data\IEP Motor Car\M-Bog.MSK	283	92a1b1bd0a4eb31a8d0ba31a8ee04c74ce5858a5832ed3d42b3547de73645f00
Annex A - KE Data\IEP Motor Car\M-C.MCO	555	a3a2851cd83394d1be3271d87d1f624f4d54f3bdb27bb55b954de0960701bf97
Annex A - KE Data\IEP Motor Car\M-C.MSK	283	c1fcb26c08aa10bc93779474ebc80482ecf5c3a39c0f4b07549a5d9df07d78a9
Annex A - KE Data\IEP Motor Car\M-E.MCO	515	6db0161711b669f98c53488dcf3e12efd9381839b7c692a6da2c7ed84db90431
Annex A - KE Data\IEP Motor Car\M-E.MSK	283	d0db23c6896b16854c5d8736744c1477d3c075bbcf5868b04232425e2427a89d
Annex A - KE Data\IEP Motor Car\M-EOT MCO	579	082763efe2d38457e0ead70e43e343f5c9557d7fa630ad9094d8641d3ae05739
Annex A - KE Data\IEP Motor Car\M-EoT.MSK	299	e379d5d1eeeb41488db44aae43a2f4180029a5cd612579047d693bcd0246542b
Annex A - KE Data\IEP Motor Car\M-F.MCO	83	ccdb4b0d3b40ee0b95ba0a0644520dc2ee052bfb21973a1cbda4b8207d381da7
Annex A - KE Data\IEP Motor Car\M-FC.MCO	83	bab8a851c243098f01fe2e666d3b31a449755b8dfa7fb090005693eb61324527
Annex A - KE Data\IEP Motor Car\M-FC.MSK	275	db873c415ed5589f29c846b49967c491eda4e65fa9d9cc74ff1f6077791e9073
Annex A - KE Data\IEP Motor Car\M-FI MSK	275	78b24dd7e7b4bf588f400350196ee26513e5fed00b93ccdabe69ba358c2570a7
Annex A - KE Data\IEP Motor Car\M-FO.MCO	619	34ad3c2cc959eb902986a3fef54e9a144447d3bb732a3c047857f4fbac7e03a1
Annex A - KE Data\IEP Motor Car\M-FO MSK	291	5b8c048e2201415575bb842bcd50c69fa58033e66042fb690d83677c4286586f
Annex A - KE Data\IEP Motor Car\M-FOB MSK	307	bf81faf2455ce4f1ead5979301877929 43d76cfe2c466884d01296cf60641af6
Annex A - KE Data\IEP Motor Car\M.MKE	432	b02821e04b5c6490aaaa2c08d2feb0354370e2b43900fd29e782718b63337cd1
Annex A - KE Data\IEP Motor Car\M.MSV	155	21de78f61d89e67a94bb4e21e24d0c441b05da20bd4e227feb84826d3e5b12e5
Annex A - KE Data\IEP Motor Car\VL B Hitachi IEP Motor Car.MSS	22	00a1b6347f955084530c6195bdf438fd57dcf317a8a5279b7614d9b434623395
Annex A - KE Data\IEP Motor Generator Car\HIEP.BMP	40430	0a84bbacdc4b86788bd38bd8af5d986d030a67d729edb44de9e18ca1573b642c
Annex A - KE Data\IEP Motor Generator Car\HIT05Me.G01	723	2831d7e627dfab0b733fb0fd0a253111c840cc2cbd0669cbbd430d99a866fa08
Annex A - KE Data\IEP Motor Generator Car\HIT05Me.G02	723	11cdd1b4e9d8cca2361cbd42fe01c677eeff088ce8609eed9b57034b01c0a7ca
Annex A - KE Data\IEP Motor Generator Car\HIT05Me.G03	723	d240aa9112728396b69106d3ef9fb87e2bf594a342c432ae4189d83625d1ab6b
Annex A - KE Data\IEP Motor Generator Car\HIT05Me.G04	723	1b16a038fdd01989b5ab0f527edc596264bbe6f4906a91147bac9321c9051a88
Annex A - KE Data\IEP Motor Generator Car\HIT05Me.T11	2595	5ee662288e4ec4f3f1a7d1562a62bb5be4e3d1db867160fe4f482c0a3a597af5
Annex A - KE Data\IEP Motor Generator Car\HIT05Me.T12	2595	4e52c3ed0087f1490275ff0dc7a8042a8891d437983d5a60f2700be84eaab88c
Annex A - KE Data\IEP Motor Generator Car\HIT05Me.T13	2595	0570f95dc9a2ba2bd626ad584d6437c36759ef8f24f1766c32ccb9f290f8294f
Annex A - KE Data\IEP Motor Generator Car\HIT05Me.T14	2587	5acd2b2213ec4e3cff2327d13a361855c5f65c1c9c0d1951d4f9a10c2900f7e1
Annex A - KE Data\IEP Motor Generator Car\HIT05Me.T15	2595	c190926a149a1fff3f611bd163b39522b427635e8824abade4d968ef998eafcb
Annex A - KE Data\IEP Motor Generator Car\HIT05Me.T16	2595	bf7ab7b55c8b13d33fa3942f0940f51aaaaaf679478645b69c04bd4e9bd29c20
Annex A - KE Data\IEP Motor Generator Car\HIT05Me.T17	2595	5c0653ee5e9cf16b1b3a86c09dfd261c96018a80fa50604755b9cd9302ec44b6
Annex A - KE Data\IEP Motor Generator Car\HIT05Me.T18	2587	bffb8bab4a1123ee2cfe63519a00fcde55bd35cbd7e11c79b1d5a98f4fed14b5
Annex A - KE Data\IEP Motor Generator Car\HIT05Me.T21	2579	d7bfe2c29fdec4d66d1ebe89f798e2cef182341d7c804d32e29c7094ebe096d0
Annex A - KE Data\IEP Motor Generator Car\HIT05Me.T22	2595	81b25641983b54c18b2d6b8e189d4ca06564cce9e7b0fcad35bf91485f052ef5
Annex A - KE Data\IEP Motor Generator Car\HIT05Me.T23	2587	d5c2e00c5123b112bf481d24fbb62bc967d6d527e410970ced8f8dd27d771278
Annex A - KE Data\IEP Motor Generator Car\HIT05Me.T24	2595	c30221cf1d6f9567dbade0c76eda078d0c0efc23a951d602f762bb8891f8b05b
Annex A - KE Data\IEP Motor Generator Car\HIT05Me.T25	2579	72be908f36b9c4cad22b623276ddf3e43cabb4496995c39f5cb18cfaef161afc
Annex A - KE Data\IEP Motor Generator Car\HIT05Me.T26	2595	f3a6d6c01b230620de83d349b7ae4c05d09a96fc1f9442402f016976ed549641
Annex A - KE Data\IEP Motor Generator Car\HIT05Me.T27	2587	4047a906525854c5f2637e5a2dfb96404496850ad5921e1bb0041b5fdb0f6051
Annex A - KE Data\IEP Motor Generator Car\HIT05Me.T28	2595	0199dbaaa9620cfa5e2eabebd4aebad1cbe900359f2e59497b03cb3b11851234
Annex A - KE Data\IEP Motor Generator Car\HIT05Me.T31	2587	dd7a8ddd9988e878060084be8a58b88cbabaf43ebc634bc51dc5e061f96df817
Annex A - KE Data\IEP Motor Generator Car\HIT05Me.T32	2587	4d202b5ecf59f0592122131bf58fe7e8ab5c46b27f33ca7417de6a622e331e1c
Annex A - KE Data\IEP Motor Generator Car\HIT05Me.T33	2587	f19812c519dea304e58e648bca9d697ae297609c7ede766220b5b7a2f36a067d
Annex A - KE Data\IEP Motor Generator Car\HIT05Me.T34	2587	62c004fb58f16beb78c39c53ad5da105fb2b278e46f87e96e979a563e2712363
Annex A - KE Data\IEP Motor Generator Car\HIT05Me.T35	2587	5376db238d4b283e84f6669e98fd8ddbc349c0bae9b04a5971964189fc58d69d
Annex A - KE Data\IEP Motor Generator Car\HIT05Me.T36	2587	c0d90c2d35193aed1b2abac7c7230f7b4bbf1931dcd475db88db05d14469cdda
Annex A - KE Data\IEP Motor Generator Car\HIT05Me.T37	2587	87b34b1860d1347897ddfc353d86a9d571faa7159ace922747676b93fb43e516
Annex A - KE Data\IEP Motor Generator Car\HIT05Me.T38	2587	1988e6890ef9c4444f6c89dc1a92d57fcd74b3b6d55d8e79be6671933514004e
Annex A - KE Data\IEP Motor Generator Car\HIT05Me.T41	2587	fd7606119cdd8475d03f3c2e8f0395d1a1da715da649ee549f7567f6b5ee17bb
Annex A - KE Data\IEP Motor Generator Car\HIT05Me.T42	2595	5ad050ab9730ab93ee65e340a15dfba0b5560d28b758c4996de72a3a95476748
Annex A - KE Data\IEP Motor Generator Car\HIT05Me.T43	2587	668f2635d5155dd018509b15160b6d70173a08af2446338cfa2b3c94999edf1f
Annex A - KE Data\IEP Motor Generator Car\HIT05Me.T44	2579	a8471a6c408ea62ffc4ab7c2e8636cd26906d5c4c17ae368aacff7613e7bea27
Annex A - KE Data\IEP Motor Generator Car\HIT05Me.T45	2587	b4736734752ac0e0124448aecd6541cb0b33fafe5d1737cd83c157305e03cab4
Annex A - KE Data\IEP Motor Generator Car\HIT05Me.T46	2595	ca3daccc87749be46af1fbea177393758090dcff98090d48425ad9bdf0b7b85d
Annex A - KE Data\IEP Motor Generator Car\HIT05Me.T47	2587	59e35d106a3556099b93f3a6f3cdfec1322848f170aa3d3437af5a4d28629574
Annex A - KE Data\IEP Motor Generator Car\HIT05Me.T48	2579	dd7f934261504cafccf851c799bc8bffcf9ccaf2578ed1d9c5ff51145d2f3d8b
Annex A - KE Data\IEP Motor Generator Car\ME-BOG.MCO	619	48df32fe4c3bd098306a2f24d4561d1c0228cda55e2260128649e6792a60a0b3
Annex A - KE Data\IEP Motor Generator Car\Me-Bog.MSK	291	6ad340cdbe451e17780145114249df5d4ed2b2ad45194d1c9ec7b37657cd00f6
Annex A - KE Data\IEP Motor Generator Car\ME-C.MCO	635	f0e4a4064655c71525d43fc0f091f6b1d3c374e5e85b998bd17370b2f2967ef1
Annex A - KE Data\IEP Motor Generator Car\Me-C.MSK	283	1041292e1583563b3a2bacf7ff3904d8107cb81485060889632fbdbbd6380f91
Annex A - KE Data\IEP Motor Generator Car\ME-E MCO	515	292e5ebcc82033375fc43fa59cf2c5d0601cb530db694259d965c14f32e7120d
Annex A - KE Data\IEP Motor Generator Car\Me-E.MSK	291	f43c38d2037b1198ea664bc90bd94f61148dd8c00d810a3f1e1dfb009d244f82
Annex A - KE Data\IEP Motor Generator Car\ME-EOT.MCO	619	3c13ad969e021cc544a8d0c8f041f82ba1d88b01516433c02d83f840f6395198
Annex A - KE Data\IEP Motor Generator Car\Me-EoT.MSK	307	06d4a1691692db74ee113f7adc6626646af185a0d698353f55b6e1815b802c5e
Annex A - KE Data\IEP Motor Generator Car\ME-F.MCO	83	67d561c7b1018f7760d29bcbf9d95528f5928ed00f406fb094a3dbdbe7352237
Annex A - KE Data\IEP Motor Generator Car\ME-FC MCO	83	5fea7b6263a134352cf0ebb4879656ba4ef10b09a553837de919aad38bc65a36
Annex A - KE Data\IEP Motor Generator Car\Me-FC.MSK	283	4bba658b393e2f0bf9974d8c34be7826a4a5eac676be6e60f291aaf28215bea6
Annex A - KE Data\IEP Motor Generator Car\Me-FI.MSK	283	c9ef9eef1bd0d841e17ebe1ada24aebcbf7a6275d35e556d69073da60f1361f7
Annex A - KE Data\IEP Motor Generator Car\ME-FO.MCO	619	685729a043e430f7a3cc621dd6ba1ea39b3a011396943ea40f44e9ad8bbdb2d0
Annex A - KE Data\IEP Motor Generator Car\Me-FO MSK	299	618df56b04e60572db06c466677373d2d62a7a22006072d0e0bb58baf46b3084
Annex A - KE Data\IEP Motor Generator Car\Me-FOB.MSK	315	fd692792f8972cdb5c1bd1536b1e92c5bf2096884ac1f249cf5626b3162dcfa8
Annex A - KE Data\IEP Motor Generator Car\ME.MKE	432	109b0b41177a4747312efe3e444a9899915eace5e3deaa5f89a0836d49d1fe4b
Annex A - KE Data\IEP Motor Generator Car\Me.MSV	179	0a4b934a30a93c14634cd392afb738d07cb23faa98277116bbae92550243faff
Annex A - KE Data\IEP Motor Generator Car\VLIB Hitachi EP Motor Generator Car.MSS	23	7e2c7cc2c43ef730f6d8730e6fe98620cbdfff4ea46285b9565d89b863a6615b
Annex A - KE Data\IEP Trailer Car\HIEP BMP	40430	0a84bbacdc4b86788bd38bd8af5d986d030a67d729edb44de9e18ca1573b642c
Annex A - KE Data\IEP Trailer Car\HIT05T.G01	715	62fc188e2b2bbf5e5bbba5e9b897ac5bdd5eb98352881332d1e7e9a787a1d770
Annex A - KE Data\IEP Trailer Car\HIT05T.G02	715	c5fe8f136b041f6d8c22cc2da58372386397a000f7de0cf208683b694cfd49d1
Annex A - KE Data\IEP Trailer Car\HIT05T.G03	715	63baa4115f5b2298b0afb2f2cdf6fa8f3923b64051d735401c465c0f5d1e2103
Annex A - KE Data\IEP Trailer Car\HIT05T.G04	715	7b698767cbd3f40e50b85d426b57bf3d994f7ce0d5efbd15f3debd743f96c790

Annex A - KE Data\IEP Trailer Car\HIT05T.T11	2595	04c888f718dd3e37f90ddc0516c5d00594a0e864ac2dc490671d464dad47f30b
Annex A - KE Data\IEP Trailer Car\HIT05T.T12	2595	1b1036ed413d1908b8e4b42740346002d55bf4a93c4c04cde10e0a1253da1879
Annex A - KE Data\IEP Trailer Car\HIT05T.T13	2579	b713b1a582acba789acb5f102b8ea57f0260e43d50b592d75e1f3468f9f4baa0
Annex A - KE Data\IEP Trailer Car\HIT05T.T14	2587	fe2aca76cd4f187f6efa3e570c56bb630584be796ed92b91860830785f05a58c
Annex A - KE Data\IEP Trailer Car\HIT05T.T15	2595	82a384877938e6228d0d187d0de547eba990b0ccfe25223cca0ee7f80321d24f
Annex A - KE Data\IEP Trailer Car\HIT05T.T16	2595	4b3da8b402d072338ca180141d26c144a0a7e017c80c95bbd8bb37db6b0e496e
Annex A - KE Data\IEP Trailer Car\HIT05T.T17	2579	6ce951b91b30afa900ba37131c34a826c9ff80bc63c07574a73e118d1a5a3962
Annex A - KE Data\IEP Trailer Car\HIT05T.T18	2587	2184cd772b4adf81ef7592ffad1e4c7724c1d8d444f59bfccf5e316c017674b7
Annex A - KE Data\IEP Trailer Car\HIT05T.T21	2587	d160eb1e11a9a8910058d0a12aac79800660b7eb71537703e048cf9c053cb171
Annex A - KE Data\IEP Trailer Car\HIT05T.T22	2587	0c11f6a3bac3a2d1f5360c0f60fc0cbab143ca7763f0a1ef82e1fde2f47d940d
Annex A - KE Data\IEP Trailer Car\HIT05T.T23	2579	c42f3166e59a909ddd67be9b0fc02b5cd41da08a89457b0a693c70cdf3dfd3a3
Annex A - KE Data\IEP Trailer Car\HIT05T.T24	2587	2faddd9ec9e325f0fa2261816086aa1e5cb5d18dc99a0b9b86f4624b81c9d02b
Annex A - KE Data\IEP Trailer Car\HIT05T.T25	2587	969144922966370c9bcf36e2a6c47df570642cf002e7788a69b189038959b448
Annex A - KE Data\IEP Trailer Car\HIT05T.T26	2587	0104388049ac4f0a316f5f0337a8da7ebfed48a531c537b38806667ab8f770e6
Annex A - KE Data\IEP Trailer Car\HIT05T.T27	2579	845c8a365070f076b3c95b32b64d19b8248bf98f9d4cb5214c4d238d6324df0e
Annex A - KE Data\IEP Trailer Car\HIT05T.T28	2587	f4d74394a02c93ec02d8a36c2575fb5124bd2234daf41662eeee664ffec668fc
Annex A - KE Data\IEP Trailer Car\HIT05T.T31	2595	ada2e6198abbae5bb41eefac0d520391c3e66591c0f7595035d2e0beba9b367d
Annex A - KE Data\IEP Trailer Car\HIT05T.T32	2587	7937357423ec6f4bc9a4cbb2f4cfa94042b0e747a87fdbba8161277a7e8f7c95
Annex A - KE Data\IEP Trailer Car\HIT05T.T33	2587	b487fc44fc0ebb2657a22951e49d4d2aaccb81c9cf736b215183b8cf0dac29b9
Annex A - KE Data\IEP Trailer Car\HIT05T.T34	2587	b29db92be64f8e732cb9d3a65eda7b4aed069d6292c0d51643a79bb0bb63c21d
Annex A - KE Data\IEP Trailer Car\HIT05T.T35	2595	6a924fa682d8ca2def4460e7ee20b535c6c5ab887b773dcccc17fe0d6f503c45
Annex A - KE Data\IEP Trailer Car\HIT05T.T36	2587	b9044077e1b1c9a81c5bde567bf4fea8f63a8a90d21ef0f1b8a1bb427dddcd43
Annex A - KE Data\IEP Trailer Car\HIT05T.T37	2587	c26e509ed71d93c59b45c248fcbb952931b44f71019f1a5c21c22405fc345f9e
Annex A - KE Data\IEP Trailer Car\HIT05T.T38	2587	20ff33a4103dcd903556463dc759c0ccb1d66ec7b01a87afa7919fec13ff056c
Annex A - KE Data\IEP Trailer Car\HIT05T.T41	2587	13653b8cc3bbed7de15de1cc022cc3d4fee35a2ed206faa37da59a25c7da8595
Annex A - KE Data\IEP Trailer Car\HIT05T.T42	2587	effd6fc24c81e286975ade24e08ad8adfb758447420beba914d482f750d043ee
Annex A - KE Data\IEP Trailer Car\HIT05T.T43	2587	1e505abbf77a165367b0a53668c50df47bf87427d29938414848a1de00da546c
Annex A - KE Data\IEP Trailer Car\HIT05T.T44	2587	450b05842e60fee04c23df989cff15339889dcc0a3309130eb6b901fb48a9309
Annex A - KE Data\IEP Trailer Car\HIT05T.T45	2587	53be23f925788a8cc3e7c4b0f0d80645cae0429e7b86124957470d271bb03454
Annex A - KE Data\IEP Trailer Car\HIT05T.T46	2587	61481069f1cbc88532f1bc2066a4397f4910f523132bb1d0b319d6f8b28e5e68
Annex A - KE Data\IEP Trailer Car\HIT05T.T47	2587	b13494ede51e881f13488aa56f6679992d2f0184c7b13375eb114a34dea9ec0c
Annex A - KE Data\IEP Trailer Car\HIT05T.T48	2587	d07c55679f92cd5f750a00cfb816770ba43b1ec871f1a2a5bef5fdd7f4c3fa6f
Annex A - KE Data\IEP Trailer Car\T-BOG.MCO	579	251452dc768ce0dfad783b164a10162ece740404863a4f17e510740a25eab9f1
Annex A - KE Data\IEP Trailer Car\T-Bog.MSK	291	1c476ce895c84b4468d81479abc3be55f28ce6be4d24faf6f7e93186f68d3aa0
Annex A - KE Data\IEP Trailer Car\T-C.MCO	611	b7719a9b61efa435262f763adaeedbb515f732b053f95d4cd8a31a23ac63f72f
Annex A - KE Data\IEP Trailer Car\T-C.MSK	283	b15fccc261ad7894a0ee08f19b8febbecf8cd2e5ae6922f1ed2ea0cdf1e9ea7a
Annex A - KE Data\IEP Trailer Car\T-E.MCO	531	5c87277398d10bb4c92325c1db2655468f58ccc2ce9a051084ff0270a10a894c
Annex A - KE Data\IEP Trailer Car\T-E.MSK	283	88ffa5d4fa2584be569edbd1eec42cd472f995805d6af0132d7262bd10ae83a2
Annex A - KE Data\IEP Trailer Car\T-EOT.MCO	675	2d1bdb92264c42a86e264d0bba647b5965d4ab90dde622ae7094d0c0c96d9b99
Annex A - KE Data\IEP Trailer Car\T-EoT.MSK	299	17ec5419e47d126e5362cbaaf138a2bfeaf98cf8d8e65db454cfb1d307de60e5
Annex A - KE Data\IEP Trailer Car\T-F.MCO	83	ccb46a6bcebb97a7705db136dcf7326a3232962f76ae808f8ffe5febce62e7de
Annex A - KE Data\IEP Trailer Car\T-FC MCO	83	05861619efd18f2be13052afa1e778de53ce4626ec745e9872f04dbbbd76fe17
Annex A - KE Data\IEP Trailer Car\T-FC MSK	283	04f160c64bab4ad8343d52e7a65bae6ddae10fcaad2d870f296df9c14df599cf
Annex A - KE Data\IEP Trailer Car\T-FI.MSK	283	c0f9658ee30bbdd94d5680428815fc19cda2fb4d29526f0caf5cf62d00a68c07
Annex A - KE Data\IEP Trailer Car\T-FO.MCO	659	5036ad20aa6d8c3badb429a6c1a9ac6686bbc01d51a7adc8e73889d0313fa61d
Annex A - KE Data\IEP Trailer Car\T-FO.MSK	299	40b304e30c46b211fbc9288a05bc2bd9283b92e287adecef4a1035bef60ca889
Annex A - KE Data\IEP Trailer Car\T-FOB.MSK	307	43b7b5ed0015f61a1950d145284473e5ef25cd2e8b990f32b426e3064b9de60e
Annex A - KE Data\IEP Trailer Car\T.MKE	432	6d088438b1b47198a99c2121b2d4332dafcbe7cb192a0dd3bb21a221f2acfaed
Annex A - KE Data\IEP Trailer Car\T MSV	163	7af822d8fc02a3d34a72e517167196d456909f950369dfcbe9397531aaf48462
Annex A - KE Data\IEP Trailer Car\VLIB Hitachi IEP Trailer Car.MSS	22	452d2fdd59c5c312c5bfb75b28b9162186815a49a72c849b89ff5f3a3ada968a

The above files contain 4 separate kinematic envelopes in ClearRoute format.

The above files are also known as KE Version 6, dated 24/06/2011.

Annex B Journey Times

The bidder shall deliver trains to meet, as a maximum, the journey times detailed below. These times shall be achieved under the following conditions:

- A passenger loading of 108 passengers per intermediate vehicle.
- A passenger loading of 88 passengers per driving vehicle (where this contains seating).
- A mean passenger mass of 80kgs.
- Use of the existing infrastructure without any proposed enhancement, except for the electrification of the Great Western Main Line from Paddington to Newbury, from Paddington to Bristol and from Paddington to Oxford.
- Current line speed profiles.
- No allowance for en route or at destination performance, pathing or engineering times.
- Station dwells to be assumed to take 0 seconds.
- Maximum acceleration.
- Still air.
- All braking with brake force equivalent to 6%g constant deceleration on level track.
- 15 degrees C ambient temperature.
- No Adverse Infrastructure Conditions present.
- The train driven to achieve the shortest possible journey time within the above constraints and with the assumption that there are no external causes of delay (e.g. due to signalling).

Route	Journey Time Requirement* (mins)		
	Electric IEP Units Electric IEP Units in Multiple	Bi-Mode IEP Units of 130, 182, 234 and 286m in length.	Bi-Mode IEP Units of 156, 208, 260 and 312m in length. Bi-Mode IEP Units in Multiple Bi-Mode IEP Units in Multiple with Electric IEP Units
Kings Cross to Edinburgh Kings Cross Peterborough York Darlington Newcastle Berwick Edinburgh	229	229	230
Kings Cross to Newcastle Kings Cross Peterborough Grantham Newark Retford Doncaster York Northallerton Darlington Newcastle	162	162	163
Edinburgh to Aberdeen Edinburgh Haymarket Inverkeithing Kirkaldy Leuchars Dundee Arbroath Montrose Stonehaven Aberdeen	N / A	136	139
Edinburgh to Inverness Edinburgh Haymarket	N / A	188	192

Route	Journey Time Requirement* (mins)		
	Electric IEP Units Electric IEP Units in Multiple	Bi-Mode IEP Units of 130, 182, 234 and 286m in length.	Bi-Mode IEP Units of 156, 208, 260 and 312m in length. Bi-Mode IEP Units in Multiple Bi-Mode IEP Units in Multiple with Electric IEP Units
Falkirk Grahamston Stirling Gleneagles Perth Pitlochry Kingussie Aviemore Inverness			
Paddington to Bristol Paddington Reading Didcot Swindon Chippenham Bath Bristol	75	75	76
Paddington to Bristol Paddington Bristol Parkway Bristol	69	69	69
Paddington to Hereford Paddington Reading Oxford Handborough Charlbury Kingham Moreton in Marsh Honeybourne Evesham Pershore Worcester Shrub Hill Worcester Foregate Street Malvern Link Great Malvern Colwall Ledbury Hereford	N / A	141	145

Annex C Passenger Demographics

The following tables define a representative passenger demographic for the IEP Train for use in dwell time simulations.

Luggage	**% of passengers**
Passengers carrying no luggage / small luggage (e.g. briefcases).	62%
Passengers carrying large / bulky luggage	38%

Disabilities	**% of passengers**
Passengers with no disability	94%
Passengers with reduced mobility	4%
Passengers with hearing difficulties	1%
Passengers with poor / no eyesight	1%

Age	**% of passengers**
Passengers aged 0-4	2%
Passengers aged 5-15	4%
Passengers aged 16-25	14%
Passengers aged 26-34	13%
Passengers aged 35-44	17%
Passengers aged 45-54	20%
Passengers aged 55-59	9%
Passengers aged 60-64	10%
Passengers aged over 65	11%

Annex D Specific Train Configuration Requirements

1 Introduction

The purpose of this Annex D is to define the specific application requirements of train configurations and interior elements (layout and features) for the Intercity Express Programme (IEP) train types.

This Annex D complements the main body of Appendix A. The main body of Appendix A defines the technical output requirements of the train systems and interior elements that may be applied to IEP train types, while this Annex D defines the specific train systems and interior elements that shall be applied to each of the IEP train types to be supplied.

1.1 Interior Layout Parameters

Section 1 of this Annex D defines the specific parameters that shall be achieved by the interior layouts of each IEP train type.

1.2 Interior Feature Parameters

Section 2 of this Annex D defines the specific interior features that shall be applied to each of the IEP train types.

1.3 Train and Interior Configurations

Section 3 of this Annex D defines the specific train and interior configurations that shall be achieved by each IEP train type.

Section 1 – Interior Layout Parameters

Interior Layout Parameters								The formations below are indicative for pricing purposes only		
				Interior type 1 5 Car	Interior type 2 8 Car	Interior type 3 9 Car	Interior type 4 5 Car High Density (Electric Only)	Interior type 6 10 Car	Interior type 7 11 Car	Interior type 8 12 Car
Class Split		Number of first class cars		1.5 cars	2.5 cars	2.5 cars	1 car	2.5 cars	3.5 cars	3.5 cars
		Number of standard class cars		3.5 cars	5.5 cars	6.5 cars	4 cars	7.5 cars	7.5 cars	8.5 cars
First Class Interior	Seating	% ratio bay / uni-directional seating		70 / 30 % ‡ [Bay / Un]	65 / 35 % ‡ [Bay / Uni]	65 / 35 % ‡ [Bay / Un]	40 / 60 % [Bay / Uni]	65 / 35 % ‡ [Bay / Uni]	65 / 35 % ‡ [Bay / Uni]	65 / 35 % ‡ [Bay / Uni]
		Seat lateral grouping		2+1	2+1	2+1	2+2	2+1	2+1	2+1
		Uni-directional seating Knee Room [min]		915mm	915mm	915mm	750mm	915mm	915mm	915mm
		Bay seating Knee Room [min]		750mm	750mm	750mm	735mm	750mm	750mm	750mm
	Luggage	Minimum number of Small Bags to be stored per passenger seat.		1	1	1	1	1	1	1
		Maximum distance of Small Bag storage from passenger seat.		1.5m	1.5m	1.5m	1.5m	1.5m	1.5m	1.5m
		Large Bag ratio per passenger [min]		1 per 3 passenger seat	1 per 3 passenger seat	1 per 3 passenger seat	1 per 4 passenger seat	1 per 3 passenger seat	1 per 3 passenger seat	1 per 3 passenger seat
		Maximum distance of Large Bag storage from passenger seat		9.5m	9.5m	9.5m	9.5m	9.5m	9.5m	9.5m
		Bicycle Storage Capacity [min]		None	None	None	None	None	None	None
		Excess Luggage Capacity [min]		None	None	None	None	None	None	None
	Catering	Level 1 – Full restaurant / at seat	Required?	Y	Y	Y	N	Y	Y	Y
		Level 2 – Servery		N	N	N	N	N	N	N
		Level 3 – Café-bar outlet		N	N	N	N	N	N	N
		Level 4 – Trolley service		N	N	N	N	N	N	N
Standard Class Interior	Seating	% ratio bay / uni-directional seating		35 / 65 % [Bay / Un]	35 / 65 % [Bay / Uni]	35 / 65 % [Bay / Un]	35 / 65 % [Bay / Uni]	35 / 65 % [Bay / Uni]	35 / 65 % [Bay / Uni]	35 / 65 % [Bay / Uni]
		Number of bays per full saloon		8	8	8	8	8	8	8
		Seat Type - Seat lateral grouping		2+2	2+2	2+2	2+2	2+2	2+2	2+2
		Uni-directional seating Knee Room [min]		750mm	750mm	750mm	750mm	750mm	750mm	750mm
		Bay seating Knee Room [min]		735mm	735mm	735mm	735mm	735mm	735mm	735mm
	Luggage	Minimum number of Small Bags to be stored per passenger seat *.		1	1	1	1	1	1	1
		Maximum distance of Small Bag storage from passenger seat.		1.5m	1.5m	1.5m	1.5m	1.5m	1.5m	1.5m
		Large Bag ratio per passenger [min]		1 per 4 passenger seat	1 per 4 passenger seat	1 per 4 passenger seat	1 per 4 passenger seat	1 per 4 passenger seat	1 per 4 passenger seat	1 per 4 passenger seat
		Maximum distance of Large Bag storage from passenger seat		9.5m	9.5m	9.5m	9.5m	9.5m	9.5m	9.5m
		Bicycle Storage Capacity [min]		4 bicycles	8 bicycles	8 bicycles	4 bicycles	8 bicycles	8 bicycles	8 bicycles
		Excess Luggage Capacity [min]		$4m^3$	$8m^3$	$8m^3$	$4m^3$	$8m^3$	$8m^3$	$8m^3$
	Catering	Catering trolley storage area [min]		1 Trolley	1 Trolley	1 Trolley	1 Trolley	1 Trolley	1 Trolley	1 Trolley
		Level 1 – Full restaurant / at seat	Required?	N	N	N	N	N	N	N
		Level 2 – Servery		N	N	N	N	N	N	N
		Level 3 – Café-bar outlet		N	N	N	N	N	N	N
		Level 4 – Trolley service		Y	Y	Y	Y	Y	Y	Y
Crew Facilities	Crew office		Required?	N	N	N	N	N	N	N

Note: Where required, the location of bicycle storage, excess luggage storage, catering trolley storage areas and catering facilities are identified in section 3.

*: In the case of standard class driving cars which do not have a wheelchair space it is permissible to exclude four seats from this requirement.

‡: DPT Seating on single seat side to be predominantly unidirectional with central bay.

Section 2 - Interior Feature Parameters

Interior Feature Parameters								The formations below are indicative for pricing purposes only		
				Interior type 1 5 Car	Interior type 2 8 Car	Interior type 3 9 Car	Interior type 4 5 Car High Density (Electric Only)	Interior type 6 10 Car	Interior type 7 11 Car	Interior type 8 12 Car
First Class Interior	Seated area spec	First Class Seat	Type	2+1	2+1	2+1	2+2	2+1	2+1	2+1
		Armrest	Required [Y/N]	Y	Y	Y	Y	Y	Y	Y
		Recline Mechanism		Y	Y	Y	N	Y	Y	Y
		Coat hook per seated position		Y	Y	Y	Y	Y	Y	Y
		Anti-macassar attachment		Y	Y	Y	Y	Y	Y	Y
		Seat back magazine/info holder [Uni]		Y	Y	Y	Y	Y	Y	Y
		Reading light		N	N	N	N	N	N	N
		Table: Fixed table [Un]		Y	Y	Y	N	Y	Y	Y
		Fixed table [Bay]		Y	Y	Y	Y	Y	Y	Y
		Feature light per bay table		N	N	N	N	N	N	N
		Magazine/info holder per bay table		Y	Y	Y	Y	Y	Y	Y
		Power point: per seat row side		N	N	N	Y	N	N	N
		Power point per seat		Y	Y	Y	N	Y	Y	Y
		Sun shade - blind		Y	Y	Y	Y	Y	Y	Y
	Toilet -Baby changing (SST toilet)*			N	N	N	N	N	N	N
	Floor Covering -Saloon		Type	Carpet	Carpet	Carpet	Carpet	Carpet	Carpet	Carpet
Standard Class Interior	Seated area spec	Standard Class Seat	Type	2+2	2+2	2+2	2+2	2+2	2+2	2+2
		Armrest	Required [Y/N]	Y	Y	Y	Y	Y	Y	Y
		Coat hook per seated position		Y	Y	Y	Y	Y	Y	Y
		Anti-macassar attachment		Y	Y	Y	Y	Y	Y	Y
		Seat back magazine / info holder [Uni]		Y	Y	Y	Y	Y	Y	Y
		Reading light		N	N	N	N	N	N	N
		Table: Seat back table [Uni]		Y	Y	Y	Y	Y	Y	Y
		Fixed table [Bay]		Y	Y	Y	Y	Y	Y	Y
		Magazine/info holder per bay table		Y	Y	Y	Y	Y	Y	Y
		Power point per seat row side		Y	Y	Y	Y	Y	Y	Y
		Sun shade - blind		Y	Y	Y	Y	Y	Y	Y
	Toilet -Baby changing (SST toilet)*			N^	N^	N^	N^	N^	N^	N^
	Floor Covering -Saloon		Type	Carpet	Carpet	Carpet	Carpet	Carpet	Carpet	Carpet
Litter Collection		Segregation for recycling	Location	Vest bule	Vestibule	Vestibule	Vestibule	Vestibule	Vestibule	Vestibule
			Required [Y/N]	Y	Y	Y	Y	Y	Y	Y
Class division		Partition Door	Required [Y/N]	Y	Y	Y	N	Y	Y	Y
Information & advert display (General - not at seat)		Information frames	Required [Y/N] Number	Y [4 per vehicle]	Y [4 per vehicle]	Y [4 per vehicle]	Y [4 per vehicle]	Y [4 per vehicle]	Y [4 per vehicle]	Y [4 per vehicle]
		Magazine/Info. leaflet rack	Required [Y/N] Number	Y [2 per vehicle]	Y [2 per vehicle]	Y [2 per vehicle]	Y [2 per vehicle]	Y [2 per vehicle]	Y [2 per vehicle]	Y [2 per vehicle]

* Note PRM TSI requires fitment of baby changing table within UAT toilet.

^ Fitment within one SST per train to be investigated during detailed design stage.

Section 3 - Train and Interior Configurations

Interior type 1 5 Car	Driving vehicle				Driving vehicle
Class	Std	Std	Std	Std / First	First
Additional Feature 1	UAT (No w'chair space)	SST	SST	Bike / Excess Luggage Area	UAT (2 x w'chair space)
Additional Feature 2		Catering Trolley Level 4	SST	Bike / Excess Luggage Area	Catering - level 1 at driving end

Interior type 2 8 Car	Driving vehicle							Driving vehicle
Class	Std	Std	Std	Std	Std	Std / First	First	First
Additional Feature 1	UAT (2 x w'chair space)	SST	SST	SST	Bike / Excess Luggage Area	Bike / Excess Luggage Area	SST	UAT (2 x w'chair space)
Additional Feature 2		Catering Trolley Level 4	SST	SST	Bike / Excess Luggage Area	Bike / Excess Luggage Area	SST	Catering - level 1 at driving end

Interior type 3 9 Car	Driving vehicle								Driving vehicle
Class	Std	Std	Std	Std	Std	Std	Std/First	First	First
Additional Feature 1	UAT (2 x w'chair space)	SST	SST	SST	SST	Bike / Excess Luggage Area	Bike / Excess Luggage Area	SST	UAT (2 x w'chair space)
Additional Feature 2		Catering Trolley Level 4	SST	SST	SST	Bike / Excess Luggage Area	Bike / Excess Luggage Area	SST	Catering - level 1 at driving end

Interior type 4 5 Car High Density Electric	Driving vehicle				Driving vehicle
Class	Std	Std	Std	Std	First
Additional Feature 1	UAT (No w'chair space)	SST	SST	Bike / Excess Luggage Area	UAT (2 x w'chair space)
Additional Feature 2		Catering Trolley Level 4	SST	Bike / Excess Luggage Area	

The configurations below are indicative only, for the purposes of determining train parameters associated with longer trains than specified above. It is accepted that it may be necessary to have functional vehicle types in excess of the number specified in TS1965 in order to deliver these formations.

Interior type 6 10 Car	Driving vehicle									Driving vehicle
Class	Std	Std	Std	Std	Std	Std	Std	Std / First	First	First
Additional Feature 1	UAT (2 x w'chair space)	SST	SST	SST	SST	SST	Bike / Excess Luggage Area	Bike / Excess Luggage Area	SST	UAT (2 x w'chair space)
Additional Feature 2		Catering Trolley Level 4	SST	SST	SST	SST	Bike / Excess Luggage Area	Bike / Excess Luggage Area	SST	Catering - level 1 at driving end

Interior type 7 11 Car	Driving vehicle										Driving vehicle
Class	Std	Std	Std	Std	Std	Std	Std	Std / First	First	First	First
Additional Feature 1	UAT (2 x w'chair space)	SST	SST	SST	SST	SST	Bike / Excess Luggage Area	Bike / Excess Luggage Area	SST	SST	UAT (2 x w'chair space)
Additional Feature 2		Catering Trolley Level 4	SST	SST	SST	SST	Bike / Excess Luggage Area	Bike / Excess Luggage Area	SST	SST	Catering - level 1 at driving end

Interior type 8 12 Car	Driving vehicle											Driving vehicle
Class	Std	Std	Std	Std	Std	Std	Std	Std	Std / First	First	First	First
Additional Feature 1	UAT (2 x w'chair space)	SST	SST	SST	SST	SST	SST	Bike / Excess Luggage Area	Bike / Excess Luggage Area	SST	SST	UAT (2 x w'chair space)
Additional Feature 2		Catering Trolley Level 4	SST	SST	SST	SST	SST	Bike / Excess Luggage Area	Bike / Excess Luggage Area	SST	SST	Catering - level 1 at driving end

Annex E East Coast Main Line Track Data

Please refer to the following attached files:

Filename	File Size	SHA256 Checksum
Annex E - ECML Track Data\A_Retford-Newark.dat	5197112	74195dffbdd2aadc0f471128374c65403660f197bb183e2867350dacd861a871
Annex E - ECML Track Data\B_Stoke-Peterborough1.dat	5197114	a26b9c1b5fa4c9873d9efdf5ffbd36be6cac1d0713ac60120c056e3fefdd3f52
Annex E - ECML Track Data\C_Stoke-Peterborough2.dat	5197111	fa9f1e09b2ed54393d07eafbd46259ee38bd9d152b6eb77c56495e971a4f3a99
Annex E - ECML Track Data\D_Huntingdon-Welwyn1.dat	5197103	d283f94b42c265723378fc0c38df51395027c2967df4e9a274ab4180f79048e3
Annex E - ECML Track Data\E_Huntingdon-Welwyn2.dat	5197106	ed4f6b0aed5b0ee7093bfbffbe82a3a78e6322cbf7583c810ecae8aad34995fc
Annex E - ECML Track Data\F_Huntingdon-Welwyn3 dat	5197108	7cc553cba804c81b33a45c4d7d5c0922680dd3c937141a3493758f4025404016

The above files contain track geometry data in VAMPIRE® format, intended for evaluation of ride comfort using computer simulations. Each file contains a 500m run-in, followed by exactly 5 minutes of measured track data (when run at the stated line speed).

When ride analysis is carried out, this should EXCLUDE the first 500m run-in. The remaining section is then suitable for analysis according to ENV12299:1999, ‘Railway applications – Ride comfort for passengers – Measurement and evaluation’.

Annex F Midland Main Line Track Data

Please refer to the following attached files:

Filename	File Size	SHA256 Checksum
Annex F - MML Track Data\G_Luton-Ampthill dat	4573400	ee59d8c924bacf61fad601e1499eab98733bae23e482e5e8a4d59759b566fbc5
Annex F - MML Track Data\H_Ampthill-Luton.dat	4573401	7ce18e0a701d500a2c8d43154a08e7e0d193368e73b695dfca6e85fc41c943bb
Annex F - MML Track Data\I_Ampthill-Wellingborough1 dat	4573494	bf7af392f60bdb824278964d611fc95d2f59a3579ac76e8c2900a4bad23b4bcc
Annex F - MML Track Data\J_Ampthill-Wellingborough2.dat	4573406	25e48b232a26000fb6b6d139744314f84a09197e32a216beea41de13cf1a9924
Annex F - MML Track Data\K_Wellingborough-Ampthill1.dat	4573409	cea78727fb4c7c5bc0c5b6b4235f8ec251aff2ed6ba96a59d1a164bc01bead7a
Annex F - MML Track Data\L_Wellingborough-Ampthill2.dat	4573404	5212e51fc058bc26bc188dfffa091bfae57b9d62dc9d139078bce648f5bc65d8
Annex F - MML Track Data\M_Kettering-Mkt_Harborough.dat	4157703	66793d8019fc11f99363407ec5b7a2cdb865eaecde4e2526c49e82bdf4bce660
Annex F - MML Track Data\N_Mkt_Harborough-Kettering.dat	4157700	9c0533b5cb6031a6a70b72bff8c56468c58af72097af8dcab7e1b18f9369d9a2

The above files contain track geometry data in VAMPIRE® format, intended for evaluation of ride comfort using computer simulations. Each file contains a 500m run-in, followed by exactly 5 minutes of measured track data (when run at the stated line speed).

When ride analysis is carried out, this should EXCLUDE the first 500m run-in. The remaining section is then suitable for analysis according to ENV12299:1999, 'Railway applications – Ride comfort for passengers – Measurement and evaluation'.

Annex G Data to be Used in the Assessment of VTISM Costs

Please refer to the following attached files:

Filename	File Size	SHA256 Checksum
Annex G - VTISM Data\IEP Standard Files\IEP Engineering mdb	2490368	d865b2f5bdacf49570fb3d4ac5659a88ef7819a0cb9ae000fe58bfdcae9c2fd5
Annex G - VTISM Data\IEP Standard Files\IEP Track Quality.mdb	401408	d1a81f261a0e2ca07ccd84a11a7f498143426cc4627d00cd91026c6b3a3366ec
Annex G - VTISM Data\IEP Standard Files\IEP Vehicles.mdb	1089536	cbd6a36a17cd1bd8d7a18c2d87d091097dd6d1c44f3e27cbdb6e48955895585e
Annex G - VTISM Data\IEP Standard Files\IEP wheel rail profile\ModeratelyWornRail ban	13515	7d03b2904669702cdd5d864db4d1841121cb6a575f08665b9f01157b31dca004
Annex G - VTISM Data\IEP Standard Files\IEP wheel rail profile\ModeratelyWornWheel.whl	28853	a7674e9c3851135b668afb40d1e7d2f7f84474219b16319d485570835a9a50da
Annex G - VTISM Data\IEP Standard Files\IEP.mod	31943	db11107bc7733a66decf2859bce611ef101e4ec5ed53872a023932cb7fc42b4d
Annex G - VTISM Data\Route A\Base Preproc.mdb	757760	617eea605b382b03868392b9ff537185f963a73b46c1e2984aba473819498c8f
Annex G - VTISM Data\Route A\Base WLRM Run.csv	365910	59d36be88b20aa7b408b37e93284b535d78681fa3dff45571c131014d732b9d4
Annex G - VTISM Data\Route A\Base WLRM Run.inp	3542	ac956280d0cce8f6581bf8164ecbced6653de337ccb4bc5f8eabd546f60b8afa
Annex G - VTISM Data\Route A\Base WLRM Run_t2v.csv	39285	22de0b4133d504e3b68bcde4ed064d926543f0a8033fe93f848eb4a930061379
Annex G - VTISM Data\Route A\Base WLRM Run_Track csv	94217	e84f9cecc3dc628c99f2ed090300a424b39867c8f2107c5194d120dab38f60da
Annex G - VTISM Data\Route A\Base WLRM Run_Traffic.csv	33554	b7930d7d13aa13098e7ebf9a9b63e5d6f34c23a29a42f2fff2872d0c98ca9c2e
Annex G - VTISM Data\Route A\Current Traffic.mdb	2404352	569582998e7bcc398c33fef6ec66f20347e8975c29629bc56accadefa02f1a4e
Annex G - VTISM Data\Route A\No HST Preproc mdb	757760	ac7055dc1ebef7a6635b6356f69dd7ae367237c82ef27fea24478493ccac2841
Annex G - VTISM Data\Route A\No HST Traffic mdb	2338816	652dbdf515b2c56e0c798e0e3ccf983b627982650035c294980f3c7a3c8d9034
Annex G - VTISM Data\Route A\No HST Wear + RCF.mdb	1605632	85e067686183cca04ef385263aa9cce8be4389488c44844498d8f8539aa793e5
Annex G - VTISM Data\Route A\No HST WLRM Run csv	365910	6ce3226f24462a5a871e0298fdb866365dfb8e5e59ea2733161177fecd4081ec
Annex G - VTISM Data\Route A\No HST WLRM Run inp	3241	f5a9bdde8fffba1019092edb99924aae7b1d4717a58a487968eb24504beec61c
Annex G - VTISM Data\Route A\No HST WLRM Run_t2v.csv	33631	a862d409c9ff701c7a9e9d0ce47ee6faed5b9586d67e2b364289c9fad8b2f463
Annex G - VTISM Data\Route A\No HST WLRM Run_Track.csv	94217	e84f9cecc3dc628c99f2ed090300a424b39867c8f2107c5194d120dab38f60da
Annex G - VTISM Data\Route A\No HST WLRM Run_Traffic.csv	28684	dc28a0c5250e0c33d7efe8b339ef4ee6aab69dcdb447425e2502ff2196c9574c
Annex G - VTISM Data\Route A\Results mdb	3997696	1a0992ad873bdbb8fee8df95c174b6e05227cf6258cedf3dd35bf9329ef517ad
Annex G - VTISM Data\Route A\Route Template.VTI	573440	b7f4cd37ac217ecc2733546392c11d2d5cc743796f7fe7986a5b5d570562b0b8
Annex G - VTISM Data\Route A\Route.mdb	3579904	7abe58d4b972448c15114e0aa367ea857ddc0c450416578fcae88ab86479498e
Annex G - VTISM Data\Route A\WLRM Run Template csv	365910	6ce3226f24462a5a871e0298fdb866365dfb8e5e59ea2733161177fecd4081ec
Annex G - VTISM Data\Route A\WLRM Run Template inp	3272	7146235d447102d381e9295b9ffb0dd9df711be7800c6f4242c531bbd7c15e8d
Annex G - VTISM Data\Route A\WLRM Run Template_t2v csv	33631	a862d409c9ff701c7a9e9d0ce47ee6faed5b9586d67e2b364289c9fad8b2f463
Annex G - VTISM Data\Route A\WLRM Run Template_Track csv	94217	e84f9cecc3dc628c99f2ed090300a424b39867c8f2107c5194d120dab38f60da
Annex G - VTISM Data\Route A\WLRM Run Template_Traffic.csv	28684	dc28a0c5250e0c33d7efe8b339ef4ee6aab69dcdb447425e2502ff2196c9574c
Annex G - VTISM Data\Route B\Base Preproc.mdb	757760	3161eb93b0ed328da0789484025b665d4a9ae537f6c8f36233cca5d2c7f1ec8e
Annex G - VTISM Data\Route B\Base WLRM Run.csv	361605	38f14173c088e75294d7df1b71409417ab9106f10d4ecd37cabc961772147fcd
Annex G - VTISM Data\Route B\Base WLRM Run.inp	3552	29d9346523a86676d157512d98a0e879927f1f447dc19028d5d2927f16df5f10
Annex G - VTISM Data\Route B\Base WLRM Run_t2v.csv	27603	3d7b4140c5d3a5c735327e0424ca7a705af4826842aec5b3c239f783fd7e0160
Annex G - VTISM Data\Route B\Base WLRM Run_Track csv	92285	9e8cf2f07fb6f82e2b92cdb4c333185a0930cd896047a7732de5fba5cd588488
Annex G - VTISM Data\Route B\Base WLRM Run_Traffic.csv	23284	b9bef57d994520e87989fcccfdb7e347e540d93b8f6f526681b101478334a956
Annex G - VTISM Data\Route B\Current Traffic.mdb	1585152	883762cc2ed1a499c8f2981d692fc4f21f3ae35fe486cc5c2fc968114065195f
Annex G - VTISM Data\Route B\No HST Preproc mdb	757760	58bbf69540e52f316b4fc551a8df3a79a2b3d9d7704f168c191fdfa918c39413
Annex G - VTISM Data\Route B\No HST Traffic mdb	1519616	a3e3bb5a2456ebab5d79f7ff839f5fb174e19dab7567581d7323b8ab693f5a48
Annex G - VTISM Data\Route B\No HST Wear + RCF.mdb	999424	ae76a70c16d6a5b7e3b13a320c1ae833bc1a2cfe170af2cf09a6c7f533b57590
Annex G - VTISM Data\Route B\No HST WLRM Run csv	361605	2f6732d4a2c8ba1ed3b498b95800a32a15013befc7e87740092f6a9d36fce644
Annex G - VTISM Data\Route B\No HST WLRM Run inp	3251	6be711002661fcbda8a54024f57af53298eb99dc279fd75a529e35d5c494ce95
Annex G - VTISM Data\Route B\No HST WLRM Run_t2v.csv	24131	ad674e35c2f9c7d9d28ca8ed287a2ddf01f4cefdb201ce439d913bb5b67d6152
Annex G - VTISM Data\Route B\No HST WLRM Run_Track.csv	92285	9e8cf2f07fb6f82e2b92cdb4c333185a0930cd896047a7732de5fba5cd588488
Annex G - VTISM Data\Route B\No HST WLRM Run_Traffic.csv	20316	c69314a8e04674bbc479f3954c6bb76c1048721d8f86a989f3c58dae586ef019
Annex G - VTISM Data\Route B\Results mdb	2478080	8e38deaed5b0f53992178f77ea7e8ab04241ce9b95ebdf48865fb08bd848572c
Annex G - VTISM Data\Route B\Route Template.VTI	573440	1d1d89cbb7a89a84a5562f875b0e48a69be502b3ac5e1f2e15a64de12762a25f
Annex G - VTISM Data\Route B\Route mdb	3260416	5cfe0138dc913f1fb7b4e74d78b0d9597382980ecd10c2c37c4bc5c647368213
Annex G - VTISM Data\Route B\WLRM Run Template.csv	361605	2f6732d4a2c8ba1ed3b498b95800a32a15013befc7e87740092f6a9d36fce644
Annex G - VTISM Data\Route B\WLRM Run Template inp	3285	3e7cdd07f4a793f8729717f505a2d3c3e7b015ae2f71217c4cfa77e985eb1611
Annex G - VTISM Data\Route B\WLRM Run Template_t2v csv	24131	ad674e35c2f9c7d9d28ca8ed287a2ddf01f4cefdb201ce439d913bb5b67d6152
Annex G - VTISM Data\Route B\WLRM Run Template_Track.csv	92285	9e8cf2f07fb6f82e2b92cdb4c333185a0930cd896047a7732de5fba5cd588488
Annex G - VTISM Data\Route B\WLRM Run Template_Traffic.csv	20316	c69314a8e04674bbc479f3954c6bb76c1048721d8f86a989f3c58dae586ef019
Annex G - VTISM Data\Vampire\Route A\IEP1.out	68800512	f25f170866749617f0a2373b12e0f89235c2220394f476557edbd93a6bbcb250
Annex G - VTISM Data\Vampire\Route A\ EP2.out	37847040	6c458998ca0392eefbb24e8a11eb5404b7f0310f4ef113ff352eca5ecee49d61
Annex G - VTISM Data\Vampire\Route A\IEP3.out	37847040	9ad2519318a2435157864a9e4b09a7b5469f11eb2d0e3bf6087f075b72ae1119
Annex G - VTISM Data\Vampire\Route A\ EP4.out	37847040	9c3f57e19a68eb5efdc25e307929399c6840af6f7172d1d3ec523fccdbb639ff
Annex G - VTISM Data\Vampire\Route A\ EP5.out	37847040	b0578a109598f7875f3276c3bf9b3cd5a78d70a4a3f310ccd78c29fc151797d5
Annex G - VTISM Data\Vampire\Route A\ EP6.out	37847040	e022050122bdd05f8efa6310b06121b15a3caf850e55eab3cd854cf69e7803d7
Annex G - VTISM Data\Vampire\Route A\ EP7.out	68800512	868cc239e6cd31064d28996d7d9f7282c164bfa4b8741a07f368a495122063e8
Annex G - VTISM Data\Vampire\Route A\ EP8.out	1.02E+08	37a63767f57e737df8e7813a67037f63d29d4c70ba9e0cb365e14c8125b6aff6
Annex G - VTISM Data\Vampire\Route A\ EP9.out	1.02E+08	0622b6ab3a469362330da4189fc00bd0e9f25622fcae5dfde60384303cbe59df
Annex G - VTISM Data\Vampire\Route A\ EP_Vampire_High_Template.run	5413	03acc93d8b76d4e5d77d2cde27be588b2c59b797e3ecc3d610bb1b6caa4abaab
Annex G - VTISM Data\Vampire\Route A\ EP_Vampire_Low_Template.run	5412	966ffe8d65bcc9083d98310799cdd51832636a357d1382aa9be35dd8a8ff9429
Annex G - VTISM Data\Vampire\Route A\Route-A.dat	38807249	d961cc85c65f8f776778ba3113283a24a6e00600e42e802bc112bdba616bc526
Annex G - VTISM Data\Vampire\Route A\Route-A_Spd dat	4187	4943375100848d85446b87abcdb9dd3602f859f95e25fd84285d07a6640f6ad2
Annex G - VTISM Data\Vampire\Route B\ EP1.out	91643904	ab008c4f62f900f90e97c4a1db5487ba04502a3de3cff4257ff418f39140932a
Annex G - VTISM Data\Vampire\Route B\IEP2.out	45821952	873dbb4f5fd9fba570f10e75bbb40c9306b1b9686a8465f595190a8f948aab4d
Annex G - VTISM Data\Vampire\Route B\IEP3.out	45821952	6d087d4971078a47c126790be24c77d4989b897d567e66850e6c19eec3f11edb
Annex G - VTISM Data\Vampire\Route B\ EP4.out	45821952	5906beff3fc79cdc4cb949f07f99fa463a0949f8daa1783328174b58adb343fb
Annex G - VTISM Data\Vampire\Route B\ EP5.out	45821952	cea81e7c38a3cc85175171fa8a062477b6ff4204b4198f3d9fc523458d4df4f8
Annex G - VTISM Data\Vampire\Route B\ EP6.out	91643904	5af04a33f9b71cecb8c9199e1f891d865ea7addfc7025f799ff348614fb87383
Annex G - VTISM Data\Vampire\Route B\ EP7.out	91643904	eaf315cc449c8286cd50c81ba3e5df839503a7c022e981372a3b41b0f41d83c8
Annex G - VTISM Data\Vampire\Route B\ EP8.out	1.36E+08	8c2f9fec480e9230f4bfe15f9ac5890716676ee9887017514167eda1d889714f
Annex G - VTISM Data\Vampire\Route B\ EP9.out	45821952	90e81ba8275572d3fe8aaaa814e808aefd2f77aec7697240138e193b8218303c
Annex G - VTISM Data\Vampire\Route B\ EP_Vampire_High_Template.run	5405	c241211fd2c01d0fc09145790aeb1457536ad0599ddb29d54353860f0a94b2aa
Annex G - VTISM Data\Vampire\Route B\ EP_Vampire_Low_Template.run	5403	8f37f058e5dbb6fecd9e54fded2d5b09f8c56273a09fc34f122b37c6a6d9e913
Annex G - VTISM Data\Vampire\Route B\Route-B.dat	50905805	83bb56477555c87fcf3617131be1c3312ccc3725ddfc8ac1cf353e78e1fd5a3c
Annex G - VTISM Data\Vampire\Route B\Route-B_Spd dat	2513	4c4f983aec275a8a2271de54e4f63779d48a96c4309367a862abb7d892b6115f
Annex G - VTISM Data\Vampire\Vehicles\Dummy File txt	10	28048096b7cd059dc78714953d0444a6bf052c8f66a5036aeb3f4f794042e5e8

Annex H Assumptions for the Calculation of Fuel Range

Diagram A, to be achieved by a 260m long bi-mode train:

Leg:	1	2	3	4	5
Journey:	Leeds to Edinburgh	Edinburgh to Aberdeen	Aberdeen to Edinburgh	Edinburgh to Kings Cross via Durham Coast and Joint Line (diversion)	Kings Cross to Leeds
Stopping at:	Leeds York Darlington Newcastle Berwick Edinburgh	Edinburgh Haymarket Inverkeithing Kirkaldy Leuchars Dundee Arbroath Montrose Stonehaven Aberdeen	Aberdeen Stonehaven Montrose Arbroath Dundee Leuchars Kirkaldy Inverkeithing Haymarket Edinburgh	Berwick Newcastle York Doncaster Peterborough Kings Cross	Kings Cross Peterborough Grantham Newark North Gate Retford Doncaster Wakefield Westgate Leeds
Notes:	Self Power Mode between Leeds and York Electric Mode between York and Newcastle Self Power Mode between Newcastle and Edinburgh	Self Power Mode	Self Power Mode	Electric Mode between Edinburgh and Newcastle. Self Power Mode between Newcastle and Northallerton Electric Mode between Northallerton and Doncaster Self Power Mode between Doncaster and Peterborough Electric Mode between Peterborough and Kings Cross.	Electric Mode.

Diagram B, to be achieved by a 208m long bi-mode train:

Leg:	1	2	3	4
Journey:	Hereford to Paddington	Paddington to Exeter St Davids	Exeter St Davids to Paddington	Paddington to Hereford
Stopping at:	Hereford Ledbury Colwall Great Malvern Malvern Link Worcester Foregate Street Worcester Shrub Hill Pershore Evesham Honeybourne Moreton in Marsh Kingham Charlbury Handborough Oxford Reading Paddington	Paddington Reading Theale Thatcham Newbury Hungerford Pewsey Westbury Taunton Tiverton Parkway Exeter St Davids	Exeter St Davids Tiverton Parkway Taunton Westbury Pewsey Hungerford Newbury Thatcham Theale Reading Paddington	Paddington Reading Oxford Handborough Charlbury Kingham Moreton in Marsh Honeybourne Evesham Pershore Worcester Shrub Hill Worcester Foregate Street Malvern Link Great Malvern Colwall Ledbury Hereford
Notes:	Self Power Mode to Oxford (stopping) then Electric Mode to Paddington	Electric Mode to Newbury (stopping) then Self Power Mode to Plymouth	Self Power Mode to Newbury (stopping) then Electric Mode to Paddington	Electric Mode to Oxford (stopping) then Self Power Mode to Hereford

Diagram C, to be achieved by a 130m long bi-mode train:

Leg:	1	2	3	4	5
Journey:	Paddington to Cheltenham Spa	Cheltenham Spa to Paddington	Paddington to Paignton	Paignton to Paddington	Paddington to Cheltenham Spa
Stopping at:	Paddington Reading Didcot Parkway Swindon Kemble Stroud Stonehouse Gloucester Cheltenham Spa	Cheltenham Spa Gloucester Stonehouse Stroud Kemble Swindon Didcot Parkway Reading Paddington	Paddington Reading Theale Thatcham Newbury Hungerford Pewsey Westbury Taunton Tiverton Parkway Exeter St Davids Dawlish Teignmouth Newton Abbot Torquay Paignton	Paignton Torquay Newton Abbot Teignmouth Dawlish Exeter St Davids Tiverton Parkway Taunton Westbury Pewsey Hungerford Newbury Thatcham Theale Reading Paddington	Paddington Reading Didcot Parkway Swindon Kemble Stroud Stonehouse Gloucester Cheltenham Spa
Notes:	Electric Mode to Swindon (stopping) then Self Power Mode to Cheltenham Spa	Self Power Mode to Swindon (stopping) then Electric Mode to Paddington	Electric Mode to Newbury (stopping) then Self Power Mode to Paignton	Self Power Mode to Newbury (stopping) then Electric Mode to Paddington	Electric Mode to Swindon (stopping) then Self Power Mode to Cheltenham Spa

It shall be possible to operate the diagrams specified under the following conditions (note that these differ in some respects to those quoted in Annex B):

- A passenger loading of 108 passengers per intermediate vehicle.
- A passenger loading of 88 passengers per driving vehicle (where this contains seating).
- A mean passenger mass of 80kgs.
- Current line speed profiles without any stops or delays other than station stops
- No allowance for en route or at destination performance, pathing or engineering times
- Maximum acceleration

- Still air.
- All braking with brake force equivalent to 6%g constant deceleration on level track.
- An ambient temperature of 30 degrees C.
- Station dwells to be assumed to take 2 minutes.
- A minimum turnaround time of 30 minutes at the end of each leg. If the diagram takes less than 18 hours in total then all turnaround times are to be increased equally to make the diagram up to 18 hours.
- Any ECS mileage under Self Power Mode required by the depot strategy is to be achieved in addition to the diagram quoted.