Dated 27 June 2013

SIEMENS PLC

CROSS LONDON TRAINS LIMITED

FIRST CAPITAL CONNECT LIMITED

MANUFACTURE AND SUPPLY AGREEMENT

Freshfields Bruckhaus Deringer

Freshfields Bruckhaus Deringer LLP
65 Fleet Street
London EC4Y 1HS

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THIS AGREEMENT is made on 27 June 2013

BETWEEN:

(1) **SIEMENS PLC** (Registered Number 727817), a company incorporated in England and Wales whose registered office is Faraday House, Sir William Siemens Square, Frimley, Camberley, GU16 8QD (the ***TMM***);

(2) **CROSS LONDON TRAINS LIMITED** (Registered Number 07813033), a company incorporated in England and Wales whose registered office is 210 Pentonville Road, London N1 9JY (the ***Owner***); and

(3) **FIRST CAPITAL CONNECT LIMITED** (Registered Number 05281077), a company incorporated in England and Wales whose registered office is 50 Eastbourne Terrace, London W2 6LG (the ***Initial Operator***).

WHEREAS:

(A) The Owner wishes to buy a new fleet of trains and associated spares and special tools and simulators which meet the requirements set out in the Applicable Specification and otherwise on terms in accordance with the terms and conditions of this Agreement. The Owner wishes to lease these trains, associated spares, special tools and simulators initially to the Initial Operator.

(B) The Operator wishes to buy certain spares and the integration laboratory train equipment and take title in the mock up which meet the requirements set out in the Applicable Specification and otherwise on terms in accordance with the terms and conditions of this Agreement.

(C) The TMM is a designer, manufacturer and maintainer of railway rolling stock vehicles, and has agreed with the Owner and the Initial Operator to design, manufacture, test, certify, commission and sell to (i) the Owner the trains, spares, and special tools and simulators referred to in Recital (A) for lease to the Operator and (ii) the Operator the spares and the integration laboratory train equipment referred to in Recital (B). The Parties have also agreed that the Operator will take title in the mock-up.

(D) This Agreement records the agreement between the TMM, the Owner and Initial Operator.

IT IS AGREED:

1. DEFINITIONS, INTERPRETATION AND COMMON TERMS

Definitions

1.1 In this Agreement, (including the Recitals) unless the context otherwise requires, all defined terms shall have the meanings given to such terms in the master definitions and common terms agreement entered into by the Parties on the date of this Agreement (the ***Master Definitions Agreement***).

Interpretation and Construction

1.2 In this Agreement, save where the contrary is expressly indicated in this Agreement, paragraph 2 (*Principles of Interpretation and Construction*) of schedule 1 (*Definitions*) of the Master Definitions Agreement shall apply and:

(a) references to dates in the Contract Programme are to such dates as may be amended only following an authorised Permitted Delay or the issue of an Authorisation to Vary;

(b) without prejudice to the rights and obligations set out in this Agreement, any reference to an internal policy of the TMM shall be deemed to be to such policy as amended or restated from time to time; and

(c) a Unit, Simulator, or item of Associated Equipment shall be deemed to be in the ***care, custody and control*** of the TMM until that Unit, Simulator, or item of Associated Equipment is Accepted, following which the provisions of (i) clause 1.2(e) of the TSA shall apply in determining care, custody and control of a Unit or Simulator, and (ii) clause 23.2 of the TSA shall apply in determining care, custody and control of the Associated Equipment.

Contract and specification precedence

1.3 In the event of any conflict between the elements of this Agreement, the following order of precedence shall apply:

(a) clauses 1 (*Definitions and Interpretation*) to 46 (*Contracts (Rights of Third Parties) Act 1999*) inclusive;

(b) the Schedules other than the Technical Schedules;

(c) Schedule 1 (*The Specification*); and

(d) the other Technical Schedules.

1.4 In the event of any conflict between the elements of the Specification, the following order of precedence shall apply:

(a) the TTS []\[8\];

(b) the TIIS;

(c) []\[9\]; and

(d) the TTD.

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8 Redaction.

9 Redaction.

Common Terms

1.5 Except as provided in clause 1.2, the common terms set out in schedule 2 (*Common Terms*) to the Master Definitions Agreement shall apply to this Agreement, where applicable, and shall be binding on all Parties. If there is any conflict between the provisions of such common terms and the provisions of this Agreement, the provisions of this Agreement shall prevail.

Contract and Specification Interface

1.6 The provisions of Schedule 1.6 (*TIIS Interface*) shall apply to the TIIS such that the terms set out in the column headed 'TIIS' therein, when used in the TIIS, shall have the meaning set out in the column headed 'MSA' in Schedule 1.6.

2. CONDITIONS PRECEDENT

Conditions Precedent

Save in relation to clause 1 (*Definitions, Interpretation and Common Terms*), this clause 2, clauses 30 (*Confidentiality of Information*) to 35 (*No Obligation to Verify Notices*) (inclusive), 37 (*Costs*) to 40 (*Assignment and Sub-Contracting*) (inclusive) and 42 (*Survival*) to 46 (*Contracts (Rights of Third Parties) Act 1999*) (inclusive), which shall be effective on and from the date of this Agreement, the rights and obligations of the Parties to this Agreement shall commence on the Effective Date.

3. [NOT USED]

4. THE REQUIREMENTS

The Units

4.1 The TMM shall design, manufacture, test, certify, commission and sell to the Owner the Initial Units, in each case in accordance with the Specification, the Contract Programme, the Quality Plan, the Agreed Testing Programme, all Applicable Laws and Standards and otherwise in accordance with and compliance with this Agreement.

4.2 The TMM acknowledges that the Owner will let the Units that have been Accepted into the possession of the Operator immediately following the transfer of title to the Owner in accordance with clause 21.2.

Special Tools and Spares

4.3 The TMM shall design, manufacture, test, certify and sell to:

(a) the Owner, the Special Tools and the Owner Owned Spares; and

(b) the Operator, the Operator Owned Spares,

in each case, in accordance with the Specification, the Contract Programme, the Quality Plan, the Agreed Testing Programme, all Applicable Laws and Standards and otherwise in accordance with and in compliance with this Agreement.

4.4 The TMM acknowledges that the Owner will let the Special Tools and Owner Owned Spares that have been Accepted into the possession of the Operator immediately following the transfer of title to the Owner in accordance with clause 21.2.

4.5 The Owner, the Operator and the TMM (in the case of the Owner Owned Spares and the Special Tools) and the Operator and the TMM (in the case of the Operator Owned Spares) shall co-operate in good faith to agree:

(a) within six months of the date of this Agreement, the list of Maintenance Special Tools (which, when delivered, shall be identified as such), their corresponding fixed prices (on a per item basis) and the Expected Delivery Date applying to each type of such tools, such list and prices to be determined with reference to the indicative list of special equipment, tools, software and other materials, set out in paragraph 1.1 (*Maintenance Special Tools*) of Schedule 7.1 (*Special Tools*) and to the Contract Programme;

(b) within six months of the date of this Agreement, the list of Operator Special Tools (which, when delivered, shall be identified as such) and their corresponding fixed prices (on a per item basis) and the Expected Delivery Date applying to each type of such tools, such list and prices to be determined with reference to the indicative list of special equipment, tools, software and other materials, set out in paragraph 1.2 (*Operator Special Tools*) of Schedule 7.1 (*Special Tools*) and to the Contract Programme;

(c) within six months of the date of this Agreement, the list of Initial Spares and Critical Spares (which, when delivered, will be identified as such) and their corresponding fixed prices (on a per item basis) and the Expected Delivery Dates applying to each type of such Spares, such list and prices to be determined with reference to the indicative list of initial spares and critical spares, set out respectively in paragraphs 1 (*Initial Spares*) and 2 (*Critical Spares*) of Schedule 7.2 (*Spares*) and to the Contract Programme; and

(d) no later than six months before the Expected Delivery Date of the First Unit, the list of Operator Owned Spares and their corresponding fixed prices (on a per item basis), such list and prices to be determined with reference to the indicative list of spares, set out in paragraph 4 (*Operator Owned Spares*) of Schedule 7.2.

4.6 In the event that the Maintenance Special Tools and Owner Owned Spares agreed by the Owner, the Operator and the TMM pursuant to clause 4.5 and provided by the TMM to the Owner in accordance with this Agreement are insufficient to enable the TMM to maintain or carry out any warranty work to the Units pursuant to this Agreement and perform the Standard Services under the TSA, the TMM shall, at its own cost, procure all necessary additional Spares and/or Maintenance Special Tools in accordance with clauses 10 (*Spares*) and 11 (*Special Tools*) of the TSA.

4.7 Without prejudice to clause 4.6, if a Spare or Special Tool is not available and this prevents the TMM performing its obligations under this Agreement, there shall be no relief granted to the TMM under this Agreement.

Mock-up

4.8 The TMM shall build a mock-up of the Units which complies with the requirements set out in Schedule 7.3 (*Mock-up*) in accordance with the Contract Programme, the Quality Plan, the Agreed Testing Programme, all Applicable Laws and Standards and otherwise in accordance with and in compliance with this Agreement.

4.9 Before Acceptance of the Mock-up, the TMM shall store the Mock-up in a secure location and grant the Owner (as required for the performance of its role in the Design Review Process) and the Operator reasonable access, subject to prior agreement of the dates and times for such access between the Owner and the Operator and the TMM (as applicable).

4.10 The TMM shall deliver the Mock-up to the Operator for Acceptance in accordance with the Contract Programme, at a location to be agreed between the Operator and the TMM. For a period of 36 months from the date of Acceptance of the Mock-up, the TMM shall, at its own cost and provided that the Operator has granted the TMM access to the Mock-up pursuant to clause 4.11, update the Mock-up when necessary to reflect changes made to the Units as part of the design process and the TMM shall keep a detailed log and photographic record (each of which shall be available to the Owner and the Operator at all times) of all changes which are made to the Mock-up.

4.11 After Acceptance of the Mock-up, the Operator shall grant to the TMM and the Owner (as required for the performance of its role in the Design Review Process) reasonable access to the Mock-up, subject to prior agreement of the dates and times for such access between the Operator and the Owner and the TMM (as applicable), whilst the Mock-up is at that agreed location.

Simulators

4.12 The TMM shall design, manufacture, test, certify, commission and sell to the Owner the Simulators, in each case in accordance with the Simulator Specification, the Contract Programme, the Quality Plan, the Agreed Testing Programme, all Applicable Laws and Standards and otherwise in accordance with and in compliance with this Agreement.

4.13 The TMM acknowledges that the Owner will let the Simulators that have been Accepted into the possession of the Operator immediately following the transfer of title to the Owner in accordance with clause 21.2.

4.14 The TMM shall deliver the Simulators to the Owner (or, if the Owner allows, the Operator's nominated training organisation) for Acceptance in accordance with the Contract Programme, at a Designated Depot or such other location as is agreed

between the TMM and the Operator in accordance with clause 4.15, such location to be notified to the Owner.

4.15 In the event of a delay to the construction of a Designated Depot such that it is reasonably likely that the accommodation for a Simulator at the relevant Designated Depot will not be completed before:

(a) in the case of the first Simulator to be supplied, the date that Simulator is required to be supplied in order to avoid a delay to the Acceptance of the First Unit by reason of paragraph 3.1(m) of Schedule 6 (*Delivery and Acceptance*); or

(b) in the case of the second Simulator to be supplied, the Expected Delivery Date for such Simulator,

then without prejudice to the provisions of clause 19.4 and Schedule 13 (*Permitted Delay Procedure*), the Operator shall use reasonable endeavours to identify and nominate an alternative location for the supply of such Simulator that would minimise the delay in the supply of that Simulator, and the TMM shall consider and respond reasonably and promptly to that nomination.

4.16 If an alternative location is agreed between the TMM and Operator for the supply of a Simulator pursuant to clause 4.15, the Operator and the TMM shall notify the Owner and shall co-operate to procure the relocation of that Simulator to the relevant Designated Depot as soon as reasonably possible after the completion of that Designated Depot. The costs of procuring an alternative location and the costs of relocation of such Simulator to the relevant Designated Depot shall be borne:

(a) by the Operator if the cause of the delay to the Designated Depot that required the use of an alternative location is a Permitted Depot Delay described under sub-paragraph (a), (b), (d) or (e) of the definition of Permitted Depot Delay in the relevant Depot Agreement for Leases;

(b) equally by the Operator and the TMM if the cause of the delay to the Designated Depot that required the use of an alternative location is a Permitted Depot Delay that arises as the result of a Depot Force Majeure Event; and

(c) otherwise, by the TMM.

Integration Laboratory Train Equipment

4.17 The TMM shall design, manufacture, test, certify, commission and sell to the Operator the Integration Laboratory Train Equipment which complies with the requirements set out in Schedule 7.4 (*Integration Laboratory Train Equipment*) in accordance with the Contract Programme, the Quality Plan, the Agreed Testing Programme, all Applicable Laws and Standards and otherwise in accordance with and in compliance with this Agreement.

4.18 The TMM shall deliver the Integration Laboratory Train Equipment to the Operator for Acceptance in accordance with the Contract Programme, at a location to be agreed between the Operator and the TMM.

Technical Data

4.19 The Parties intend that each of:

(a) the TTS;

(b) the TIIS;

(c) the data described in the TIIS as "Virtual Test Track files" and/or "VTT files";

(d) the TTD;

(e) []10;

(f) []11; and

(g) Schedule 1.6 (*TIIS Interface*),

will be recorded electronically (on CD-ROM or such other medium acceptable to Owner, Operator and TMM) on the date of this Agreement and stored and marked in a manner agreed by the Parties instead of being printed.

5. DESIGN

Obligation to produce design descriptions

5.1 Without prejudice to the TMM's obligations under clauses 4.1 and 4.2, the TMM shall, in accordance with the Design Review Process, produce the design descriptions for each item of Equipment for review by the Owner and the Operator. Each design description shall:

(a) include detailed technical proposals and a list of technology to be utilised in the design and production of the relevant item of Equipment, in accordance with the Design Review Process; and

(b) demonstrate to the reasonable satisfaction of the Operator and the Owner that the TMM understands and has fully taken account of the Applicable Specification in relation to that item of Equipment and, in relation to the Units, the CONOPS, and that the TMM's proposals (including the design descriptions) will result in an item of Equipment which is at all times capable of meeting the TMM's obligations under this Agreement and the TSA and the Supplier's obligations under the TSSSA (together, the ***Design Requirement***).

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10 Redaction.

11 Redaction.

Notices of Non-Compliant Design

5.2 The Owner and/or the Operator shall, acting reasonably, be entitled (but not obliged) at any time during the review period (in accordance with the Design Review Process) of the design descriptions in relation to any item of Equipment to notify the TMM that the Design Requirement in relation to that item has not been met (a ***Notice of Non-Compliant Design***). Any Notice of Non-Compliant Design shall specify:

(a) those aspects of the Design Requirement that the Owner and/or the Operator believe have not been met in relation to any item of Equipment; and

(b) the reasonable time period within which the TMM shall revise its proposals to meet the Design Requirement in relation to that item of Equipment.

5.3 Following receipt of any Notice of Non-Compliant Design in relation to any item of Equipment, the TMM shall notify the Owner and the Operator within 5 Working Days of receipt that it either:

(a) agrees that its proposals fail to meet the Design Requirement in relation to that item of Equipment, in which case the TMM shall revise its proposals so that those proposals do meet the Design Requirement in relation to that item of Equipment and resubmit them to the Owner and the Operator, in each case within the time period specified in that Notice of Non-Compliant Design; or

(b) does not agree (acting reasonably) that its proposals fail to meet the Design Requirement in relation to that item of Equipment, in which case, the TMM may either:

(i) unless the Party who served the Notice of Non-Compliant Design has already withdrawn such Notice of Non-Compliant Design, under clause 5.8, refer that Notice of Non-Compliant Design to an Expert for determination in accordance with clause 5.5 below; or

(ii) notify the Owner and the Operator that it intends to continue with its proposals at the TMM's own cost and risk without having the matter referred to an Expert.

5.4 On receipt of such notice under clause 5.3(b)(ii), if the Owner and/or Operator decides that it does not wish the TMM to continue with its proposal at the TMM's own risk, the Owner or Operator (as the case may be) may refer the Notice of Non-Compliant Design to an Expert in accordance with clause 5.5. If and to the extent that the matter is referred to an Expert pursuant to this clause 5.4 and:

(a) it is determined by an Expert that the Design Requirement has not been met in relation to that item of Equipment, the TMM shall revise its proposals so that those proposals do meet the Design Requirement in relation to that item of Equipment and resubmit them to the Owner and the Operator, in each case within the time period specified in that Notice of Non-Compliant Design, provided that such time period shall commence on and from the date of determination by the Expert; or

(b) it is determined by an Expert that the Design Requirement has been met in relation to that item of Equipment, the TMM shall, subject to the provisions set out at Schedule 13 (*Permitted Delay Procedure*), be entitled to a Permitted Delay (either under limb (a) of the definition of Permitted Delay, if the Operator served the Notice of Non-Compliant Design, or limb (b) of the definition of Permitted Delay, if the Owner served the Notice of Non-Compliant Design) from the date on which the matter is referred to the Expert for determination pursuant to this clause 5.4 until the date of determination by the Expert.

5.5 If a Notice of Non-Compliant Design is referred to an Expert for determination, the Applicable Expert Determination Provisions shall apply.

5.6 The issue of a Notice of Non-Compliant Design or a determination by an Expert in relation to any item of Equipment (whether or not in favour of the TMM) shall not preclude the issue by the Owner and/or the Operator of any further Notices of Non-Compliant Design in relation to design descriptions of that item of Equipment during the review period of those design descriptions in accordance with the Design Review Process.

5.7 The TMM shall not be entitled to any Permitted Delay or, save where an Authorisation to Vary is issued, other extension of an Expected Delivery Date as a result of it being agreed or determined that the Design Requirement has not been met in relation to any item of Equipment.

5.8 A Party who has served a Notice of Non-Compliant Design may withdraw such Notice of Non-Compliant Design at any time (including, without limitation, after referral to an Expert under clause 5.4). The Party so withdrawing its Notice of Non-Compliant Design shall be liable for the reasonable costs of the other Parties in responding to such Notice of Non-Compliant Design, including the costs of any Expert that have accrued prior to the withdrawal.

Opinions and preferences

5.9 Whether or not the Design Requirement has been met during the review period (in accordance with the Design Review Process), the Owner and/or the Operator shall be entitled to give opinions on the design descriptions (or any part thereof) to the TMM but the Owner and/or Operator shall not have any liability whatsoever in relation to any actions carried or not carried out by the TMM on the basis of or arising from such opinions.

5.10 Any indication of approval or acceptance by the Owner and/or the Operator shall not be deemed to be acceptance of any liability or responsibility by either the Owner or the Operator for any design description or such other information in connection with such design description, which shall at all times remain the TMM's obligation and responsibility.

Improvements and modifications

5.11 If the TMM or any Sub-Contractor of a Key Component, acting reasonably, identifies any relevant improvements and/or modifications in relation to the design, testing and manufacturing process of any Equipment, which it identifies as a result of its participation in the design, manufacturing, testing and operation of rolling stock vehicles or equipment relating thereto that are similar to the relevant Equipment, it will notify the Owner and the Operator and discuss in good faith whether and how such improvements can be incorporated into the design, manufacturing, testing and operation of the relevant Equipment by reference to the Engineering Change Control Procedure and the Applicable Variation Procedure.

Project Standards

5.12 In the event that the TMM identifies a situation whereby a design feature, system, subsystem or component is not adequately specified by all Applicable Laws and Standards, it shall be the responsibility of the TMM to establish or adopt a standard (the ***Project Standard***) to apply to the relevant design feature, system, sub-system or component in accordance with clause 5.13.

5.13 The TMM shall, promptly after it identifies a situation described in clause 5.12;

(a) notify the Owner and the Operator of such situation;

(b) submit its proposed Project Standard to the Owner and the Operator;

(c) discuss in good faith any changes or amendments to the TMM's proposed Project Standard with a view to agreeing a Project Standard; and

(d) submit the agreed Project Standard to an appropriate approval authority for endorsement, where necessary.

5.14 The TMM shall not be entitled to seek a Permitted Delay as a result of the performance of its obligations under clauses 5.12 and 5.13. The establishment or adoption of a Project Standard shall not constitute a Variation.

[][12]

5.15 [][13]

5.16 [][14]

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12 Redaction.

13 Redaction.

14 Redaction.

TTD Amendments

5.17 Where a design description is agreed by the Owner, the Operator and the TMM (or it is determined (in each case pursuant to the Design Review Process)) not to be consistent with, or otherwise to require an amendment to, the requirements of the TTD, then provided that the design description and the TTD as amended comply with the terms and requirements of the TTS and the TIIS:

(a) the adoption of such design description and the amendment of the TTD shall not constitute an Unauthorised Contract;

(b) the Applicable Variation Procedure shall not apply to and no Party shall be required to seek or obtain an Authorisation to Vary in respect of such design description or implementation of such design description, provided that such implementation is carried out in accordance with the terms of this Agreement; and

(c) references to the Specification shall mean references to the Specification so amended in accordance with the adoption of that design description.

6. APPROVALS

Notified Body

6.1 The TMM has appointed Interfleet Certification Limited as a Notified Body to validate the Design and construction of the Units in accordance with the requirements of the Railways (Interoperability) Regulations 2011. The TMM shall inform the Operator and the Owner in writing if it wishes to appoint an alternative Notified Body.

Authorisation For Placing Into Service

6.2 The TMM shall obtain from the ORR in accordance with the Approvals Plan, an unconditional Authorisation For Placing Into Service on the Thameslink Network, as required by Regulation 4.1 of the Railways (Interoperability) Regulations 2011 and undertake all activities necessary and related to obtaining such authorisation.

6.3 The Operator shall co-operate with the TMM for the purpose of obtaining an unconditional Authorisation for Placing into Service and shall, when requested by the TMM, provide the following co-operation in a timely manner and (in relation to the activities described in sub-clauses (a) and (b) of this clause 6.3) in any event within 5 Working Days of being requested to do so by the TMM:

(a) signing the necessary applications (where the TMM is unable to do so on the Operator's behalf);

(b) supplying any necessary information which is in the Operator's sole possession;

(c) promptly updating the Operator's Railway Safety Certificate (where the TMM is unable to do so on the Operator's behalf); and

(d) supplying appropriately qualified representatives to attend meetings with affected Parties, as may be necessary.

Relevant Approvals

6.4 Subject to the provisions of clauses 6.5 to 6.14 inclusive, the TMM, the Operator and the Owner shall co-operate in the preparation of material for submissions to be presented to the applicable Government Authority in support of applications for Relevant Approvals.

6.5 The TMM shall ensure that all the characteristics of the Units which are referable to the obligations of the TMM under this Agreement or the TSA are such that when the Units are operated on routes on the Thameslink Network which have the technical characteristics of the infrastructure interfaces specified in the TIIS by an experienced, diligent and prudent operator in accordance with the Manuals and all Applicable Laws and Standards, such characteristics are consistent with those of an electric unit which would be able to obtain all Relevant Approvals in accordance with the Approvals Plan.

6.6 The Approvals Plan is the TMM's plan for obtaining all Relevant Approvals required under this Agreement. The Approvals Plan specifies the obligations of the TMM, the Owner and the Operator under this Agreement in relation to all Relevant Approvals and, in certain cases, the time periods within which such obligations must be carried out.

6.7 The TMM, the Operator and the Owner shall implement the Approvals Plan in accordance with its terms.

6.8 Each time it is necessary for the Operator or the Owner to make a formal submission to a Government Authority for Relevant Approvals in relation to the Units, the TMM shall be primarily responsible for co-ordinating a review of the Approvals Plan and agreeing any amendments that are necessary to the Approvals Plan with the Owner and the Operator.

6.9 Notwithstanding the agreement of the TMM, the Owner and the Operator to co-operate in the preparation of materials for submissions for Relevant Approvals to Government Authorities and the provisions of clause 6.10, the TMM shall, in accordance with the Approvals Plan, be responsible for preparing all material necessary to support an application to a Government Authority for obtaining Relevant Approvals, staged approvals and letters of no objection which could be made by a rolling stock vehicle manufacturer to a Government Authority, with the reasonable assistance, where necessary, of the Operator pursuant to clause 6.11(a) or the Owner pursuant to clause 6.12(a).

6.10 Where a Relevant Approval may only be granted to a Train Operator or to the Owner (when it has become the Project Entity), the Operator or the Owner (as applicable) shall make the formal presentation of the submissions for such Relevant Approval to the relevant Government Authority in a timely manner and in any event within 10 Working Days of being requested to do so by the TMM, provided that the TMM shall have:

(a) provided the Operator or the Owner (as applicable) with the necessary documentation in accordance with the Approvals Plan so as to allow such Relevant Approval to be obtained in accordance with the Approvals Plan; and

(b) ensured that all documentation which the TMM provides is in the format that is agreed with the Operator or (if applicable) the Owner (both Parties acting reasonably) so as to be suitable for submission to the applicable Government Authority by the Operator or the Owner (as applicable) without re-drafting.

6.11 The Operator shall be responsible for:

(a) the preparation in a timely manner and in any event within 10 Working Days of being requested to do so by the TMM of all documentation forming part of submissions to Government Authorities for the Relevant Approvals that describe activities which are unique to the Operator's operation of the Units and which are therefore not within the TMM's control;

(b) enforcing its rights against Network Rail under any track access agreements to which it is a Party (including, without limitation, the Testing Track Access Agreement and the Track Access Agreement) in so far as such rights relate to the enforcement of Network Rail's obligations relevant to obtaining the Authorisation For Placing Into Service and other Relevant Approvals necessary for the introduction of new rolling stock into passenger service; and

(c) such parts of the formal submission process of obtaining Relevant Approvals which are not permitted in law to be carried out by any Party other than the Operator, and shall perform these obligations in a timely manner and in any event within 10 Working Days of being requested to do so by the TMM.

6.12 The Owner, when it has become the Project Entity, shall be responsible for:

(a) the preparation in a timely manner and in any event within 10 Working Days of being requested to do so by the TMM of all documentation forming part of submissions to Government Authorities for the Relevant Approvals that relates uniquely to the Owner's role as Project Entity and cannot be prepared by the TMM; and

(b) such parts of the formal submission process of obtaining Relevant Approvals which are not permitted in law to be carried out by any Party than the Owner (in its capacity as Project Entity), and shall perform such obligations in a timely manner and in any event within 10 Working Days of being requested to do so by the TMM.

6.13 Where any of the Parties wish to change any aspect of the design, maintenance or use of the Units in a way which would invalidate an existing Relevant Approval, the Parties shall seek to obtain any new Relevant Approvals, on the basis of the allocation of responsibilities set out in clauses 6.4 to 6.12 inclusive, subject to an Authorisation to Vary being issued where required in accordance with Transaction Documents.

6.14 To assist the TMM to comply with its obligations under clause 6.2, the Operator shall use reasonable endeavours to:

(a) pursue the application for an Authorisation For Placing Into Service with all due diligence and expedition with a view to ensuring the issue of any necessary Authorisation For Placing Into Service prior to the Expected Delivery Date for each Unit; and

(b) do all such other things as may reasonably be necessary to obtain an Authorisation For Placing Into Service prior to the Expected Delivery Date for such Unit.

Obligations in relation to infrastructure

6.15 The TMM hereby undertakes that:

(a) each of the Units:

(i) will, in accordance with the Approvals Plan, have the approval to operate (or have a permanent derogation which shall not be, and shall not be capable of becoming, a derogation limited in duration and which is acceptable to the Owner and the Operator, each acting reasonably) on all routes on the Thameslink Network which have the technical characteristics of the infrastructure interfaces specified in the TIIS; and

(ii) will be compatible with the technical characteristics of the infrastructure interfaces specified in the TIIS (or have a permanent derogation which shall not be, and shall not be capable of becoming, a derogation limited in duration and which is acceptable to the Owner and the Operator); and

(b) subject to clauses 6.16 to 6.21 (inclusive), it shall be solely responsible for ensuring that stepping distances on the Thameslink Network to and from each Vehicle doorway are compliant with all Applicable Laws and Standards.

6.16 If such stepping distances to and from each Vehicle doorway do not comply with the Applicable Laws and Standards by reason of the infrastructure not being compliant with Applicable Laws and Standards, then the Operator shall use reasonable endeavours to manage the stepping distance within the existing Operator's Safety Management System.

6.17 If:

(a) having used reasonable endeavours to do so, the Operator is not able to manage the stepping distance within the Operator's Safety Management System;

(b) the relevant platform is not listed in Schedule 3.2 (*Stepping Distances: List of Platforms*) as a failed platform; and

(c) the data upon which the list in Schedule 3.2 was produced (being the National Grid Database (NGD 110 dated July 2012)) (the ***Platform Base Data***) was correct and complete insofar as it relates to the relevant platform,

then the TMM shall be responsible for procuring the carrying out of any platform modifications necessary to ensure that the relevant stepping distances comply with Applicable Laws and Standards.

6.18 To the extent that the TMM is obliged pursuant to clause 6.17 to procure the carrying out of modifications to the infrastructure, the Operator shall use all reasonable endeavours to assist the TMM in obtaining access to the Network to carry out such modifications, including attending meetings with Network Rail, subject to reasonable notice of the requirement for any such meeting being received by the Operator. In the event that:

(a) the Operator, as a Train Operator, is the only Party (as between the TMM and the Operator) who can, in accordance with its track access rights, require Network Rail or any other infrastructure provider to carry out or permit the carrying out of the requested infrastructure modification; or

(b) the TMM and the Operator agree that it is appropriate for the Operator, rather than the TMM, to enter into the necessary infrastructure contracts required to undertake the requested infrastructure modification,

then the Operator agrees to enter into such infrastructure contracts at the TMM's risk and cost.

6.19 [NOT USED]

6.20 If:

(a) having used reasonable endeavours to do so, the Operator is unable to manage the stepping distance within the existing Operator's Safety Management System;

(b) the relevant platform is not listed as a failed platform in Schedule 3.2 (*Stepping Distances: List of Platforms*); and

(c) the Platform Base Data was not correct and complete insofar as it relates to the relevant platform,

the Operator will take responsibility (at the cost and risk of the Operator), for procuring that any platform modifications necessary to ensure that the relevant stepping distances comply with Applicable Laws and Standards are carried out, (such work to be completed by the completion date to be set out in the relevant Variation), and the Parties shall enter into a Variation (provided that such Variation has been approved by the Secretary of State issuing an Authorisation to Vary, it being the Operator's responsibility to secure such approval) to amend Schedule 3.2 and Schedule 9 (*Contract Programme*) (by the addition of a completion date for the relevant platform modification works), but such Variation shall not provide any financial compensation or relief to the TMM in any circumstances whatsoever:

(d) in relation to any Modifications to the Units or modifications to the infrastructure which the TMM must undertake to comply with its obligations under clauses 6.15 to 6.17 (inclusive); and

(e) save where, and to the extent that:

(i) it is confirmed in the relevant Authorisation to Vary that the platform modifications to be procured under the Variation are such that the TMM's performance of Infrastructure Dependent Obligations is or will be delayed; or

(ii) the relevant modification works are not completed by the completion date set out in the Variation,

and in each case such delay or failure is agreed or determined, in accordance with the provisions of Schedule 13 (*Permitted Delay Procedure*), to give rise to a Permitted Delay under paragraph (h) of the definition of such term in the Master Definition Agreement.

6.21 Subject to clauses 6.15 to 6.18 inclusive, the Operator shall be responsible for procuring platform modifications to those platforms listed as failed platforms in Schedule 3.2 to the extent such modifications are necessary to ensure that stepping distances to and from each Vehicle doorway comply with Applicable Laws and Standards, such work to be completed by the date stated in the Contract Programme.

7. OPERATOR'S TRAINERS' TRAINING AND PROGRAMME

Agreed Training Programme

7.1 The TMM shall provide the Operator with a draft training programme no later than four months after the date of this Agreement which shall include:

(a) the specified number of courses and maximum numbers of attendees on each such course as set out in the Appendix (*Required Training Courses*) to Schedule 10 *Project Management*) for the purpose of training of:

(i) training instructors to enable the Operator to:

(A) train its drivers, other employees and the drivers, and other employees of other Train Operators where any Units are to be subleased as permitted pursuant to the Lease, in each case to operate the Units and the Simulators;

(B) provide training to its repair training staff in respect of the Repair Procedures;

(C) undertake its responsibilities in relation to the provision of drivers and train crew for testing under this Agreement; and

(D) undertake its responsibilities under the TSA including in respect of the carrying out of Cosmetic Repairs to the Units; and

(ii) other employees of the Operator to administer such programme; and

(b) the provision of the training materials referred to in clause 7.4.

7.2 The Operator, acting reasonably, shall notify the TMM of any amendments to the draft training programme with the purpose of achieving the objective referred to in clause 7.1 within 30 Working Days of receiving the draft training programme from the TMM and the TMM shall incorporate such amendments as are agreed between the TMM and the Operator, each acting reasonably, as soon as reasonably practicable thereafter.

7.3 The TMM shall provide the Operator with the final version of the training programme, incorporating only those amendments referred to in clause 7.2 (in hard copy and electronic copy form) within 14 days of the Operator notifying the TMM of any amendments in accordance with clause 7.2 and the final version shall be the ***Agreed Training Programme***, as defined for the purposes of this Agreement.

7.4 Without prejudice to clause 10.8, the TMM shall in accordance with the Agreed Training Programme provide the Operator with such training materials (including the Manuals and any updates thereto) in both hard copy and in an electronic format specified by the Operator as are, in each case, reasonably necessary to permit the Operator's training instructors to undertake further training of the Operator's drivers, other employees and the drivers and other employees of other Train Operators where any Units are to be subleased pursuant to the Lease, subject in the case of such further training, to the provision by the Operator of reasonable access to an Accepted Unit. The Operator shall be entitled, free of charge, to duplicate as many copies of such training materials as it reasonably requires for the purposes of training its drivers and other employees and, in relation to training materials relating to the operation, maintenance and repair of the Units (including Cosmetic Repairs) only, the drivers and other employees of other Train Operators to whom the Units are subleased as permitted pursuant to the Lease.

7.5 The training programme shall be provided at the locations set out in the Appendix (*Required Training Courses*) to Schedule 10 (*Project Management*) and otherwise at the TMM's test centre at Wildenrath, Germany or, if agreed between the TMM and the Operator, at a Designated Depot (or at any other location as may be agreed by the TMM and the Operator) over a period and at times to be agreed between the TMM and the Operator.

7.6 The Operator shall be responsible for:

(a) the costs of its own employees, including accommodation, subsistence and travel costs;

(b) when the training occurs on the Thameslink Network, any consequent track access charges to effect such training; and

(c) where the training occurs at a Designated Depot, for the provision of track access to such Designated Depot,

unless such costs arise as a result of a failure by the TMM to comply with the Agreed Training Programme, in which case, such costs shall be borne by the TMM.

Additional Training

7.7 The TMM will, at the Operator's request and cost, provide such additional training, over and above any training specified in the Agreed Training Programme, as the Operator may require from time to time. Any such request by the Operator shall not constitute a Variation Proposal and the Applicable Variation Procedure shall not apply in relation to such request. On completion of the additional training, the TMM shall submit an invoice to the Operator at the address specified in clause 34 (*Notices*) within five Working Days of the last day of such additional training. The invoice shall detail the additional training carried out and shall specify the total cost of the additional training (which shall be reasonable). The Operator shall, subject to receipt by it of an appropriate invoice, pay to the TMM the amount of the invoice no later than 28 days following receipt of such an invoice.

7.8 Where such additional training is required as a result of:

(a) any Modifications requested by the TMM (other than a Mandatory Modification);

(b) an event which would constitute a Change in Law but for the exceptions contained in the definition thereof; or

(c) any delayed delivery of any Units which leads to a requirement for refresher training (unless such delay constitutes a Permitted Delay, in which case the costs shall be paid by the Owner in accordance with paragraph 4.5(b) of Schedule 13 (*Permitted Delay Procedure*) if the Permitted Delay, falls under limb (b) of the definition of Permitted Delay in the Master Definitions Agreement, and by the Operator in all other cases of Permitted Delay),

such additional training shall, in each case, be provided by the TMM at no additional cost to the Operator, save where the Operator is required to pay such costs pursuant to clause 7.8(c).

8. TESTING AND CERTIFICATION

Unit and Simulator testing

8.1 The TMM shall carry out testing on the Units and the Simulators in accordance with the Agreed Testing Programme, the Contract Programme, the Quality Plan and all Applicable Laws and Standards.

8.2 The TMM's obligations pursuant to clause 8.1 shall specifically include the following:

(a) supply and correct calibration of all Test Equipment required for the testing of the Units;

(b) inspection and maintenance in accordance with the Pre-Acceptance Maintenance Plan;

(c) preparation of all test scripts in respect of all tests undertaken by the Units and Simulators;

(d) preparation and completion of all test reports in respect of all tests undertaken by the Units and Simulators;

(e) repair and rectification of defects to Units and Simulators discovered during testing and any testing required following such repair and/or rectification;

(f) carrying out of all necessary post-delivery testing;

(g) undertaking any pre- and post-delivery commissioning work prior to testing of the Units on the Thameslink Network; and

(h) undertaking any pre- and post-delivery commissioning work prior to Acceptance in relation to the Simulators.

Acceptance Testing Matrix and Agreed Testing Programme

8.3 The TMM shall provide the Owner and the Operator with a draft Acceptance Testing Matrix no later than 5 months after the Effective Date.

8.4 The Owner and the Operator, each acting reasonably, shall notify the TMM of any amendments required to the draft Acceptance Testing Matrix within 30 Working Days of receiving the draft Acceptance Testing Matrix from the TMM, and the TMM shall incorporate such amendments as are agreed between the TMM, the Owner and the Operator, each acting reasonably, as soon as reasonably practicable thereafter.

8.5 The TMM shall provide the Owner and the Operator with an updated version of the Acceptance Testing Matrix, incorporating only those amendments referred to in clause 8.4, (in electronic form) within 14 days of the Owner and/or the Operator notifying the TMM of any amendments in accordance with clause 8.4 and such updated version shall, subject to clause 8.6, be the ***Acceptance Testing Matrix*** as defined for the purposes of this Agreement.

8.6 If, the Owner, Operator and TMM subsequently agree that any part of the Acceptance Testing Matrix shall be amended (except by way of an amendment that is inconsistent with Schedule 4.1 (*Requirements for Agreed Testing Programme*)), then the TMM shall incorporate such amendments into the Agreed Testing Programme without submitting a Variation Proposal, such amendment shall not constitute a Variation under the Applicable Variation Procedure, and no person shall be required to seek or obtain an Authorisation to Vary in respect of such amendment.

Full Testing, Opinions and Witnessing

8.7 The TMM shall give at least 20 Working Days' notice to the Owner and the Operator of the full testing programmes being undertaken in accordance with the Acceptance Testing Matrix, and the Owner and the Operator, or their respective

representative (who is authorised in accordance with clause 15.1), may witness any such testing.

8.8 The Owner and Operator shall be entitled to give opinions on any testing to TMM, but shall have no liability to the TMM in relation to any actions taken or not taken by TMM on the basis of those opinions.

Track Access and Train Crew

8.9 The Operator shall, at its own cost:

(a) procure such track access as is specified in the Agreed Testing Programme and in accordance with the profile set out in Schedule 4.1 and Schedule 9 (*Contract Programme*);

(b) provide the train crew, operating supervisors and drivers for testing to be carried out on the Network as are specified in the Agreed Testing Programme and in accordance with the profile set out in Schedule 4.1 and Schedule 9;

(c) where any Unit fails whilst it is being tested pursuant to the Agreed Testing Programme:

(i) provide rescue locomotives and rescue locomotive drivers; and

(ii) arrange for the transport of such Unit to the relevant Designated Depot (or such other location as the relevant testing is being conducted from),

provided that if such a Unit cannot be moved by rail, the Operator shall move the Unit to a safe location and the TMM shall be responsible for (including meeting the costs of) transporting that Unit by road; and

(d) upon notification by the TMM that any track access which has been booked by the Operator is required on a different date (whether before or after the original booking), use reasonable endeavours to:

(i) cancel that booking and to re-book on an alternative date requested by the TMM; and

(ii) provide the necessary train crew, operating supervisors and drivers for testing on such alternative date,

provided that if the re-booking is caused by the TMM and not due to a Permitted Delay, the TMM shall reimburse to the Operator any additional costs incurred by the Operator in making such cancellation and re-booking, net of any savings (if any) made by the Operator. Prior to confirming any such re-booking, the Operator shall inform the TMM of its net additional costs arising therefrom. The Operator shall be under a duty to use reasonable endeavours to avoid or mitigate the additional cost resulting from any such re-booking,

but this clause 8.9 shall not apply to the operation of the Testing Units (for which the provisions of clause 8.21 shall apply).

8.10 Where the TMM requires the Operator to provide any train crew, operating supervisors, drivers, track access, rescue locomotives or rescue locomotive drivers that are over and above the relevant requirements of clause 8.9 or the Agreed Testing Programme:

(a) the Operator shall provide such crew, supervisors, drivers, access or locomotives (as the case may be), in which regard the Operator shall use reasonable endeavours to provide them on the dates requested by the TMM and, if it is unable to do so, shall provide them as soon as reasonably practicable thereafter, provided that the Operator is not required to do anything under this clause 8.10 that would be reasonably likely to adversely affect its ability to provide revenue-earning services, in accordance with its Franchise Agreement; and

(b) any such provision shall be at the TMM's cost.

ERTMS and ATO Integration Testing

8.11 The TMM shall, subject to the requirements of the Maintenance Plan (and, if the Owner and the Operator agree to use a Unit with any Preconditions other than completion of the ERTMS/ATO testing set out in Schedule 4.2 (*ERTMS/ATO Testing Support*), subject to the Preconditions Timetable relating to such Preconditions) make available to the Operator for use at a Network Rail integration testing facility notified by the Operator to the TMM (and/or such other location(s) on the Thameslink Network notified by the Operator to the TMM), the following Units (together, the ***Testing Units***) to carry out the testing specified in Phase 2 of the ERTMS/ATO Integration Testing Programme:

(a) one Type 1 Unit that has functioning Automatic Train Operation and European Train Control System equipment installed that in each case complies with the Specification, for a period of up to []15 consecutive months (the ***Testing Period***) commencing as soon as reasonably practicable, but in any event, no later than []16 months from the date of this Agreement or such later date as is mandated by any relevant Permitted Delay; and

(b) one Type 1 Unit or Type 2 Unit (as decided by the Operator) that has functioning Automatic Train Operation and European Train Control System equipment installed that in each case complies with the Specification, for a period in aggregate of three months during the Testing Period, on dates to be agreed by the TMM and the Operator (which shall be dates on which the Type 1 Unit referred to in clause 8.11(a) is also available for the testing specified in Phase 2 of the ERTMS/ATO Integration Testing Programme),

and the TMM shall procure that each of the Testing Units has received a Qualified Provisional Acceptance Certificate where the only Precondition attached to that Unit is, unless the Owner and the Operator otherwise agree and subject to clause 8.23, the successful

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15 Redaction.

16 Redaction.

completion of Phase 2 of the ERTMS/ATO Integration Testing Programme by the relevant date specified in this clause 8.11 for which they are first made available for the carrying out of the Automatic Train Operation and European Train Control System integration testing specified in Phase 2 of the ERTMS/ATO Integration Testing Programme.

8.12 Where one or more Faults on a Testing Unit causes such Unit to be unavailable for testing pursuant to Phase 2 of the ERTMS/ATO Integration Testing Programme during the Testing Period, the TMM shall be deemed not to have made such Unit (and, if both Testing Units were scheduled for testing in the period during which such unavailability takes place, both Testing Units to the extent that the scheduled testing required the availability of both Testing Units) available for the period during which such Testing Unit is unavailable for testing.

8.13 If a Fault on a Testing Unit causes the unavailability of that Testing Unit as described in clause 8.12, the TMM shall be entitled to replace such unavailable Testing Unit with another Unit (and such replacement Unit shall become a Testing Unit and the replaced Unit shall cease to be a Testing Unit), provided that such replacement Unit shall:

(a) be in the same configuration as the replaced Unit immediately prior to the Fault (except to the extent that such configuration was the cause of the Fault); and

(b) be deemed to have been made available as a Testing Unit pursuant to clause 8.11 only when it satisfies sub-clause (a) above.

8.14 In the event that an unavailability of Testing Units causes any part of Phase 2 of the ERTMS/ATO Integration Testing Programme to be delayed past the end of the Testing Period:

(a) the Testing Period shall be extended in accordance with clause 8.15;

(b) if required, the ERTMS/ATO Integration Testing Programme shall be amended to take account of such extension pursuant to clause 8.31; and

(c) the requirement that the Testing Period be one continuous period shall no longer apply.

8.15 The Owner, Operator and TMM shall use reasonable endeavours to agree a mutually acceptable extension to the Testing Period to complete the testing that has been delayed past the end of the Testing Period as a result of the unavailability of Testing Unit(s) referred to in clause 8.14, taking into account the constraints of such delayed testing (including but not limited to the location for such testing and the availability of traincrews and the availability of testing engineers from the signalling contractor, Network Rail or the Operator), provided that if and to the extent that there is any change to the period, such change shall not constitute a Variation and no person shall be required to seek or obtain an Authorisation to Vary in respect of such change.

8.16 [NOT USED]

8.17 The support provided by the TMM pursuant to clauses 8.11 to 8.31 (inclusive) and as further described and defined in Schedule 4.2 (the ***ERTMS/ATO Support***), shall be provided by the TMM up to and including the ERTMS/ATO Support Date. The ERTMS/ATO Support Date shall not be amended by the implementation of any Permitted Change (MSA).

8.18 If any delay (except for Permitted Delay) in delivery for Acceptance of Units causes the testing in Phases 2 and/or 3A of the ERTMS/ATO Integration Testing Programme to be delayed beyond the ERTMS/ATO Support Date:

(a) the ERTMS/ATO Support Date shall be postponed in accordance with clause 8.20; and

(b) if required, the ERTMS/ATO Integration Testing Programme shall be amended to take account of such postponement pursuant to clause 8.31.

8.19 [NOT USED]

8.20 Where the ERTMS/ATO Support Date is to be postponed pursuant to clause 8.18, the Owner, Operator and TMM shall use reasonable endeavours to agree a mutually acceptable postponement of the ERTMS/ATO Support Date (provided that if and to the extent that there is any change to such date, such change shall not constitute a Variation and no person shall be required to seek or obtain an Authorisation to Vary in respect of such change).

8.21 The Operator shall, at its own cost, procure such track access and provide such train crew, operating supervisors and drivers as, in each case, are required for the testing specified in Phase 2 of the ERTMS/ATO Integration Testing Programme, for moving Units to and from the Designated Depots for maintenance pursuant to the Maintenance Plan (and, if the Owner and the Operator agree to use a Unit with any Preconditions other than completion of the testing set out in Phase 2 of the ERTMS/ATO Integration Testing Programme, for actions required to address those Preconditions in accordance with the relevant Precondition Timetable).

8.22 For the purposes of paragraph 7 (*Fleet Acceptance*) of Schedule 6 (*Delivery and Acceptance*):

(a) the TMM shall not be required to have achieved Final Acceptance in respect of the Testing Units; nor

(b) shall the Testing Units be counted as part of the Fleet for the purposes of paragraph 7.2(c) of Schedule 6,

provided that, on the date on which the last Initial Unit (other than the Testing Units) achieves Final Acceptance, the only Precondition remaining to be satisfied on the Qualified Provisional Acceptance Certificate of each of the Testing Units is the successful completion of the testing specified in Phase 2 of the ERTMS/ATO Integration Testing Programme.

8.23 For the purposes of paragraph 4.12 of Schedule 6, if:

(a) the Testing Units have been made available during the Testing Period pursuant to clause 8.11 (and, if applicable, clause 8.14); and

(b) despite not achieving successful completion of the testing specified in Phase 2 of the ERTMS/ATO Integration Testing Programme, no Fault related to onboard ERTMS or ATO equipment that has been identified on either of the Testing Units remains to be rectified by the end of the Testing Period,

then the Precondition relating to successful completion of the testing specified in Phase 2 of the ERTMS/ATO Integration Testing Programme shall be deemed to have been satisfied.

ERTMS/ATO Integration Testing Programme

8.24 The Operator shall provide the Owner and the TMM with a draft ERTMS/ATO integration testing programme, which defines the overall scope, sequence and timing of tests (but not the detailed test procedures), in accordance with the outline set out in Schedule 4.2:

(a) in relation to Phase 1 of the testing specified in Schedule 4.2, no later than []17 after the date of this Agreement;

(b) in relation to Phase 2 of the testing specified in Schedule 4.2, no later than []18 after the date of the FDR meeting of TFR 11 as set out in the Contract Programme and Schedule 2.1 (*Design Review Process*);

(c) in relation to Phase 3A of the testing specified in Schedule 4.2, no later than []19 after the date of the FDR meeting of TFR 11 as set out in the Contract Programme and Schedule 2.1; and

(d) in relation to Phase 3B of the testing specified in Schedule 4.2, no later than []20 after the date of the FDR meeting of TFR 11 as set out in the Contract Programme and Schedule 2.1.

8.25 The Owner and the TMM, each acting reasonably, shall notify the Operator of any amendments required to any draft ERTMS/ATO integration testing programme submitted in accordance with clause 8.24 within 30 Working Days of receiving the draft programme from the Operator, and the Operator shall incorporate such amendments as are agreed between the Owner, the TMM and the Operator, each acting reasonably, as soon as reasonably practicable thereafter. Any such amendments shall not constitute a Variation and no person shall be obliged to seek or obtain an Authorisation to Vary in respect of such amendments.

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17 Redaction.

18 Redaction.

19 Redaction.

20 Redaction.

8.26 The Operator shall provide the Owner and the TMM with the final version of each ERTMS/ATO integration testing programme incorporating only those amendments referred to in clause 8.25 (in hard copy and electronic copy format) within 14 days of the Owner and/or the TMM notifying the Operator of any amendments in accordance with clause 8.25 and such final versions shall constitute the ***ERTMS/ATO Integration Testing Programme*** for the relevant phase of the testing specified in Schedule 4.2 as defined for the purposes of this Agreement. The Owner, the TMM or the Operator may subsequently propose amendments to the relevant ERTMS/ATO Integration Testing Programme and such amendments shall be considered by the other Parties, acting reasonably, and if agreed incorporated in an updated document, and such updated document or documents shall constitute the relevant ERTMS/ATO Integration Testing Programme. Any such updates to the timing of an ERTMS/ATO Integration Testing Programme shall not constitute a Variation (and no person shall be required to seek or obtain an Authorisation to Vary in respect of such updates) unless there is also an impact on the obligations of any Party to this Agreement or the risks to which a Party is exposed under this Agreement, in which case the affected party will be entitled to use the Applicable Variation Procedure.

8.27 The relevant ERTMS/ATO Integration Testing Programme shall contain clear criteria indicating what shall constitute successful completion for the purposes of clause 8.23 of Phase 2 of the ERTMS/ATO Integration Testing Programme. Such criteria shall be based on demonstration that the relevant Testing Unit remains compliant with the relevant aspects of the Specification when operated under ATO/ERTMS control on the Thameslink Network.

8.28 The TMM shall support the development and execution of the ERTMS/ATO Integration Testing Programme, with the objectives of demonstrating that:

(a) the Units remain compliant with the Specification when operated under ERTMS and ATO control on the Thameslink Network;

(b) the Units can interface correctly with the ERTMS and ATO equipment installed in the Network Rail infrastructure; and

(c) the Units, when integrated with the infrastructure, are ready to support a 24 trains per hour service through the Thameslink Core.

8.29 As part of the ERTMS/ATO Support, the TMM shall provide all necessary expert support to the Operator during the execution of the ERTMS/ATO Integration Testing Programme as set out in Schedule 4.2, in relation to the design of the Units (including the ERTMS/ATO onboard subsystems and their interfaces with the corresponding infrastructure based subsystems), the performance of the Units and the diagnosis and proposed resolution of integration issues which may arise. Such support shall include cooperation and participation with the Operator and Network Rail in the development and implementation of a common approach to problem resolution during integration which will include a common DRACAS (defect reporting and corrective action system) for identifying and analysing faults across the track-to-train interface and providing both a common forum for guiding analysis and diagnosis and a fast

acting process for reaching technical agreement on the diagnosis and proposed resolution of integration issues which may arise.

Variations

8.30 In accordance with (and subject to the other provisions of) this Agreement: (i) changes to the Units required as a result of integration problems which are discovered through the execution of the ERTMS/ATO Integration Testing Programme and are not demonstrated to be due to a Fault or Design Defect would be authorised as Variations initiated by the Operator; and (ii) such Variations to the Units would be priced in accordance with schedules 4 (*Variations and Changes in Law*) and 5 (*Determining Financial Consequences of Variations and other changes*) of the Umbrella Agreement, [][21].

8.31 If an amendment to the ERTMS/ATO Integration Testing Programme is agreed between the TMM, the Operator and the Owner in the course of its execution, then, provided that such amendment does not require any change to the Units, the Specification or the Contract Price (in which case clause 8.30 will apply):

(a) such amendment of the ERTMS/ATO Integration Testing Programme and the execution of that programme incorporating such amendment shall not constitute an Unauthorised Contract;

(b) the Applicable Variation Procedure shall not apply to and no Party shall be required to seek or obtain an Authorisation to Vary in respect of the implementation of such amendment and the execution of the ERTMS/ATO Integration Testing Programme incorporating such amendment; and

(c) references to the ERTMS/ATO Integration Testing Programme shall mean that programme so amended.

9. ACCEPTANCE

Acceptance

9.1 The Units, the Owned Spares, the Special Tools, the Integration Laboratory Train Equipment, the Mock-up and the Simulators shall be delivered and Accepted in accordance with Schedule 6 (*Delivery and Acceptance*).

Units

9.2 The TMM shall supply to the Owner the Units, together with all associated Delivery Documentation and the Manuals, at an amount equal to the Total Contract Price:

(a) all in accordance with the Specification, the Contract Programme, the Quality Plan, the Agreed Testing Programme and all Applicable Laws and Standards; and

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[21] Redaction.

(b) such that they shall be Fit for Purpose (MSA) and otherwise in accordance with this Agreement.

Special Tools

9.3 The TMM shall supply to the Owner the Special Tools together with all associated Special Tools Delivery Documentation at the Special Tools Price:

(a) all in accordance with the Specification, the Contract Programme, the Quality Plan, the Agreed Testing Programme and all Applicable Laws and Standards; and

(b) such that they shall be Fit for Purpose (MSA) and otherwise in accordance with this Agreement.

Owner Owned Spares

9.4 The TMM shall supply to the Owner the Owner Owned Spares together with all associated Spares Delivery Documentation at the Owner Owned Spares Price:

(a) all in accordance with the Specification, the Contract Programme, the Quality Plan, the Agreed Testing Programme and all Applicable Laws and Standards; and

(b) such that they shall be Fit for Purpose (MSA) and otherwise in accordance with this Agreement.

Operator Owned Spares

9.5 The TMM shall supply to the Operator the Operator Owned Spares together with all associated Spares Delivery Documentation at the Operator Owned Spares Price:

(a) all in accordance with the Specification, the Contract Programme, the Quality Plan, the Agreed Testing Programme and all Applicable Laws and Standards; and

(b) such that they shall be Fit for Purpose (MSA) and otherwise in accordance with this Agreement.

Mock-up

9.6 The TMM shall supply the Mock-up to the Operator together with all associated Mock-up Delivery Documentation for consideration which forms part of the Total Contract Price (it being acknowledged by the Parties that no separate consideration is payable for the Mock-Up):

(a) all in accordance with Schedule 7.3 (*Mock-Up*), the Contract Programme, the Quality Plan, the Agreed Testing Programme and all Applicable Laws and Standards; and

(b) such that it shall be Fit for Purpose (MSA) and otherwise in accordance with this Agreement.

Simulators

9.7 The TMM shall supply the Simulators to the Owner together with all associated Simulator Delivery Documentation at the Simulators Price:

(a) all in accordance with the Simulator Specification, the Contract Programme, the Quality Plan, the Agreed Testing Programme and all Applicable Laws and Standards; and

(b) such that they shall be Fit for Purpose (MSA) and otherwise in accordance with this Agreement.

Integration Laboratory Train Equipment

9.8 The TMM shall supply to the Operator the Integration Laboratory Train Equipment together with all associated Integration Laboratory Train Equipment Delivery Documentation and the documentation described in Schedule 7.4 (*Integration Laboratory Train Equipment*) at the Integration Laboratory Train Equipment Price:

(a) all in accordance with Schedule 7.4, the Contract Programme, the Quality Plan, the Agreed Testing Programme and all Applicable Laws and Standards; and

(b) such that it shall be Fit for Purpose (MSA) and otherwise in accordance with this Agreement.

Storage

9.9 The TMM shall be responsible for providing for the storage of each of the Units, the Owned Spares, the Special Tools, each Simulator, the Integration Laboratory Train Equipment and the Mock-up at all times until, as the case may be:

(a) the transfer of title of that Unit under clause 21.2;

(b) Acceptance of the Owner Owned Spares and Operator Owned Spares under paragraph 8 (*Acceptance of Owned Spares*) of Schedule 6;

(c) Acceptance of the Special Tools under paragraph 9 (*Acceptance of Special Tools*) of Schedule 6;

(d) Acceptance of the Mock-Up under paragraph 10 (*Acceptance of Mock-up*) of Schedule 6;

(e) Acceptance of the Integration Laboratory Train Equipment under paragraph 11 (*Acceptance of Integration Laboratory Train Equipment*) of Schedule 6; and

(f) the transfer of title of that Simulator under clause 21.2.

10. TMM'S OBLIGATIONS

Performance of Obligations

10.1 The TMM agrees that, at all times in performing its obligations set out in this Agreement, it shall:

(a) do so in accordance with all due skill, competence, care, diligence, prudence and foresight to be expected of appropriately qualified and experienced professional designers, engineers, manufacturers and maintainers with experience in carrying out work of a similar scope, type, nature and complexity to that required under this Agreement;

(b) do so in accordance with the best modern design and engineering principles and practices of train manufacture and procurement prevailing at the date of this Agreement;

(c) comply in all respects with the standards or methods of performance detailed in any Applicable Specification and with all Industry Standards;

(d) ascertain and comply in all respects with all Applicable Laws and Standards, including performing its obligations in a safe manner and free from any material risk to the health and well being of persons using, operating or maintaining, or involved in the management of the Equipment, free from any material risk of pollution, nuisance, interference or hazard in relation to the Equipment;

(e) without prejudice to the foregoing, exercise all due skill, care, diligence and good safety practice in the performance of its obligations under this Agreement and not in any manner endanger the health and safety or unreasonably interfere (except as expressly provided in this Agreement) with the proper performance of the duties of the Operator's and/or the Owner's employees or those of any third parties and comply with the Health and Safety at Work etc. Act 1974 and the Transport and Works Act 1992;

(f) comply with any safety requirements as set out in this Agreement or any Applicable Laws and Standards; and

(g) use materials and goods which are new and of sound and good quality such that the Equipment will be of a new manufacture and of sound and good quality.

10.2 The TMM hereby warrants and undertakes that upon the date of Acceptance of each item of Equipment and in relation to each such item of Equipment:

(a) it is selling such item of Equipment with full title guarantee and free and clear of all encumbrances save in respect of any encumbrance created by, or attributable to, the Owner or the Operator;

(b) it has taken all necessary action to enable it to sell such item of Equipment to the Owner or Operator (as the case may be) and to make available or license to the Owner or Operator (as the case may be) all the Intellectual Property Rights referred to in clause 26 (*Intellectual Property Rights*);

(c) the entering into and performance of this Agreement by the TMM has not involved any breach of covenant, term or condition of any other contract to which it is a party;

(d) the item of Equipment complies with, is complete and in all respects in satisfactory working order and condition to perform in accordance with, the Applicable Specification;

(e) the item of Equipment complies with all Applicable Laws and Standards in relation to such item of Equipment and all required or recommended safety apparatus or appliances (if any) have been properly installed;

(f) the item of Equipment has been constructed using material and goods which are new and of good quality such that that Equipment will be of new manufacture and of sound, good and satisfactory quality;

(g) the item of Equipment is Fit for Purpose (MSA), provided that, in relation to the condition under paragraph (a)(iv) of the definition of Fit for Purpose (MSA) in the Master Definitions Agreement, a Unit shall only be required to have the Relevant Approvals as required at that stage in accordance with the Approvals Plan to operate the Train Plan with passengers, including an Authorisation For Placing Into Service; and

(h) that, as far as it is aware having made all reasonable and proper enquiries, there are no outstanding disputes, claims or proceedings relating to or arising from this Agreement or the construction, testing, supply, delivery, condition, possession or operation of such item of Equipment with any Sub-Contractor or any other person involving the TMM.

10.3 The TMM shall provide all equipment, support services and other facilities necessary for the full performance by the TMM of its obligations under this Agreement.

10.4 In entering into and performing its obligations under this Agreement, the TMM shall be an independent manufacturer and maintainer and is not and shall not hold itself out as, and shall ensure that none of its employees or Sub-Contractors or their employees, holds themselves out as an agent of the Owner or the Operator. All personnel used by the TMM in the performance of its obligations under this Agreement shall be employees of the TMM or of a relevant Sub-Contractor or agent of the TMM and in each case shall be suitably qualified to perform such obligations.

10.4A [][22]

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[22] Redaction.

10.4B []23

10.4C []24

Licensed Non-Design Documents and the Technical Library

10.5 The TMM shall deliver those Licensed Non-Design Documents (other than the Performance Reports) that do not form part of this Agreement on the date of its signature to the Owner and the Operator either:

(a) in accordance with clause 10.11 or paragraph 12 (*Acceptance of Simulators*) of Schedule 6 (*Delivery and Acceptance*) (as applicable); or

(b) as soon as practicable and in any event, six months prior to the Expected Delivery Date of the First Unit to be delivered under this Agreement.

10.6 Without prejudice to clauses 26.12 to 26.17 (inclusive), the TMM shall:

(a) within 28 days from the Effective Date, establish a secure place in the United Kingdom for the storage of the Technical Resource Materials and Licensed Design Documents (the ***Technical Library***);

(b) deliver to the Technical Library, a full copy of the Licensed Design Documents, the Manuals and the Technical Resource Materials no less than six months prior to the Expected Delivery Date of the First Unit, provided that the TMM shall deliver any such documents that are not in existence at that date no later than the last day of the month following the month in which the relevant document was signed off or approved by the TMM;

(c) ensure that the Technical Library shall be presented in a clear format and any information provided therein shall enable a suitably qualified person to understand that documentation;

(d) prior to Acceptance of the First Accepted Unit, ensure that, as soon as reasonably practicable after updated information is available, it updates, as necessary, the contents of the Technical Library such that all relevant and up-to-date versions of the Technical Resource Materials, the Manuals and Licensed Design Documents (including all Licensed Design Documents as may have been produced by third parties) are kept there;

(e) prior to Acceptance of the First Accepted Unit, ensure that, as soon as reasonably practicable after it updates the contents of the Technical Library in accordance with clause 10.6(d), it informs the Owner and the Operator that it has updated the contents of the Technical Library and if requested by the Owner and/or the Operator, deliver to the Owner and/or the Operator (as appropriate) the updated information where this Agreement, the TSA or the

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23 Redaction.

24 Redaction.

TSSSA expressly provides that the Owner and the Operator have the right to copies of such information; and

(f) prior to Acceptance of the First Accepted Unit, ensure that the Owner and Operator shall have unlimited access to the Technical Library on reasonable notice for the purpose of exercising their rights (including taking a reasonable number of copies) in respect of the Technical Resource Materials and Licensed Design Documents under clause 26 (*Intellectual Property Rights*).

10.7 The Parties undertake to comply with the Data Protection Acts 1984 and 1998 and any other relevant data protection legislation in respect of all information contained in the Technical Library.

The Manuals

10.8 The TMM shall provide the Owner and the Operator with a draft maintenance manual, servicing and cleaning manual, driver's manual and the train crew manuals (in each case in relation to the Units, Vehicles, Simulators and, to the extent that any of the following require maintenance, Spares, Special Tools and Parts) no later than eight months before the Expected Delivery Date of the First Unit.

10.9 The Owner and the Operator, acting reasonably in each case, shall notify the TMM of any reasonable amendments required to each of the draft manuals provided by the TMM pursuant to clause 10.8 within 30 Working Days of receiving the relevant draft from the TMM, and the TMM shall, as soon as reasonably practicable, incorporate such amendments to the extent that they relate to:

(a) safety issues;

(b) the Operator's Safety Management System;

(c) the Operator's operational requirements; or

(d) any matters or information incorrectly omitted from or incorrectly or incompletely described in the relevant draft manual.

The TMM shall not make any amendments to any of the draft manuals it provides to the Owner and the Operator pursuant to clause 10.8 other than incorporating amendments notified by the Owner and/or the Operator pursuant to this clause 10.9.

10.10 The TMM shall provide the Owner and the Operator with the final version of each of the manuals referred to in clause 10.8 (in electronic copy form) within 14 days of the Owner and the Operator notifying the TMM of any amendments in accordance with clause 10.9 and such final versions shall be the ***Maintenance Manual***, the ***Servicing and Cleaning Manual***, the ***Driver's Manual*** and the ***Train Crew Manuals***.

10.11 The TMM shall, no later than six months before the Expected Delivery Date of the First Unit, supply and deliver to each of the Owner and the Operator 12 full sets of each of the Maintenance Manual, the Servicing and Cleaning Manual, the Driver's Manual and the Train Crew Manuals in CD-ROM format.

10.12 The Owner and the Operator shall be entitled, without charge, to duplicate as many copies of the Driver's Manual and Train Crew Manuals as they reasonably require for the purposes of training the Operator's drivers and other employees and the drivers and other employees of the other Train Operators to whom any Units are to be subleased as permitted pursuant to the Lease, in each case, to operate the Units.

10.13 Title to the physical copies of (but not the underlying Intellectual Property Rights in) the CD-ROMs of the Manuals supplied to the Owner and the Operator pursuant to clause 10.11 shall vest in, and remain with, the Owner from the date of delivery pursuant to clause 10.11.

The Pre-Acceptance Maintenance Plan

10.14 The TMM shall provide the Owner and the Operator with a draft pre-acceptance maintenance plan no later than three months before the start of Fault Free running of the first Unit (as set out in the Contract Programme) at the TMM's test centre at Wildenrath, Germany.

10.15 The Owner and the Operator, acting reasonably in each case, shall notify the TMM of any reasonable amendments required to the draft pre-acceptance maintenance plan within 30 Working Days of receiving the draft pre-acceptance maintenance plan from the TMM, and the TMM shall, as soon as reasonably practicable, incorporate such amendments to the extent that they relate to:

(a) safety issues;

(b) the Operator's Safety Management System;

(c) the Operator's operational requirements; or

(d) any matters or information incorrectly omitted from or incorrectly or incompletely described in the draft pre-acceptance maintenance plan.

The TMM shall not make any amendments to the draft pre-acceptance maintenance plan other than incorporating amendments notified by the Owner and/or the Operator pursuant to this clause 10.15.

10.16 The TMM shall provide the Owner and the Operator with the final version of the pre-acceptance maintenance plan (in hard copy and electronic copy form) within 14 days of the Owner and the Operator notifying the TMM of any amendments in accordance with clause 10.15 and such final version shall be the ***Pre-Acceptance Maintenance Plan***.

Amendments to the Pre-Acceptance Maintenance Plan

10.17 Any amendments to the Pre-Acceptance Maintenance Plan shall be made in accordance with the Engineering Change Control Procedure or such other procedure as all of the Parties agree should apply in relation to the proposed amendments, and shall not constitute a Variation to the terms of this Agreement under the Applicable Variation Procedure and no person shall be obliged to seek or obtain an Authorisation to Vary in respect of such amendments.

The Maintenance Plan

10.18 The TMM shall provide the Owner and the Operator with a draft maintenance plan no later than eight months before the Expected Delivery Date of the First Unit.

10.19 The Owner and the Operator, acting reasonably in each case, shall notify the TMM of any reasonable amendments required to that draft maintenance plan within 30 Working Days of receiving the draft maintenance plan from the TMM, and the TMM shall, as soon as reasonably practicable, incorporate such suggested amendments to the extent that they relate to:

(a) safety issues;

(b) the Operator's Safety Management System;

(c) the Operator's operational requirements; or

(d) any matters or information incorrectly omitted from or incorrectly or incompletely described in the draft maintenance plan.

The TMM shall not make any other amendments to the draft maintenance plan other than incorporating such amendments notified by the Owner and/or the Operator pursuant to this clause 10.19.

10.20 The TMM shall provide the Owner and the Operator with the final version of the maintenance plan (in hard copy and electronic copy form) within 14 days of the Owner and the Operator notifying the TMM of any amendments in accordance with clause 10.19 and such final versions shall be the ***Maintenance Plan***.

Amendments to the Manuals and the Maintenance Plan

10.21 The Owner and the Operator each acknowledge that if the Owner or the Operator (as the case may be) relies on documentation delivered to it under clause 10.11, rather than the updated copies contained in the Technical Library, the TMM shall not be liable for any losses which arise therefrom.

10.22 Any amendments to the Manuals and the Maintenance Plan shall be made in accordance with the TSA, the Engineering Change Control Procedure and, save only as provided in clauses 20.13 to 20.17 (inclusive) of the TSA, the Applicable Variation Procedure.

10.23 Without prejudice to its other obligations in respect of design in accordance with this Agreement, the TMM agrees that:

(a) it will act as the design authority for the duration of its appointment to provide either (i) the TSA Services, or (ii) the TSSSA Services; and

(b) upon termination of its appointment(s) referred to in sub-clause (a), the Owner shall be entitled to require the TMM to continue to act as the design authority in accordance with the terms and conditions of Schedule 23 (*Design Authority*).

Part and serial numbers

10.24 The TMM shall supply to the Owner no later than four months prior to the Expected Delivery Date of the First Unit, the part numbers and original equipment manufacturer serial numbers (if applicable) and, where applicable, original equipment manufacturers' certificates of conformance for all Parts, Special Tools and Owner Owned Spares provided to the Owner and Operator Owned Spares provided to the Operator, in each case, under this Agreement.

Manufacturing Tooling

10.25 Within 28 days of the date of Final Acceptance of the Last Unit, the TMM shall provide the Owner and the Operator with a list of all Manufacturing Tooling used in the manufacture of the Units, the Spares and/or the Special Tools.

10.26 In the event that the TMM wishes to dispose of any of the Manufacturing Tooling, the TMM shall give six weeks' written notice to both the Operator and the Owner of its intention. On receipt of such notice, both the Operator and Owner shall consult and either of them shall have the opportunity to acquire, free of charge, any of the Manufacturing Tooling from the TMM (and the Operator acknowledges that the Owner shall have priority to acquire any of the Manufacturing Tooling if there is insufficient Manufacturing Tooling available for both the Owner and the Operator). The TMM shall not dispose of the Manufacturing Tooling until the TMM has received the written consent of both the Owner and the Operator. Such consent shall be deemed to have been given if neither the Owner nor the Operator has notified the TMM of its requirement to acquire some or all of the Manufacturing Tooling by the expiry of the notice period given pursuant to this clause 10.26.

MSA Software

10.27 The TMM shall:

(a) ensure that the MSA Software is designed, and that the design process is documented, in accordance with standard industry practice, and using standard industry quality control methods;

(b) retain copies of the object code in relation to the MSA Software in the Technical Library;

(c) retain copies of the Source Code in escrow pursuant to the Software Escrow Agreement;

(d) retain, and use reasonable endeavours to procure that its Sub-Contractors retain, copies of all software used in the design and production of the MSA Software until Fleet Acceptance; and

(e) ensure that all copies of MSA Software retained in accordance with clause 10.27(b) are updated as necessary as soon as reasonably practicable to incorporate any modifications to the MSA Software carried out by the TMM or any Sub-Contractor.

10.28 The Operator or the Owner shall:

(a) on one occasion at any time after the date of this Agreement and before any material amendments are made to the MSA Software; and

(b) after such audit has been carried out, only if (and following) the making of any material amendment to the MSA Software, with only one such audit permitted following each such material amendment unless and until a further material amendment is made,

each be entitled to audit the output format of the MSA Software to ensure compliance with the Specification, and shall notify the other of its decision to do so. The other of the Operator or the Owner shall have the right to join in such audit, but the other shall have no right to a separate audit.

10.29 The Owner confirms to the TMM that clause 17.19 of the Common Terms Agreement provides that, upon entering into any Project Document designated as such by the Intercreditor Agent after the Effective Date, the Owner is obliged to procure the provision of such legal opinions as the Intercreditor Agent may reasonably request by reference to the legal opinions provided to the Intercreditor Agent in respect of the Project Documents entered into on or about the Effective Date. The TMM will provide the Owner with such information as is reasonably necessary to enable the Owner to procure such legal opinions.

11. OPERATOR BOND, ADVANCE PAYMENT BOND AND OWNER BOND

Provision of the Operator Bond

11.1 The TMM shall procure that there shall be a valid and effective Operator Bond in favour of the Operator []:[25]

(a) []:[26]

(b) substantially in the agreed form set out in Schedule 20.1 (*Agreed Form of Operator Bond*) []:[27];

(c) duly executed and delivered by a Bond Provider; and

(d) []:[28]

Claims under the Operator Bond

11.2 The Operator shall be entitled to make claims under the Operator Bond in accordance with its terms. To the extent that the Operator receives an amount from the Bond Provider under the Operator Bond in respect of such a claim, the TMM's

[25] Redaction.

[26] Redaction.

[27] Redaction.

[28] Redaction.

liability under paragraph 2.2 of Part 1 (*Consequential Termination Provisions Pre-Minimum Fleet*) of Schedule 19.2 (*Consequential Termination Provisions*) or paragraph 2.2 of Part 2 (*Consequential Termination Provisions Following MSA TMM Event of Default Post-Minimum Fleet*) of Schedule 19.2 (as applicable) shall be reduced accordingly *pro tanto*.

Provision of the Advance Payment Bond

11.3 The TMM shall procure that there shall be a valid and effective Advance Payment Bond in favour of the Owner:

(a) [][29]

(b) [][30]

(c) duly executed and delivered by a Bond Provider; and

(d) [][31]

11.3A [][32]

Claims under the Advance Payment Bond

11.4 The Owner shall be entitled to make claims under the Advance Payment Bond in respect of the Advance Payment Bond Amount in accordance with its terms. To the extent that the Owner receives an amount from the Bond Provider under the Advance Payment Bond in respect of such a claim the TMM's liability under the Refund Clauses shall be reduced accordingly *pro tanto*.

11.5 [][33]

11.6 [][34]

Provision of the Owner Bond

11.7 The TMM shall procure that there shall be a valid and effective Owner Bond:

(a) [][35]

(b) [][36]

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[29] Redaction.

[30] Redaction.

[31] Redaction.

[32] Redaction.

[33] Redaction.

[34] Redaction.

[35] Redaction.

(c) duly executed and delivered by a Bond Provider; and

(d) []37

Owner Bond Values

11.8 []38

11.9 []39

11.10 []40

11.11 []41

Claims under the Owner Bond

11.12 [NOT USED]

11.13 []42

11.14 [NOT USED]

11.15 []43

11.16 []44

11.17 []45

11.18 []46

11.19 []47

11.20 []48

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36 Redaction.

37 Redaction.

38 Redaction.

39 Redaction.

40 Redaction.

41 Redaction.

42 Redaction.

43 Redaction.

44 Redaction.

45 Redaction.

46 Redaction.

47 Redaction.

48 Redaction.

11.21 [][49]

11.22 [][50]

11.23 [][51]

11.24 [][52]

11.25 [][53]

[][54]

11.26 [][55]

Provision of Replacement Bonds

11.27 Subject to compliance with clauses 11.29 and 11.30, the TMM may replace any Performance Bond that is in force and effect at any time prior to the expiry or termination of the relevant Performance Bond in accordance with its terms, provided that such replacement Performance Bond is:

(a)

(i) in the case of the Operator Bond, in accordance with clause 11.1(b) (or any other form acceptable to the Operator in its discretion);

(ii) in the case of the Advance Payment Bond, in accordance with clause 11.3(a) (or such other form as is acceptable to the Owner (in its discretion)); and

(iii) in the case of the Owner Bond, in accordance with clause 11.7(b), taking into account any amendment which may be required by clause 11.26 (or such other form as is acceptable to the Owner (in its discretion));

(b) duly executed and delivered by a Bond Provider; and

(c) for an amount that is equal to:

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49 Redaction.

50 Redaction.

51 Redaction.

52 Redaction.

53 Redaction.

54 Redaction.

55 Redaction.

(i) in the case of the Operator Bond, the amount specified in clause 11.1(d) but reduced to take account of any amounts called under any previous Operator Bond;

(ii) in the case of the Advance Payment Bond, the amount specified in clause 11.3(d) but reduced to take account of any amounts called under any previous Advance Payment Bond;

(iii) in the case of the Owner Bond, the amount specified in clause 11.7(d) but reduced in accordance with clauses 11.9 and 11.10 (if applicable), and increased (if applicable) in accordance with clause 11.26; and

(iv) [][56]

Acceptability of any Bond Provider

11.28 In determining whether a Bond Provider under any replacement Performance Bond is acceptable, the Operator or the Owner (as appropriate) shall not be obliged to accept as the Bond Provider, any Bond Provider of a previous Performance Bond unless that Bond Provider is an Acceptable Bank at the time of that determination.

11.29 The TMM shall provide such information relating to any Bond Provider or proposed Bond Provider as the Operator or the Owner (as appropriate) may reasonably require from time to time and shall further provide reasonable information as to the form of the replacement Performance Bond prior to the instrument coming into effect.

[][57]

11.30 [][58]

11.31 [][59]

Return of Performance Bonds upon Termination

11.32 If this Agreement or the Project is terminated:

(a) [][60]

(b) [][61]

(c) [][62]

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[56] Redaction.

[57] Redaction.

[58] Redaction.

[59] Redaction.

[60] Redaction.

[61] Redaction.

(d) []63

(e) []64

then:

(i) []65

(A) the Owner shall return the Advance Payment Bond or the Owner Bond []66; and

(B) []67; and

(ii) []68 the Operator shall return the Operator Bond to the TMM,

[]69

[]70

11.33 []71

[]72

11.34 []73

12. GUARANTEE

Provision of the Operator Guarantee and the Owner Guarantee

12.1 In order to secure the performance of its obligations under this Agreement, the TMM shall procure that there shall be a valid and effective Operator Guarantee and Owner Guarantee:

(a) []74

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62 Redaction.

63 Redaction.

64 Redaction.

65 Redaction.

66 Redaction.

67 Redaction.

68 Redaction.

69 Redaction.

70 Redaction.

71 Redaction.

72 Redaction.

73 Redaction.

(b) in the agreed form set out in, as appropriate, Schedule 21.2 (*Form of Owner Guarantee*) or Schedule 21.1 (*Form of Operator Guarantee*); and

(c) []74

[]75

12.2 []76

[]77

12.3 []78

12.4 [NOT USED]

12.5 [NOT USED]

Return of Guarantees following Termination

12.6 If this Agreement or the Project is terminated:

(a) []79

(b) []80

(c) []81

(d) []82

(e) []83

then:

(i) in relation to the Owner Guarantee, subject to:

(A) []84

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74 Redaction.

75 Redaction.

76 Redaction.

77 Redaction.

78 Redaction.

79 Redaction.

80 Redaction.

81 Redaction.

82 Redaction.

83 Redaction.

84 Redaction.

(B) []86

(ii) in relation to the Operator Guarantee subject to:

(A) []87

(B) []88

(iii) []89

(iv) in relation to the Owner Guarantee, subject to:

(A) []90

(B) []91

(v) in relation to the Operator Guarantee, subject to:

(A) []92

(B) []93

the Owner shall return the Owner Guarantee to the TMM and the Operator shall return the Operator Guarantee to the TMM, []94.

13. OWNER'S OBLIGATIONS

13.1 Subject to the terms of this Agreement, the Owner shall purchase the Units, the Owner Owned Spares, the Special Tools and the Simulators in each case, designed, manufactured, tested, certified, commissioned and sold in accordance with this Agreement, the Applicable Specification, the Contract Programme, the Quality Plan, the Agreed Testing Programme, and all Applicable Laws and Standards.

13.2 Without prejudice to clause 13.1, the Owner agrees to comply with its obligations set out in this Agreement.

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85 Redaction.

86 Redaction.

87 Redaction.

88 Redaction.

89 Redaction.

90 Redaction.

91 Redaction.

92 Redaction.

93 Redaction.

94 Redaction.

13.3 In respect of any breach of this Agreement by the Owner which is capable of remedy by the TMM, the TMM shall have the right to rectify such breach of this Agreement by the Owner, at the Owner's cost, provided that:

(a) the TMM has given the Owner 10 Working Days' written notice, specifying the nature of the breach; and

(b) the Owner, within 10 Working Days of its receipt of that notice, has failed to take steps with a view to rectifying such breach.

13.4 The TMM shall be entitled to recover any costs or expenses it has incurred in rectifying any breach of this Agreement by the Owner pursuant to clause 13.3 in accordance with paragraph 4.7 of Schedule 13 (*Permitted Delay Procedure*).

14. OPERATOR'S OBLIGATIONS

14.1 Subject to the terms of this Agreement, the Operator shall purchase the Operator Owned Spares and the Integration Laboratory Train Equipment and take title to the Mock-up designed, manufactured, tested, certified, commissioned and sold in accordance with this Agreement, the Applicable Specification, the Contract Programme, the Quality Plan, the Agreed Testing Programme and all Applicable Laws and Standards.

14.2 Without prejudice to clause 14.1, the Operator agrees to comply with its obligations set out in this Agreement.

14.3 In respect of any breach of this Agreement by the Operator which is capable of remedy by the TMM, the TMM shall have the right to rectify any breach of this Agreement by the Operator, at the Operator's cost, provided that:

(a) the TMM has given the Operator 10 Working Days' written notice, specifying the nature of the breach; and

(b) the Operator, on receipt of that notice, has failed to rectify such breach within 10 Working Days of that notice.

14.4 The TMM shall be entitled to recover any costs or expenses it has reasonably and properly incurred in rectifying any breach of this Agreement by the Operator pursuant to clause 14.3, by presentation of an invoice to the Operator, and the Operator shall pay any sum so due from it to the TMM within 28 days of its receipt of such invoice.

15. RIGHT OF VERIFICATION

Rights to Inspect and Audit

15.1 In order to verify the TMM's performance of, and compliance with, this Agreement and the Manuals, where applicable, each of the Owner and the Operator, shall be entitled, either itself or using such reputable and competent agents or representatives as it may authorise, provided that any such agent or representative is (i) a sub-contractor appointed by the Owner pursuant to clause 40.11 or by the

Operator pursuant to clause 40.18 or (ii) in respect of any other agent or representative, is not a person who is a manufacturer of trains, or a member of a group which includes companies which manufacture trains, to:

(a) inspect or witness any aspect of the design, manufacture (including the welding process), testing, certification or commissioning of the Equipment, their components or allied services;

(b) inspect any of the Manufacturing Documents; and

(c) audit the management systems of the TMM specific to this Agreement,

and the TMM shall:

(i) ensure that each of the Owner and the Operator have similar rights to audit the management systems of the Approved Sub-Contractors (MSA); and

(ii) use reasonable endeavours to ensure each of the Owner and the Operator have similar rights to audit the management systems of Sub-Contractors other than the Approved Sub-Contractors (MSA).

15.2 The Owner and the Operator shall ensure that any inspection or audit made in accordance with clause 15.1 shall not unreasonably disrupt the commercial and industrial operation of the TMM.

15.3 Any corrective action required as a consequence of any inspection or audit in the performance of or compliance with the TMM's obligations under this Agreement shall be carried out by the TMM at its own expense, and the TMM shall not be entitled to a Permitted Delay in respect of such corrective action.

15.4 The TMM shall use reasonable endeavours to obtain rights of inspection, audit or witness on premises other than those of the TMM or other members of the TMM's Group for the benefit of each of the Owner and the Operator (and/or any representative of the Owner and/or the Operator authorised in accordance with clause 15.1). The Owner and/or the Operator (and/or any representative of the Owner and/or the Operator authorised in accordance with clause 15.1), as the case may be, shall be entitled to such inspection or audit or witness on premises other than those of the TMM or other members of the TMM's Group only where the TMM is entitled by agreement with the relevant third party to grant each of the Owner and the Operator (and/or any representative of the Owner and/or the Operator authorised in accordance with clause 15.1) such inspection or witness rights.

15.5 The TMM acknowledges that, notwithstanding such rights of inspection as are provided for in this Agreement, the Owner and the Operator will be relying on the skill and judgement of the TMM, and that the TMM accordingly has sole responsibility to ensure that the Equipment conforms in all respects with this Agreement irrespective of any consultation with, or other action which involves, the Owner and/or the Operator.

15.6 The Owner (or its representative from time to time authorised in accordance with clause 15.1) and the Operator (or its representative from time to time authorised in accordance with clause 15.1) shall each be entitled to be present at all times at any of the TMM's premises where the TMM's obligations under this Agreement are being performed. The TMM shall, at its own risk and expense, ensure that each such person has access to and the use of proper office facilities, including a separate shared office and dedicated telephones and computer facilities. The TMM shall also:

(a) ensure that each such person has similar access rights as set out in this clause 15.6 at an Approved Sub-Contractor's (MSA) premises; and

(b) shall use reasonable endeavours to procure similar access rights as set out in this clause 15.6 for each such person at the premises of Sub-Contractors other than the Approved Sub-Contractors (MSA).

Programme of Inspection

15.7 The Owner and the TMM shall agree a programme of inspection, which may include (without limitation) inspection of any milestone or key event, within six months of the date of this Agreement which shall be updated by agreement from time to time, including in the event of an amendment to the Contract Programme.

15.8 The Owner agrees that the Operator shall be entitled to make representations to the Owner regarding the programme of inspection to be agreed pursuant to clause 15.7, and the Owner acknowledges and agrees that it will have due regard to the comments of the Operator in agreeing such programme of inspection with the TMM under clause 15.7.

15.9 The TMM agrees that the Owner and the Operator and each of the representatives authorised in accordance with clause 15.1 shall be entitled to participate in all inspections in the programme of inspection agreed pursuant to clause 15.7.

15.10 If the Owner and the TMM fail to agree a programme of inspection pursuant to clause 15.7, the following shall apply:

(a) the Owner shall notify the TMM (copied to the Operator) of the time and location at which it wishes to carry out an inspection pursuant to clause 15.1; and

(b) within three Working Days of the Owner making such a request for inspection, the TMM shall (acting reasonably) either notify the Owner (copied to the Operator) that the Owner can carry out the requested inspection or shall suggest an alternative time and/or location for the inspection which shall be no later than six Working Days from the original date requested by the Owner for the relevant inspection pursuant to clause 15.10(a).

Specification Non-Compliance and/or Not Fit for Purpose (MSA)

15.11 Where the Owner and/or the Operator believes, prior to the Acceptance of any item of Equipment, that such item of Equipment is not Fit for Purpose (MSA), the Owner and/or the Operator shall notify the TMM (in writing) of such belief with a copy to the non-notifying Party (if applicable). Following receipt of such notice, the TMM shall promptly take appropriate steps to demonstrate, to the satisfaction of the Owner and/or, if applicable, the Operator, that such item of Equipment is Fit for Purpose (MSA). In the event that the TMM fails to demonstrate to the satisfaction of the Owner and/or, if applicable, the Operator that the item of Equipment is Fit for Purpose (MSA), the Owner and/or, if applicable, the Operator shall be entitled to require that the TMM forthwith rectifies the non-compliance or supplies a replacement item of Equipment of the same type as the one that is non-compliant which is Fit for Purpose (MSA). The TMM shall not be entitled to a Permitted Delay in respect of any such rectification or replacement.

Review of Major Events

15.12 Prior to the occurrence of each event identified in the programme of inspection agreed pursuant to clause 15.7, or any other event which the TMM would reasonably expect the Owner and the Operator to wish to attend, the TMM shall provide the Owner and the Operator with reasonable notice of the date upon which such event is due to take place and the Owner and the Operator or their respective authorised agents or representatives shall be entitled to attend.

[][95]

15.13 [][96]

[][97]

15.14 [][98]

No Copies

15.15 Nothing in this clause 15 shall permit the Owner, the Operator, [][99] or any third party acting on behalf of the Owner or the Operator, to take copies of any documents (whether in the course of an inspection or audit or otherwise under this clause 15). The provisions of this clause 15 are without prejudice to any permission granted elsewhere in this Agreement to the Owner or the Operator or any third party acting on behalf of the Owner or the Operator to take copies of any documents.

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95 Redaction.

96 Redaction.

97 Redaction.

98 Redaction.

99 Redaction.

16. PROJECT MANAGEMENT

16.1 The Parties agree to comply with their respective obligations as to project management set out in Schedule 10 (*Project Management*).

16.2 The Parties shall hold meetings on a regular basis (not less than at monthly intervals) for the purpose of discussing the TMM's performance and to resolve any problems in the operation of this Agreement.

16.3 The TMM shall provide the Owner and the Operator with written reports as set out in Schedule 10 (*Project Management*) highlighting any defects, design, maintenance or operational issues affecting the Equipment and (subject to any relevant duty of confidentiality) any design defects affecting any analogous equipment (which include electric multiple units that have been designed and manufactured using similar processes and key components to those that have been used in the design and manufacture of the Units), where such design defect may have a safety or material adverse impact on the relevant Equipment.

16.4 The provisions of clause 5 (*Nominated Representatives*) of the Umbrella Agreement shall apply in relation to the appointment of Nominated Representatives, who shall include the Operator's Contract Manager, the TMM's Contract Manager and the Owner's Contract Manager appointed in accordance with Schedule 10 (*Project Management*).

17. PAYMENTS

Obligation to pay

17.1 Provided that no notice has been delivered under paragraph 2 (*Notice of TMM Default*) of Schedule 19.1 (*TMM Events of Default*) which remains outstanding, and subject to clause 17.4A:

(a) the Owner shall, in accordance with the provisions of this clause 17, pay to the TMM the Contract Price for each Unit, the Owner Owned Spares Price, the Special Tools Price and the Simulators Price in the manner set out in clause 17.4; and

(b) the Operator shall, in accordance with the provisions of this clause 17, pay to the TMM the Operator Owned Spares Price and the Integration Laboratory Train Equipment Price in the manner set out in clause 17.7.

17.2 The TMM shall submit an invoice (setting out in reasonable detail, where appropriate, a description of the Milestone achieved) to:

(a) the Owner, in respect of Milestones 1, 4, 5, 6, 7, 8, 9, 10 and 11, on completion of the relevant action described in column three (*Actions Required to complete Milestone*) of the table set out in Schedule 12, [][100]:

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[100] Redaction.

(i) []101

(ii) []102

(b) the Operator, in respect of Milestones 3, 3A and 14, on completion of the relevant action described in column three of the table set out in Schedule 12.

17.3 Each invoice shall be submitted, as appropriate, to the Owner for the attention of the Owner's Nominated Representative (with a copy to the Operator's Nominated Representative) or to the Operator's Nominated Representative (with a copy to the Owner's Nominated Representative) at the relevant address specified in clause 34 (*Notices*).

17.4 The Owner shall, subject to receipt by it of an invoice in accordance with clause 17.2, clause 17.3 and clause 38.1:

(a) in respect of Milestones 1 and 4 and subject to clause 11.3A, pay to the TMM within one Working Day of receipt of the relevant invoice, the percentage of the Contract Price for each Unit, the percentage of the Owner Owned Spares Price and the percentage of the Special Tools Price, in each case specified in column 4 (*Amount payable by Owner*) against that Milestone in the table set out in Schedule 12;

(b) in respect of Milestone 10, pay to the TMM within one Working Day of receipt of the relevant invoice, the percentage of the Contract Price for each Unit, the percentage of the Owner Owned Spares Price and the percentage of the Special Tools Price, in each case specified in column 4 (*Amount payable by Owner*) against that Milestone in the table set out in Schedule 12;

(c) in respect of Milestones 7 and 11 in relation to each Unit, pay to the TMM within one Working Day of receipt of the relevant invoice, the percentage of the Contract Price for that Unit specified in column 4 against such Milestones in the table set out in Schedule 12; and

(d) in respect of Milestone 8 in relation to the Owner Owned Spares, pay to the TMM within one Working Day of receipt of the relevant invoice, the applicable percentage of the Owner Owned Spares Price specified in column 4 against that Milestone in the table set out in Schedule 12;

(e) in respect of Milestone 9 in relation to the Special Tools, pay to the TMM within one Working Day of receipt of the relevant invoice, the applicable percentage of the Special Tools Price specified in column 4 against that Milestone in the table set out in Schedule 12; and

(f) in respect of Milestones 5 and 6 in relation to the Simulators, pay to the TMM within one Working Day of receipt of a relevant invoice, the applicable

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101 Redaction.

102 Redaction.

percentage of the Simulators Price specified in column 4 against those Milestones in the table set out in Schedule 12,

provided that, in each case, the Owner shall not be required to make any Milestone Payment due to the TMM under this clause 17.4 prior to the relevant date set out in column 5 (*Earliest Milestone Payment Date*) against the relevant Milestone in the table set out in Schedule 12. The Owner shall provide the Operator with a copy of the receipted invoice in each case.

17.4A []103

17.5 []104

17.6 []105

17.7 The Operator shall, subject to receipt by it of an invoice in accordance with clause 17.2, clause 17.3 and clause 38.1:

(a) in respect of each of Milestones 3 and 3A in relation to the Integration Laboratory Train Equipment, pay to the TMM within one Working Day of receipt of the relevant invoice, 50 per cent. of the Integration Laboratory Train Equipment Price,

(b) in respect of Milestone 14 in relation to a delivery of Operator Owned Spares, pay to the TMM within one Working Day of receipt of the relevant invoice, 100 per cent. of the Operator Owned Spares Price relating to the Operator Owned Spares in that delivery,

and, in each case, the Operator shall provide the Owner with a copy of the receipted invoice.

[]106

17.8 []107

Method of Payment

17.9 All payments required to be made under this Agreement will be made on the due date in cleared funds to such account at a bank in the United Kingdom as the payee shall have notified to the payer by not less than five Working Days' notice, free and clear of any deduction, withholding, set-off or counterclaim whatsoever except to the extent any deduction is required by Applicable Laws and Standards, or is in accordance with the express provisions of this Agreement. If the due date for any

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103 Redaction.

104 Redaction.

105 Redaction.

106 Redaction.

107 Redaction.

payment falls on a day which is not a Working Day, payment shall be made on the next Working Day.

17.10 If any Party is required by law to make any deduction or withholding from any payment hereunder (such Party referred to herein as the ***Payer***), it shall do so and the sum due from the Payer in respect of such payment shall be increased to the extent necessary to ensure that, after the making of such deduction or withholding, the Party to whom such payment is due (such Party referred to herein as the ***Payee***) receives and retains (free of any liability in respect of any such deduction or withholding) a net sum equal to the sum it would have received and retained had no deduction or withholding been required to be made.

17.11 If following the making of any deduction or withholding in respect of sums payable hereunder and the payment by the Payer of any increased amount in accordance with the provisions of clause 17.10, the Payee receives or is granted a credit against, remission for or repayment of any Tax payable by it, which credit, remission or repayment is referable to that increased amount so paid by the Payer, the Payee shall, to the extent that it is satisfied that it can do so without prejudice to the retention of such credit, remission or repayment, reimburse the Payer with such amount as the Payee shall certify to be the proportion of such credit, remission or repayment as will leave the Payee (after such reimbursement and taking into account the time any Taxation was payable and any such credit, remission or repayment was received by the Payee) in no worse or no better position (after Taxation) than it would have been in had there been no such deduction or withholding from the said sums payable by the Payer hereunder. Such reimbursement shall be made as soon as possible upon such credit or remission or repayment having, in the reasonable opinion of the Payee, been received or granted.

Default Interest

17.12 Save as provided in clause 17.13, if any Party fails to pay any amount payable under this Agreement on the date when it is due, interest will accrue (both before and after judgment) on such unpaid amount from the date on which such amount was due and payable (compounding in each successive Railway Period) until the date of payment in full of the original amount and all interest thereon pursuant to this clause 17.12, at the Default Interest Rate. All such interest will be calculated on the basis of the actual number of days elapsed and a 365 day year and will be payable on demand of the non-defaulting party.

17.13 [][108]

(a) [][109]

(b) [][110]

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[108] Redaction.

[109] Redaction.

[110] Redaction.

All such interest will be calculated on the basis of the actual number of days elapsed and a 365 day year and will, where sub-clause (b) applies, be payable in accordance with paragraph 4.7 of Schedule 13 (*Permitted Delay Procedure*).

17.14 The Late Payment of Commercial Debts (Interest) Act 1998 and related regulations (as from time to time amended, extended or re-enacted) shall not apply to the late payment of any sums due under this Agreement.

Payments in Sterling

17.15 All payments to be made pursuant to this Agreement are denominated in, and shall be made in, Sterling.

Taxes on indemnity payments

17.16 If and to the extent that any sums payable by one Party to another under this Agreement by way of indemnity prove to be insufficient, by reason of any Taxation suffered thereon, for the receiving Party to discharge its corresponding liability to a third party, the paying party shall on the receiving Party's demand pay to the receiving party such additional sum as (after taking into account any Relief to which the receiving party is entitled as a result of the liability which gives rise to the indemnity and any Taxation suffered by the receiving party on the additional sum and the time that the same is suffered) shall be required to make up the relevant deficit.

17.17 If and to the extent that any Indemnity Sum is treated as taxable in the hands of the First Party, the paying party shall on demand pay to the First Party such Compensation Sum. In calculating any amounts due under this clause 17, the First Party shall take into account any Relief to which it becomes entitled as a result of the liability which gives rise to the indemnity.

Disputed Invoices

17.18 The Owner or the Operator (as appropriate) shall notify the TMM in writing (with a copy to the Operator or Owner (as appropriate)) of any disputed amounts or invoices stating the reasons for such dispute within five Working Days of receipt of such invoice. Any such dispute shall be determined in accordance with the dispute resolution procedure set out in Applicable Dispute Resolution Provisions.

No Set-Off

17.19 Unless expressly stated otherwise in this Agreement or the TSA, no Party shall be entitled to set off any liability for payment under this Agreement against any sum owed to it by the other Parties under this Agreement, the Umbrella Agreement, the TSA, the TSSSA or the Lease.

17.20 [][111]

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[111] Redaction.

18. PERMITTED DELAYS

Any application for, or consideration or grant of, an extension of time to any Expected Delivery Date, any other date by which the TMM is required to perform its obligations or any Milestone, shall be undertaken in accordance with the procedure set out in Schedule 13 (*Permitted Delay Procedure*).

19. LIQUIDATED DAMAGES

Late Acceptance of Units due to TMM

19.1 Subject to clauses 19.7, 19.8 and 19.18, if Acceptance of any Unit has not occurred on or before the Expected Delivery Date in respect of such Unit, the TMM shall pay liquidated damages (as compensation for loss and not as a penalty) in respect of the period commencing from the Expected Delivery Date of such Unit until the date of Acceptance of that Unit (or any earlier date on which the TMM's obligations to deliver that Unit under this Agreement are terminated):

(a) to the Operator at a rate of [][112] per Vehicle per day for each day (or part thereof); and

(b) to the Owner at the rate set out in paragraph (a) of the definition of Owner Liquidated Damages Rate in the Master Definitions Agreement.

19.2 [][113]

19.3 [][114]

19.4 [][115]

19.5 [][116]

19.6 [][117]

19.7 The aggregate amount of all liquidated damages payable by the TMM to the Owner pursuant to clauses 19.1 to 19.5 (inclusive) (but excluding any liquidated damages paid or payable pursuant to clause 19.18 or any liquidated damages (including the interest paid on such amounts) paid to the Owner which are reimbursed by the Owner to the TMM pursuant to paragraph 14.2 of Schedule 6 (*Delivery and Acceptance*) or paragraph 8.3 of Schedule 13 (*Permitted Delay Procedure*)) shall not exceed the amount specified for this purpose in clause 25.4(b)(i). The aggregate amount of all liquidated damages payable by the TMM to the Operator pursuant to

[112] Redaction.

[113] Redaction.

[114] Redaction.

[115] Redaction.

[116] Redaction.

[117] Redaction.

clause 19.1, and liquidated damages payable to the Owner pursuant to clause 19.18 (but excluding any liquidated damages (including the interest paid on such amounts) paid to the Operator which are reimbursed by the Operator to the TMM pursuant to paragraph 14.2 of Schedule 6 or paragraph 8.3 of Schedule 13) shall not exceed the amount specified in clause 25.4(c)(i).

19.8 Amounts payable by the TMM under clauses 19.1 to 19.5 (inclusive) and 19.18 shall be invoiced by the Owner or Operator (as the case may be) no earlier than the first day of the month after the month in which the liquidated damages accrued, and paid by the TMM within []118 of receipt by it of such invoice.

19.9 The payment of liquidated damages by the TMM to the Owner or Operator pursuant to clauses 19.1 to 19.5 (inclusive) and 19.18 (as appropriate) shall (subject, in the case of amounts to which clause 19.6 applies, to any obligation of the Owner or the Operator to reimburse such amounts) be in full and final satisfaction of all the TMM's liability for delay in the Acceptance of the Equipment under this Agreement, provided that this clause 19 shall not affect:

(a) in the case of the Owner:

(i) the rights of termination under clause 23 (*Termination*) and Schedule 19.1 (*TMM Events of Default*); and

(ii) the Owner's rights following termination, as set out in paragraph 1 (*Owner's and Operator's Rights Following MSA TMM Event of Default*) of Schedule 19.1 and Schedule 19.2, including (without limitation) the right to receive financial sums from the TMM; and

(b) in the case of the Operator:

(i) the rights of termination under clause 23 and Schedule 19.1; and

(ii) the Operator's rights following termination, as set out in paragraph 1 of Schedule 19.1 and Schedule 19.2, including the right to receive financial sums from the TMM.

Weight Guarantee

19.10 The tare load of each Unit Type shall be as defined in paragraph 3.1 (*Operational Loading Definitions*) of the TTS. The TMM shall weigh the tare load of each Unit at the TMM's premises to determine whether, subject to an adjustment of such weight in accordance with clause 19.11:

(a) that Unit meets the condition specified in paragraph 3.1(c) of Schedule 6 (*Delivery and Acceptance*); and

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118 Redaction.

(b) if that Unit is Accepted, any payment should be made by the TMM or the Operator to the other in accordance with clauses 19.12 to 19.16 (inclusive) as a result of the tare load of that Unit.

19.11 If, prior to its Acceptance, any modification is made to a Unit after it has been weighed pursuant to clause 19.10, such modification shall be made in accordance with the Engineering Change Control Procedure (and shall not constitute a Variation to this Agreement), and:

(a) the impact of such modification upon the tare load of that Unit shall be calculated;

(b) the tare load of the Unit as measured at the TMM's premises pursuant to clause 19.10 shall be adjusted accordingly; and

(c) such adjusted tare load shall be used as the tare load of that Unit for the purposes of clauses 19.12 to 19.16 (inclusive).

19.12 The threshold weights for each Unit Type, which determine whether payments are to be made by the TMM or the Operator in respect of a Unit upon its Acceptance, are as follows:

Column 1	**Column 2**	**Column 3**
Unit Type	**Malus Weight (tonnes)**	**Bonus Weight (tonnes)**
Type 1 Unit	[]119	[]120
Type 2 Unit	[]121	[]122

19.13 If a Unit is Accepted and the tare load of that Unit, as measured or calculated pursuant to clauses 19.10 and 19.11, exceeds the Malus Weight for the applicable Unit Type, the TMM shall pay to the Operator a one-off payment by way of liquidated damages (as compensation for loss and not as a penalty) for each tonne or part thereof by which the tare load of that Unit exceeds the Malus Weight for the applicable Unit Type, at the rate of []123 per tonne per Unit (pro-rated for each part tonne thereof).

19.14 If a Unit is Accepted and the tare load of that Unit, as measured or calculated pursuant to clauses 19.10 and 19.11, is less than the Bonus Weight for the applicable Unit Type, the Operator shall pay to the TMM a one-off payment by way of a bonus for each tonne or part thereof by which the tare load of that Unit is less than the Bonus

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119 Redaction.

120 Redaction.

121 Redaction.

122 Redaction.

123 Redaction.

Weight for the applicable Unit Type, at the rate of []^[124] per tonne per Unit (pro-rated for each part tonne thereof).

19.15 If a Unit is Accepted and the tare load of that Unit, as measured or calculated pursuant to clauses 19.10 and 19.11, is greater than or equal to the Bonus Weight but less than or equal to the Malus Weight, in each case of the applicable Unit Type, neither the Operator nor the TMM shall be required to pay any amount to the other Party in relation to the tare load of that Unit.

19.16 Amounts payable under clause 19.13 or 19.14 shall be:

(a) invoiced by the Party to whom payment is due promptly after the relevant Unit is Accepted; and

(b) paid by the Party responsible for payment within 15 days of its receipt of such invoice.

19.17 Without prejudice to the rights of the Owner and the Operator under Schedule 14 (*Design Life, Warranties and Fault Rectification*) (save as provided in paragraph (c) below), the payment of liquidated damages by the TMM pursuant to clause 19.13 shall be the sole and exclusive remedy of the Owner and the Operator arising from the tare load of a Unit exceeding the Malus Weight of the applicable Unit Type, and where this is the case, the Owner and the Operator shall not be entitled to:

(a) either:

(i) withhold the issue of a Provisional Acceptance Certificate or a Qualified Provisional Acceptance Certificate in relation to a Unit for this reason; or

(ii) specify a reduction in the weight of that Unit as a Precondition to the issue of a Qualified Provisional Acceptance Certificate in relation to that Unit,

except where the Owner and the Operator have the right to withhold the issue of a Provisional Acceptance Certificate or a Qualified Provisional Acceptance Certificate in relation to that Unit pursuant to paragraph 3.1(c) of Schedule 6;

(b) require modification to that Unit to reduce its weight, except by way of a Variation Proposal in respect of which the Secretary of State issues an Authorisation to Vary in accordance with schedule 4.3 (*Secretary of State Authorisation of Variations*) of the Umbrella Agreement (or, after the expiry or termination of the Umbrella Agreement, schedule 5.3 (*Secretary of State Authorisation of Variations*) of the Maintenance Direct Agreement); or

(c) at any time after the Acceptance of that Unit, specify the weight of that Unit as being a Potential Design Defect or a Fault in its own right.

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[124] Redaction.

[][125]

19.18 [][126]

20. DESIGN LIFE, WARRANTIES AND MSA FAULT RECTIFICATION

The provisions of Schedule 14 (*Design Life, Warranties and Fault Rectification*) shall apply in relation to Design Life, warranties and fault rectification.

21. TITLE, RISK AND TOTAL LOSS

Title and Risk

21.1 Prior to the transfer of title and risk to the Owner in accordance with clause 21.2, 21.4, 21.4A or 21.5 or to the Operator in accordance with clause 21.7, title to and risk in relation to each item of Equipment shall rest with the TMM and the TMM shall maintain appropriate insurance cover in respect of each such item in accordance with clause 24.4.

21.2 Save as provided in clauses 21.3, 21.4, 21.4A and 21.5, title to and risk in each Unit, Owner Owned Spare, Special Tool and Simulator shall pass to the Owner on [][127] such passing of title being in each case with full title guarantee save in respect of any encumbrance created by, or attributable to, the Owner or the Operator.

21.3 [][128]

21.4 [][129]

21.4A [][130]

21.5 [][131]

21.6 The Operator acknowledges and agrees that the Owner will not be able to deliver a Unit, Owner Owned Spare, Special Tool or Simulator under the Lease until title has passed to the Owner in accordance with clause 21.2, 21.3, 21.4, 21.4A or 21.5 (as the case may be) and the Operator undertakes not to seek to operate a Unit, Owner Owned Spare, Special Tool or Simulator before it has received a copy of the relevant Payment Instruction from the Owner as evidence that such a transfer of title has occurred.

21.7 Title to and risk in:

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[125] Redaction.

[126] Redaction.

[127] Redaction.

[128] Redaction.

[129] Redaction.

[130] Redaction.

[131] Redaction.

(a) each Operator Owned Spare and each item of the Integration Laboratory Train Equipment shall pass to the Operator on the date on which payment of the amount payable upon the achievement of the Milestone that relates to the Acceptance of such Operator Owned Spare or such Integration Laboratory Train Equipment, as the case may be, is made; and

(b) the Mock-up shall pass to the Operator on the date of Acceptance of the Mock-up,

in each case with full title guarantee save in respect of any encumbrance created by, or attributable to, the Owner or the Operator.

21.8 The transfer of risk and title pursuant to clauses 21.2, 21.3, 21.4, 21.4A, 21.5 and/or 21.7 shall be without prejudice:

(a) as between the Owner and the Operator, to any provisions of the Lease for transfer of risk to the Operator; and

(b) as between the TMM and the Operator, to any provisions of the TSA for transfer of risk between the TMM and the Operator.

Total Loss

21.9 In the event of a Total Loss of a Unit, Vehicle, Owned Spare, Special Tool, Integration Laboratory Train Equipment, Mock-up or a Simulator prior to the Acceptance of that Unit, Owned Spare, Special Tool, Integration Laboratory Train Equipment, Mock-up or Simulator (each such item that suffers a Total Loss being ***Lost Equipment***), the TMM shall:

(a) promptly notify the Owner and the Operator; and

(b) at no additional cost, replace that Lost Equipment (in which case the terms of its replacement (other than cost, which shall remain unchanged) shall be agreed in accordance with the Applicable Variation Procedure, which shall include an appropriate amendment to the Expected Delivery Date for that replacement).

21.10 The occurrence of a Total Loss does not, unless caused by one of the events listed in the definition of Permitted Delay, constitute a Permitted Delay and shall be without prejudice to the TMM's obligations under clauses 19.1 to 19.5 (inclusive), provided always that with effect from the date of such Total Loss, the TMM shall (without prejudice to accrued liability up to such date) have no further liability under clauses 19.1 to 19.5 (inclusive) in respect of the relevant Lost Equipment unless the reason for the Total Loss was due to a breach by the TMM of its obligations under this Agreement, in which case, where the Lost Equipment was a Unit, an Owner Owned Spare, a Special Tool or a Simulator, the TMM shall continue to be liable under clause 19.1 to 19.5 (inclusive) until (i) the Acceptance of a replacement Unit, or (ii) the Acceptance of the Owner Owned Spare, Special Tool or Simulator (as applicable).

22. FORCE MAJEURE

The provisions of Schedule 18 (*Force Majeure*) shall apply in relation to the occurrence of a Force Majeure Event.

23. TERMINATION

The provisions of Schedule 19 (*Termination*) shall apply in relation to the termination of this Agreement.

24. LIABILITIES, INDEMNITY AND INSURANCE

TMM Indemnity

24.1 Subject to clauses 24.3, 24.19, 24.20 and 25 (*Limitations of Liability*) and without prejudice to clauses 24.21 to 24.26 (inclusive), the TMM shall be liable for, and shall indemnify on an after-tax basis each of the Owner and/or the Operator, as the case may be, including any of its/their respective employees, servants, agents, sub-contractors, directors and officers against all expense, liability, loss and claims suffered or incurred by the Owner and/or the Operator and/or their respective employees, servants, agents, sub-contractors, directors and officers in respect of:

(a) []132

(b) []133

(c) []134

(d) []135

24.2 []136

24.3 The benefit of the indemnities in clauses 24.1 and 24.2 shall not apply to the Party seeking indemnification thereunder to the extent that the expense, liability, loss and claims suffered or incurred by that Party (or that Party's employees, servants, agents, sub-contractors, directors or officers):

(a) arises as a direct result of instructions given by that Party to the TMM;

(b) is of such nature as is intended to be compensated by the payment of liquidated damages to that Party pursuant to this Agreement or (in the case of the Operator) the payment of Performance Liquidated Damages pursuant to the TSA;

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132 Redaction.

133 Redaction.

134 Redaction.

135 Redaction.

136 Redaction.

(c) is compensated for under another provision of this Agreement or the TSA; or

(d) is in excess of the relevant limits (if any) on the TMM's liability under this Agreement.

TMM MSA Insurances

24.4 [][137]

24.5 [][138]

24.6 [][139]

24.7 [][140]

24.8 [][141]

24.9 [][142]

24.10 [][143]

24.11 [][144]

24.12 [][145]

24.13 [][146]

24.14 [][147]

Operator Indemnity

24.15 The Operator shall, subject to clauses 24.16, 24.17, 24.19, 24.20 and 25 (*Limitations of Liability*) and without prejudice to clauses 24.21 to 24.26 (inclusive), be liable for, and shall indemnify on an after-tax basis each of the TMM, the Owner and their respective employees, servants, agents, sub-contractors, directors and officers against all expense, liability, loss and claims suffered or incurred by the TMM

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[137] Redaction.

[138] Redaction.

[139] Redaction.

[140] Redaction.

[141] Redaction.

[142] Redaction.

[143] Redaction.

[144] Redaction.

[145] Redaction.

[146] Redaction.

[147] Redaction.

and/or the Owner (and/or their respective employees, servants, agents, sub-contractors, directors and officers) in respect of:

(a) death or personal injury to any employee, servant, agent, sub-contract or, director or officer of the TMM or the Owner or any employee, servant, director or officer of an agent or sub-contractor of the TMM or the Owner;

(b) any loss of or damage to property belonging to the TMM (including the Units prior to Acceptance to the extent that the TMM and/or the Owner (as applicable) are unable to recover under the TMM MSA Insurances) or the Owner or for which either of them is responsible; and

(c) any third party actions, claims, demands, costs, charges and expenses (including legal expenses on an indemnity basis) relating to death or personal injury or loss of or damage to property belonging to a third party,

in each case arising out of (i) the operation of the Units by the Operator or any other Train Operator to whom the Operator sub-leases the Units pursuant to the Lease, or (ii) the performance, non-performance or purported performance by the Operator or any of those sub-lessees or their respective servants, agents or employees of the Operator's obligations under this Agreement or (iii) the acts or omissions at the Designated Depots or any other location owned or managed by the TMM or its Sub-contractors of the Operator, a sub-contractor of the Operator or their employees or agents, or (iv) the breach by Network Rail of its obligations under the Track Access Agreement.

24.16 The Operator shall not be responsible or be obliged to indemnify the TMM or the TMM's employees. servants, agents, sub-contractors, directors or officers under clause 24.15 to the extent that the expense, liability, loss and claims suffered or incurred by the TMM or, as the case may be, the TMM's employees, servants, agents, sub-contractors, directors or officers:

(a) is due to the negligence, acts, omissions or wilful misconduct of the TMM, or any of its employees, agents or sub-contractors;

(b) is due to the breach by the TMM of its obligations under this Agreement;

(c) arises as a direct result of the Operator acting on instructions given by the TMM to the Operator;

(d) is compensated for under another provision of this Agreement or the TSA; or

(e) is in excess of the relevant limits (if any) on the Operator's liability under this Agreement.

24.17 The Operator shall not be responsible or be obliged to indemnify the Owner or the Owner's employees, servants, agents, sub-contractors, directors or officers under clause 24.15 to the extent that the expense, liability, loss and claims suffered by the Owner or, as the case may be, the Owner's employees, servants, agents, sub-contractors, directors or officers:

(a) is due to the negligence, acts, omissions or wilful misconduct of the Owner, its employees, agents or contractors;

(b) is due to the breach by the Owner of its obligations under this Agreement;

(c) arises as a direct result of the Operator acting on instructions given by the Owner to the Operator;

(d) is compensated under another provision of this Agreement or under the Lease; or

(e) is in excess of the relevant limits (if any) on the Operator's liability under this Agreement.

Operator Insurance

24.18 [][148]

Survival

24.19 Subject to any shorter applicable limitation at law, the indemnities set out in this Agreement shall, notwithstanding any breach or repudiation of this Agreement or the termination of any rights and obligations of the Parties hereunder, continue in full force for six years after:

(a) the expiry or termination of this Agreement; or

(b) the earlier termination of the participation of a relevant Party in this Agreement (but without prejudice to the rights of any successor to that Party in respect of the period of that successor's participation in the Agreement),

but, in each case, only in respect of any relevant expense, liability, loss and claims suffered or incurred which are attributable to any event or circumstance occurring prior to or on such expiry or termination.

No Double Recovery

24.20 No Party to this Agreement shall be entitled to recover (by way of indemnity or otherwise) more than once in respect of the same loss or damage suffered by that Party under any Transaction Document. There shall be no duplication solely by reason of there being multiple beneficiaries to a claim hereunder and each Party acknowledges that the other Parties may each suffer different losses which each shall be entitled to recover to the extent permitted hereunder.

Notification of claims procedures and assistance in defending claims

24.21 Any Party who has (or claims to have) the benefit of an indemnity under this Agreement (for the purposes of this clause 24.21 and clauses 24.22 to 24.26 (inclusive), the ***Beneficiary***) shall, if it receives any notice, demand, letter or other

[148] Redaction.

document concerning any claim for which it appears that the Beneficiary is, or may become entitled to indemnification under this Agreement, notify the Party giving the relevant indemnity under this Agreement (for the purposes of this clause 24.21 and clauses 24.22 to 24.26 (inclusive), the ***Indemnifier***) as soon as reasonably practicable after receipt of the same.

24.22 Subject to clauses 24.23, 24.24 and 24.25, on the giving of a notice by the Beneficiary pursuant to clause 24.21, where it appears that the Beneficiary is or may be entitled to indemnification from the Indemnifier in respect of all (but not part only) of the liability arising out of the claim, the Indemnifier shall (subject to the Indemnifier agreeing to pay the Beneficiary for all reasonable costs and expenses that the Beneficiary may incur by reason of such action) be entitled to dispute the claim in the name of the Beneficiary at the Indemnifier's own expense, and take conduct of any defence, dispute, compromise or appeal of the claim and of any incidental negotiations. The Beneficiary shall give the Indemnifier all reasonable co-operation, access and assistance for the purposes of considering and resisting such claim.

24.23 With respect to any claim conducted by the Indemnifier pursuant to clause 24.22, the Indemnifier:

(a) shall keep the Beneficiary fully informed and consult with it about the conduct of the claim; and

(b) shall not bring the name of the Beneficiary into disrepute.

24.24 The Beneficiary shall be free to pay or settle any claim on such terms as it thinks fit and without prejudice to its rights and remedies under this Agreement if the Indemnifier:

(a) is not entitled to take conduct of the claim in accordance with clause 24.22;

(b) fails to notify the Beneficiary of its intention to take conduct of the relevant claim within 20 Working Days of its receipt of the notice from the Beneficiary under clause 24.21 or notifies the Beneficiary that it does not intend to take conduct of the claim; or

(c) fails to comply in any material respect with clause 24.23.

24.25 The Beneficiary shall be free at any time to give notice to the Indemnifier that it is retaining or taking over (as the case may be) the conduct of any defence, dispute, compromise or appeal of any claim (or of any incidental negotiations) to which clause 24.22 applies. On receipt of such notice, the Indemnifier shall promptly take all steps necessary to transfer the conduct of such claim to the Beneficiary, and shall provide to the Beneficiary all reasonable co-operation, access and assistance for the purposes of considering and resisting such claim. If the Beneficiary gives any notice pursuant to this clause 24.25 then the Indemnifier shall be released from any liability in relation to that claim under the relevant indemnity and, without prejudice to any accrued liabilities, any liability for the Beneficiary's costs under clause 24.22 in respect of such claim.

24.26 Where it appears that either:

(a) the Beneficiary is or may be entitled to indemnification from more than one Indemnifier in respect of the liability arising out of a single claim; or

(b) the Beneficiary will not be entitled to indemnification from the Indemnifier in respect of all the liability arising out of the claim,

the Parties shall comply with the requirements of any insurer who has an obligation to provide an indemnity in respect of such claim, and the Parties acknowledge that, in respect of any claim involving the Operator, the CAHA shall apply in relation to such claim, provided that as between the Parties to this Agreement, in the event of any conflict between the terms of the CAHA and this Agreement, the terms of this Agreement shall take precedence.

25. LIMITATIONS OF LIABILITY

General

25.1 In all cases, the Party establishing or alleging a breach of, or requiring indemnification under, this Agreement shall be under a duty to use reasonable endeavours to avoid or mitigate the loss and/or damage which has occurred or may occur as a result thereof and in respect of which the relevant claim is made, and the Party against which such claim is made shall not be liable in respect of any incremental costs to the extent that they are incurred as a result of the Party making such claim failing to comply with its duty under this clause 25.1.

25.2 Without prejudice to any Party's rights to recover [][149], no Party shall be liable to another Party to this Agreement by way of indemnity, or by reason of any breach of this Agreement, breach of statutory duty or by reason of tort (including negligence) for any loss of profit, loss of use, loss of revenue, loss of production, interruption of operations, loss of information or data, loss of interest or loss of contracts or any other like form of indirect consequential losses.

TMM's Liability

25.3 The TMM's liability shall [][150]

25.4 [][151]

25.5 The limitations on liability set out in this clause 25 are without prejudice to the Owner's and the Operator's joint right to terminate this Agreement under Schedule 19.1 (*TMM Events of Default*).

25.6 [][152]

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[149] Redaction.

[150] Redaction.

[151] Redaction.

25.7 The TMM shall be entitled in circumstances where its aggregate liability to the Owner and the Operator is expressly limited under this Agreement to pay each and every claim submitted to it which is subject to limitation in the order in which it receives a valid invoice in respect of such claim and without taking into account prior notice of such claim or of any other claim which is subject to the same limitation. If the TMM receives or is deemed to have received more than one such invoice on the same day it shall be entitled to elect the order of payment.

Owner's liability

25.8 Save as provided in clauses 25.9 and 25.10, the Owner's aggregate liability, in each case, whether arising by way of indemnity, in contract, tort (including negligence), breach of statutory duty or otherwise:

(a) []153

(b) to the Initial Operator and all Successor Operators under the Contracts (other than in respect of any Rental Rebate Amounts) shall not exceed the Owner Aggregate Liability Cap.

25.9 The Owner's liability under paragraph 4 (*Termination Sum*) of Schedule 19.3 (*Owner Events of Default*) shall be limited as set out in that paragraph.

25.10 []154

25.11 The limitations on liability set out in clauses 25.8 and 25.9 are, without prejudice to the TMM's right to terminate this Agreement under Schedule 19.3 (*Owner Events of Default*).

Operator's liability

25.12 Save as provided in clause 25.13, the Operator's aggregate liability to the TMM under this Agreement, whether arising by way of indemnity, in contract, tort (including negligence), breach of statutory duty or otherwise shall not exceed []155 in the aggregate.

25.13 The limitation on the Operator's liability in clause 25.12 shall not operate to exclude or limit the Operator's liability in respect of the following:

(a) the indemnities under clauses 24.15(a) and (c) in relation to personal injury or death;

(b) use or enabling or permitting any third party to use any materials in which the Intellectual Property Rights are vested in the TMM or a member of the

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152 Redaction.

153 Redaction.

154 Redaction.

155 Redaction.

TMM's Group or any of its Sub-Contractors, in breach of the terms of this Agreement;

(c) payments to the TMM of the Operator Owned Spares Price, the Integration Laboratory Train Equipment Price and amounts payable for the ERTMS/ATO Support pursuant to clause 17.8, plus any applicable interest thereon at the Default Interest Rate in accordance with clause 17.12;

(d) reimbursement to the TMM of any amounts payable by the Operator under paragraphs 2.2(i) and (iii), 4.5(a), 4.5(c) and 4.5(d) of Schedule 13 (*Permitted Delay Procedure*) and paragraphs 4.10(b) and (c) of Schedule 14 (*Design Life, Warranties and Fault Rectification*);

(e) reimbursement to the TMM of any amounts of liquidated damages paid by the TMM to the Operator pursuant to paragraph 14.2 of Schedule 6 (*Delivery and Acceptance*) or paragraph 8.2 of Schedule 13 (*Permitted Delay Procedure*), plus interest on such amounts at the Default Interest Rate where it is subsequently agreed between the TMM and the Operator, or determined in accordance with the Applicable Expert Determination Provisions that the TMM was not liable to pay such liquidated damages, including, without limitation, pursuant to paragraph 14.3 of Schedule 6 or paragraph 8.3 of Schedule 13;

(f) the indemnities under clauses 17.16 and 17.17; and

(g) the indemnity in respect of loss of or damage to property of the Owner or the TMM under clause 24.15(b) or loss of or damage to property of a third party under clause 24.15(c), provided that such liability shall not exceed the amount of the Minimum Liability Coverage in respect of any one occurrence or series of occurrences consequent upon one event or original cause and annually in the aggregate.

25.14 The limitation on liability set out in clause 25.12 is without prejudice to the TMM's right to terminate the Operator's participation in this Agreement under Schedule 19.4 (*Operator Events of Default*) and, where applicable, to require the replacement of the Operator in accordance with paragraph 1 of schedule 2.1 (*Section 54 Undertakings*) of the Umbrella Agreement.

26. INTELLECTUAL PROPERTY RIGHTS

26.1 Intellectual Property Rights created before or during the term of this Agreement in the following:

(a) the Licensed Design Documents;

(b) the Licensed Non-Design Documents;

(c) the Technical Resource Materials;

(d) the Escrow Materials; and

(e) the Equipment,

shall vest in the TMM, or where such Intellectual Property Rights are created by a Sub-Contractor, the TMM shall procure that such Intellectual Property Rights are assigned to the TMM or licensed to the TMM with the right for the TMM to grant such licences to the Intellectual Property Rights as are set out in this Agreement.

26.2 The TMM, the Operator and the Owner shall enter into negotiations with the Escrow Agent to enter into the Software Escrow Agreement as soon as reasonably practicable after the date of this Agreement. The TMM undertakes to:

(a) lodge all Escrow Materials, which materials shall contain all information in human-readable form and on suitable media to enable a suitably skilled programmer or analyst to understand, maintain and correct the MSA Software, with the Escrow Agent as soon as reasonably practicable after the entry into of the Software Escrow Agreement; and

(b) lodge any update of the Escrow Materials with the Escrow Agent as soon as reasonably practicable after that update is made,

such lodging, in each case, to be in accordance with the Software Escrow Agreement and until the later to occur of:

(i) the expiry of the Unit Design Life of the Last Unit; and

(ii) the expiry of the Design Life of all Key Components.

26.3 The Escrow Materials shall be released to the Owner and (for so long as it is the lessee under the Lease) to the Operator upon occurrence of an Escrow Release Event, and with effect from such release, the TMM hereby grants to the Owner and to the Operator, subject to the Software Escrow Agreement, an unconditional, irrevocable, perpetual, transferable, royalty free licence (with the right to sub-license) to use the Escrow Materials for the life of each Unit (Unit being defined to include Vehicles, Spares, Parts and Special Tools) for the purposes set out in clause 26.10, as further provided under this Agreement.

26.4 The Parties acknowledge that a Successor Operator shall accede to the Software Escrow Agreement in place of the outgoing Operator.

26.5 The TMM hereby warrants that it is or shall be by the date on which the relevant materials are supplied under this Agreement, the owner, or the licensee (with a right to sub-license and to grant a right to sub-license) of all Intellectual Property Rights in the Licensed Design Documents, Licensed Non-Design Documents, the Technical Resource Materials, the Escrow Materials, the Equipment and the MSA Software and anything else provided by the TMM pursuant to or in connection with this Agreement and that the use of the Licensed Design Documents, Licensed Non-Design Documents, the Technical Resource Materials, the Escrow Materials, the Equipment and the MSA Software or anything else provided by the TMM pursuant to or in connection with this Agreement by the Owner or the Operator as permitted under this Agreement shall not infringe any third party Intellectual Property Rights.

26.6 The TMM shall be liable to the Owner and the Operator for any infringement or alleged infringement of any third party Intellectual Property Rights and the consequences thereof arising out of a breach by the TMM or its Sub-Contractors of its obligations or warranties under this Agreement or where the infringement arises out of the proper use as permitted under this Agreement by the Owner or the Operator of the Equipment, the MSA Software, the Licensed Design Documents, Licensed Non-Design Documents, the Technical Resource Materials and the Escrow Materials or anything else provided by the TMM pursuant to or in connection with this Agreement and the TMM shall:

(a) subject to clause 26.7, indemnify and shall keep indemnified and hold harmless the Owner and the Operator against all actions, claims, loss and damages and costs (including legal costs) arising from or claimed by, any third party in relation to such infringement or alleged infringement or breach (whether or not reasonably foreseeable as a result of the infringement, alleged infringement or breach); and

(b) in the event of any such infringement or alleged infringement or breach (whether or not reasonably foreseeable as a result of the infringement, alleged infringement or breach), at the TMM's choice and cost:

(i) procure a licence for use as permitted under this Agreement for the Owner and the Operator, together with a right to sub-license, on terms which are acceptable to them both of the relevant Equipment, the MSA Software, the Licensed Design Documents, the Licensed Non-Design Documents, the Technical Resource Materials and the Escrow Materials or other assets, items and documents provided by the TMM pursuant to or in connection with this Agreement; or

(ii) replace or remanufacture the infringing item (without reducing the performance and functionality of the same), so as to avoid the infringement, and to enable the Owner and the Operator to continue to use as permitted under this Agreement, the Equipment, the MSA Software, the Licensed Design Documents, Licensed Non-Design Documents, the Technical Resource Materials and the Escrow Materials or other assets, items and documents provided by the TMM pursuant to, or in connection with, this Agreement and licensed to them.

26.7 The indemnity provided for in clause 26.6(a) shall not apply to the Owner or the Operator to the extent that the relevant actions, claims, loss or damages and costs (including legal costs) are due to a breach by, as appropriate, the Owner or the Operator of any of their obligations under this Agreement or any modifications or additions made by, as appropriate, the Owner or the Operator to the Equipment, MSA Software, Licensed Design Documents, Licensed Non-Design Documents, Technical Resource Materials or the Escrow Materials or other assets, items and documents provided by the TMM pursuant to or in connection with this Agreement.

26.8 The provisions of clauses 24.21 to 24.26 (inclusive) shall apply to any claims against the Owner or the Operator for which the Owner or the Operator is indemnified by the TMM under clause 26.6(a).

Licensed Non-Design Documents

26.9 The TMM hereby grants (or shall procure the grant) to each of the Operator and the Owner an unconditional, irrevocable, perpetual, transferable, royalty free licence (together with the right to sub-license) to use all Intellectual Property Rights (including any Intellectual Property Rights existing prior to the date of this Agreement) in the Licensed Non-Design Documents for any purpose the Owner and/or the Operator may reasonably require in their respective capacities as Owner and Operator of any Equipment (including, without limitation, any of the purposes specified in clause 26.10 for which the Intellectual Property Rights in the Licensed Design Documents may be used).

Licensed Design Documents and Equipment

26.10 The TMM hereby grants (or shall procure the grant of) to each of the Operator and the Owner an unconditional, irrevocable, perpetual, transferable, royalty free licence (with the right to sub-licence) to use the Intellectual Property Rights (including any Intellectual Property Rights existing prior to the date of this Agreement) in the Licensed Design Documents:

(a) to use and operate the Equipment;

(b) to maintain, service, repair, refurbish and overhaul the Equipment, and if:

(i) the TSA is subsisting, to have such actions performed by a third party where and to the extent entitled to do so pursuant to clause 8.8 of the TSA, or where and to the extent such actions are outside the scope of the TSA Services to be performed under the TSA; or

(ii) the TSA is no longer subsisting, to have such actions performed by a third party (but not, save where clause 26.10(f) applies, to complete the manufacture of any of the Units);

(c) if the TSA has terminated and has not been replaced by the TSSSA, or where the TSSSA has been terminated, or where and to the extent the Owner and the Operator are entitled to place work with a reputable and competent third party pursuant to clause 8.8 of the TSA, or where and to the extent such actions are outside the scope of the TSA Services to be performed under the TSA or the TSSSA Services to be performed under the TSSSA:

(i) to manufacture, modify, or convert any parts or equipment which are not supplied by the TMM under this Agreement and which are or shall be for use in connection with the Units, including enabling any of the above to be connected to or operated with other railway vehicles, or have such actions performed by a third party;

(ii) to manufacture spares or any other equipment for use in the maintenance, service, repair, overhaul, refurbishment, modification, conversion, or adaptation of the Units, or have such actions performed by a reputable and competent third party; and

(iii) to invite tenders for parts or services, or have such actions performed by a third party;

(d) to comply with requests from any Government Authority acting under Applicable Laws and Standards;

(e) to comply or co-operate with any enquiries made or carried out by the British Transport Police, Network Rail, the RAIB, HMRI, or the ORR (or any successor to any of their respective functions), or any other person carrying out any judicial or quasi-judicial function or to comply with obligations under the Umbrella Agreement, or have such actions performed by a third party;

(f) upon any termination of this Agreement in respect of Equipment which has not been Accepted, as the result of an MSA TMM Event of Default that occurs when an Insolvency Event has occurred and is continuing in relation to the TMM, to complete (or permit a third party to complete) the manufacture of the Units;

(g) to design, produce, use, distribute and sell reasonable advertising, marketing and merchandising materials, or have such actions performed by a third party;

(h) to perform an audit to check that the material comprising the Licensed Design Documents is the correct material and is complete and meaningful, or have such actions performed by a third party;

(i) to remedy Faults where permitted to do so under paragraph 3.3 of Schedule 14 (*Design Life, Warranties and Fault Rectification*) or remedying Design Defects where permitted to do so under paragraph 4.11 of Schedule 14;

(j) to train the Operator's drivers, other employees and the drivers and other employees of other Train Operators where any Units are to be subleased pursuant to the Lease, in each case to operate the Units; and

(k) to copy and modify the materials licensed under this Agreement only to the extent necessary in connection with any of the above, or have such actions performed by a third party.

26.11 While the TSA is in force and effect, if the Owner or the Operator wishes to make any modification to, or wishes to convert, any of the Units, it shall submit a Variation Proposal in respect of such work required to effect the modification or conversion in accordance with the terms of the Applicable Variation Procedure. Where and to the extent the Owner and the Operator are entitled to instruct a third party repairer under clause 8.8 of the TSA, the TMM hereby grants to each of the Owner and the Operator for the purpose of carrying out such modification or

conversion or procuring that a third party performs such modification or conversion on its behalf:

(a) an unconditional, irrevocable, transferable, royalty-free licence to use all Intellectual Property Rights in such of the Technical Resource Materials as are necessary to carry out the relevant modification; and

(b) an unconditional, irrevocable, perpetual, transferable, royalty-free licence to use all Intellectual Property Rights in the Licensed Design Documents,

in each case only to the extent the Owner and the Operator are entitled to instruct a third party to carry out such TSA Services under clause 8.8 of the TSA.

Technical Resource Materials

26.12 If there is a TMM Default Partial Termination of this Agreement and the TMM is not performing the TSA Services under the TSA or the TSSSA Services under the TSSSA, the TMM shall:

(a) with effect from the date of such TMM Default Partial Termination, grant to each of the Owner and the Operator an unconditional, irrevocable, perpetual, transferable, royalty-free licence to use all Intellectual Property Rights (including any Intellectual Property Rights existing prior to the date of this Agreement) in the Technical Resource Materials for the purpose of modifying or converting the Units and all purposes set out in clause 26.10; and

(b) promptly following such TMM Default Partial Termination, deliver copies of all the Technical Resource Materials and the Licensed Design Documents to the Owner.

26.13 If the TSA terminates:

(a) due to the occurrence of a TSA TMM Event of Default;

(b) pursuant to schedule 13.4 ([][156]) of the TSA due to a [][157];

(c) pursuant to schedule 13.5 (*Operator Voluntary Termination Right*) of the TSA;

(d) the occurrence and continuing effect of a Force Majeure Event in accordance with schedule 11 (*Force Majeure*) of the TSA in circumstances where this Agreement is not also terminated; or

(e) by reason of the expiry of the TSA in accordance with the terms thereof,

and, in each case provided that the TMM is not performing the TSSSA Services under the TSSSA, the TMM shall:

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156 Redaction.

157 Redaction.

(i) with effect from the date of such termination or expiry, grant to each of the Owner and the Operator an unconditional, irrevocable, perpetual, transferable, royalty-free licence to use all Intellectual Property Rights (including any Intellectual Property Rights existing prior to the date of this Agreement) in the Technical Resource Materials which relate to design material produced by the TMM or its Sub-Contractors in carrying out the TSA Services under the TSA, for the purpose of modifying or converting the Units and all purposes set out in clause 26.10; and

(ii) promptly following such termination or expiry, deliver to the Owner copies of all the Technical Resource Materials and the Licensed Design Documents which in each case relate to design material produced by the TMM or its Sub-Contractors in carrying out the TSA Services under the TSA.

26.14 [NOT USED]

26.15 If the TSA terminates due to an Operator Event of Default after the Backstop Date and no Replacement Lease is entered into, the Owner shall be entitled to exercise all the rights of the Operator under this Agreement and the TSA in relation to the Technical Resource Materials and the Licensed Design Documents, including (without limitation) the rights of the Operator in clauses 26.10, 26.11 and 26.17, and the TMM agrees that the Owner may exercise and enjoy all such rights of the Operator in substitution for the Operator.

26.16 [NOT USED]

26.17 Unless and until the TSA is terminated due to the occurrence of any event set out in clause 26.13, the Owner and the Operator shall have the right to use the Technical Resource Materials for the following purposes:

(a) to comply with requests from any Government Authority acting under Applicable Laws and Standards;

(b) to comply or co-operate with any enquiries made or carried out by British Transport Police, Network Rail, the RAIB, HMRI, or the ORR (or any successor to any of their respective functions), or any other person carrying out any judicial or quasi-judicial function, or have such actions performed by a third party;

(c) to perform an audit to check that the material comprising the Technical Resource Materials is the correct material and is complete and meaningful;

(d) in respect of documentation submitted to obtain any Relevant Approval, to obtain such Relevant Approval as the Owner or the Operator may be required to do so pursuant to this Agreement; and

(e) to copy the materials licensed under this Agreement only to the extent necessary in connection with any of the above, or have such copying performed by a third party.

26.18 Where the TSSSA becomes effective upon any termination of the TSA, then upon termination of the TSSSA, the TMM shall promptly deliver copies of all the Technical Resource Materials and the Licensed Design Documents to the Operator.

26.19 [][158]

26.20 No rights under this Agreement or the TSA shall be granted to a Party in (or to use) any of the trade marks of another Party.

26.21 In respect of documentation owned by a Sub-Contractor, the TMM shall use reasonable endeavours (unless that Sub-Contractor is a member of the TMM's Group, in which case the obligation shall be absolute) to:

(a) ensure that it has all necessary rights to place the documentation owned by a third party Sub-Contractor in the Technical Library or in escrow under the Software Escrow Agreement (as the case may be); and

(b) procure the right for the Owner and the Operator to access and use such materials as provided in this Agreement.

27. PERMITTED CHANGES, VARIATIONS AND CHANGES IN LAW

Permitted Changes

27.1 The Owner and the Operator may exercise a Permitted Change (MSA) in accordance with the provisions of the Permitted Changes Schedule. The TMM shall not be entitled to any change or relief in the performance of the Contract Programme (including any Permitted Delay) or any additional payment in respect of the implementation of a Permitted Change (MSA).

27.2 The TMM shall be responsible for ensuring that all Permitted Changes (MSA) are carried out to the Units, the Vehicles, the Simulators, the Owned Spares and the Special Tools in accordance with the provisions of the Permitted Changes Schedule and within any time limits set out in the Permitted Changes Schedule for the completion of such Permitted Changes (MSA).

27.3 The Applicable Variation Procedure shall not apply to and no Party shall be required to seek or obtain an Authorisation to Vary in respect of any Permitted Change (MSA), provided that such Permitted Change (MSA) is exercised or carried out in accordance with the terms of this Agreement.

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[158] Redaction.

Restriction On The Right To Vary

27.4 The Parties shall not vary the terms of this Agreement and no such agreement purporting to vary the terms of this Agreement shall be enforceable between the Parties other than Variations entered into in accordance with clauses 27.5 and 27.6.

Applicable Variation Procedure

27.5 Save as expressly stated to the contrary in the Contracts, the Applicable Variation Procedure shall apply in relation to the issuing, consideration, authorisation and implementation of Variations to this Agreement, including (without limitation) Variations to the Applicable Specification, the Contract Programme, any Modification, any Equipment Price or the rights and/or obligations of the TMM, the Owner or the Operator under this Agreement, and where the Applicable Variation Procedure does so apply, the Parties shall comply with their obligations under the terms of the Applicable Variation Procedure.

Obligation to enter into a Contract Amendment Agreement

27.6 The Parties shall enter into a Contract Amendment Agreement amending the terms of this Agreement in accordance with any Authorisation to Vary requiring the same, promptly after receipt of that Authorisation to Vary from the Secretary of State pursuant to schedule 4.3 (*Secretary of State Authorisation of Variations*) of the Umbrella Agreement (or, after the expiry or termination of the Umbrella Agreement, schedule 5.3 (*Secretary of State Authorisation of Variations*) of the Maintenance Direct Agreement). Any Contract Amendment Agreement shall not be valid or binding on any Party unless and until the Secretary of State has issued an Authorisation to Vary in respect of such Contract Amendment Agreement.

Change in Law

27.7 The provisions of schedule 4.5 (*Change in Law*) of the Umbrella Agreement (or, after the expiry or termination of the Umbrella Agreement, schedule 5.5 (*Change in Law*) of the Maintenance Direct Agreement) shall apply in relation to any Change in Law including a Qualifying Change in Law that requires a Mandatory Modification.

Mandatory Modifications

27.8 The TMM shall be responsible for ensuring that all applicable Mandatory Modifications are carried out to the Units, the Vehicles, the Simulators, the Owned Spares and the Special Tools in accordance with all Applicable Laws and Standards following the issue of an Authorisation to Vary issued by the Secretary of State in accordance with schedule 4.3 of the Umbrella Agreement and within:

(a) any time limits set out in such Applicable Laws and Standards for the completion of such Mandatory Modifications; or

(b) where compliance with Applicable Laws and Standards is achieved by the application of a Derogation of a temporary nature, the period before such Derogation ceases.

27.9 The Operator shall be responsible for securing the approval of the Secretary of State in accordance with schedule 4.3 (*Secretary of State Authorisation of Variations*) of the Umbrella Agreement (or, after the expiry or termination of the Umbrella Agreement, schedule 5.3 (*Secretary of State Authorisation of Variations*) of the Maintenance Direct Agreement) to each Mandatory Modification, and the TMM shall not be obliged to implement a Variation that relates to such Mandatory Modification until the Secretary of State has issued an Authorisation to Vary in respect of such Mandatory Modification.

28. [NOT USED]

29. PRICED OPTIONS

29.1 In the event that a Variation proposed and authorised pursuant to the Applicable Variation Procedure requires the purchase (in whole or in part) of additional Type 1 Units or Type 2 Units that fall within the parameters of either paragraph 1 (*Priced Option 1*) or paragraph 2 (*Priced Option 2*) of Schedule 17 (*Priced Options*), then the purchase price of such Units shall be governed by the terms of Schedule 17 (*Priced Options*).

29.2 Any requirement for Associated Equipment in respect of the purchase (in whole or in part) of additional Type 1 Units or Type 2 Units shall be addressed in the relevant Variation Proposal and/or responses to such Variation Proposal as referred to in clause 29.1.

30. CONFIDENTIALITY OF INFORMATION

Prohibition on Advertising

30.1 No Party shall without the other Parties' prior consent in writing, such consent not to be unreasonably withheld, advertise, announce or otherwise publish the fact of the existence of this Agreement or that it is a party to, and is carrying out, this Agreement for the other Parties.

Confidential Information

30.2 In this clause 30, ***Confidential Information*** shall mean the terms of this Agreement, all documents related hereto and all data and information furnished hereunder and all information or data concerning the Intellectual Property Rights, designs, operations, commercial or financial arrangements or affairs of any of the TMM, the Owner or the Operator and includes, in the case of information furnished by the TMM, the Licensed Design Documents, the Licensed Non-Design Documents, the Technical Resource Material and the Escrow Materials.

Restriction on disclosure of Confidential Information

30.3 Each of the TMM, the Owner and the Operator agrees that it shall keep confidential the Confidential Information of each of the other Parties supplied to it in connection with this Agreement and save as provided in clauses 30.5 and 30.7, a Party receiving Confidential Information (whether the TMM, the Owner or the Operator as

the case may be) shall not reveal that Confidential Information to any third party save with the prior written consent of the Party who owns the Confidential Information.

30.4 Each of the TMM, the Owner and the Operator agrees that it shall require its employees who have access to the Confidential Information to be subject to appropriate confidentiality undertakings. The disclosing party (whether the TMM, the Owner or the Operator (as the case may be)) shall be responsible to the Party that owns the Confidential Information for any abuse by the recipient employee of such Confidential Information.

Disclosure in exercising IPR and seeking intellectual property protection

30.5 Where the Owner or the Operator is entitled to use the Intellectual Property Rights of the TMM in accordance with clause 26 (*Intellectual Property Rights*) and in order to do so wishes to disclose the Confidential Information of the TMM to a third party, the following provisions shall apply:

(a) the Owner or the Operator (as the case may be) shall reveal the Confidential Information of the TMM only as reasonably necessary and shall at all times seek to minimise both the number of such third party recipients and the amount of Confidential Information of the TMM passed to such third parties so far as is reasonably possible;

(b) the Owner or the Operator (as the case may be) shall use reasonable endeavours to obtain an undertaking of confidentiality (which is directly enforceable by the TMM against the relevant recipient) on substantially the same terms as this clause 30 from each relevant third party recipient of the Confidential Information;

(c) save where the relevant recipient has provided an undertaking of confidentiality to the TMM that is directly enforceable by the TMM in accordance with clause 30.5(b), the Owner shall be responsible for any breach of the provisions of this clause 30 by any third party recipient of such Confidential Information to whom disclosures are made by the Owner, and the Operator shall be responsible for any breach of the provisions of this clause 30, by any third party recipient of such Confidential Information to whom disclosures are made by the Operator; and

(d) the Owner or the Operator shall not require any consent of the TMM to disclose the Confidential Information where permitted to do so under this clause 30.5.

30.6 If the TMM wishes to obtain a patent, send a technical disclosure bulletin to the Science Reference Library, register a design or trade mark, or obtain other similar protection in respect of the work to be performed under this Agreement, the obligations of confidentiality referred to in clause 30.3 shall not prevent the TMM from disclosing the information necessary to obtain such protection.

Permitted Disclosures

30.7 The restrictions in clause 30.3 shall not apply in respect of the disclosure of an item of Confidential Information referred to above:

(a) to the Secretary of State, whose obligations in relation to Confidential Information are set out in clause 4 (*Confidentiality*) of the Umbrella Agreement;

(b) to ORR, the Prudential Regulation Authority, the Financial Conduct Authority, the Competition Commission or the London Stock Exchange or the Bank of England where that item is required to be disclosed by law or by any written requirements of any taxation authority;

(c) to:

(i) any solvent Affiliate of the disclosing party or other solvent member of the group of companies of which the disclosing party is a member (in each case excluding for these purposes any person or other entity described in paragraph (b)(ii) or paragraph (c) of the definition of Affiliate in the Master Definitions Agreement which is not a direct or indirect shareholder of the Owner or a member of the Owner's Group) or any direct or indirect shareholder of the Owner or a member of the Owner's Group;

(ii) any lawyers, accountants, insurers or others providing professional services (other than any engineering or design services (including the provision of such services by train manufacturers)) to the TMM, the Owner or the Operator;

(iii) any financier of the Operator, the TMM or any Financier of any member of the Owner's Group;

(iv) any Sub-Contractor or any sub-contractor of the Owner or the Operator (including, in the case of the Operator, any person who sub-leases the Units in accordance with the terms of the Lease and the TSA);

(v) [][159]

(vi) [][160]

provided that in any such case:

(A) disclosure is necessary in order to enable the relevant recipient to perform its role in the Project, or the disclosing party needs to make such disclosure in order to run its business; and

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[159] Redaction.

[160] Redaction.

(B) the disclosing party agrees that:

(I) it shall use reasonable endeavours to obtain an undertaking of confidentiality (which is directly enforceable by the owner of such Confidential Information against the relevant recipient) on substantially the same terms as this clause 30 from each relevant third party recipient of the Confidential Information; and

(II) save where the relevant recipient has provided an undertaking of confidentiality to the owner of such Confidential Information that is directly enforceable by the owner of such Confidential Information in accordance with sub-paragraph (I), it shall be responsible for any breach of the provisions of this clause 30 by any relevant persons referred to in paragraphs (i) to (vi) inclusive to whom disclosures are made;

(d) where the item is required in connection with any litigation provided that the disclosing party shall reveal only such Confidential Information as is reasonably necessary for such litigation and shall seek to minimise both the number of third party recipients of such Confidential Information and the amount of Confidential Information disclosed;

(e) where the item is in the public domain other than as a result of the breach of any obligation of confidentiality;

(f) which is required in connection with an assignment, transfer or other disposition of rights permitted hereunder where the proposed assignee or transferee has agreed in writing to be bound by the provisions of this clause 30;

(g) which is required in connection with a sale or other disposition of shares or other interest in the TMM, the Operator, any member of the Owner's Group or any parent company (or other entity which is a direct or indirect shareholder of any member of the Owner's Group) of those persons, provided always that any recipient of such information has provided an undertaking of confidentiality on substantially the same terms as set out in this clause 30; or

(h) where the item was made available to the disclosing party on a non confidential basis.

Standard of care

30.8 In fulfilling its obligations under this clause 30, each Party shall be required to use a proper standard of care, which shall in no event be less than the same degree of care to prevent unauthorised disclosure of the Confidential Information as it would

use to prevent the disclosure of its own commercial and financial information of the same or similar nature and which it considers proprietary or confidential.

Remedies

30.9 The Parties acknowledge and agree that a breach of any of the provisions of clauses 30.3 to 30.8 inclusive may cause the owner of Confidential Information to suffer irreparable damage that could not be adequately remedied by an action at law. Accordingly, each Party agrees that the owner of Confidential Information that is disclosed in breach of any of clauses 30.3 to 30.8 inclusive is entitled to specific performance of those provisions to enjoin a breach or attempted breach thereof and to any other remedy, including, *inter alia*, damages and injunctive relief, awarded by the English courts.

30.10 The provisions of clause 40.13 shall apply to any breach by Eversholt of the terms of the undertaking of confidentiality granted by Eversholt to the TMM or the Operator as the case may be.

Survival

30.11 The obligations of the Parties under this clause 30 shall survive the expiry or the termination of this Agreement for whatever reason.

31. ILLEGALITY

If at any time any one or more of the provisions of this Agreement becomes invalid, illegal or unenforceable in any respect under any law, the validity, legality and enforceability of the remaining provisions shall not in any way be affected or impaired.

32. WAIVER

Except as expressly stated in this Agreement, no failure or delay by any of the Parties to this Agreement at any time to enforce any of the provisions of this Agreement shall be construed as a waiver by such Party of such provision or in any way affect the validity of this Agreement or any part of it. The respective rights of the Parties (whether arising under this Agreement or under the general law) shall not be capable of being waived otherwise than by an express waiver in writing.

33. ENTIRE AGREEMENT

33.1 This Agreement supersedes any previous written or oral agreement between the Parties in relation to the matters dealt with in this Agreement and contains the whole agreement between the Parties relating to the subject matter of this Agreement at the date hereof, to the exclusion of any terms implied by law which may be excluded by contract, and shall not be varied otherwise than by an instrument of even date herewith or subsequent hereto executed by or on behalf of the Parties hereto, including by way of the UA Variation Procedure under the Umbrella Agreement.

33.2 Each Party acknowledges that it has not been induced to enter into this Agreement by any representation, warranty or undertaking not expressly incorporated

into it. So far as permitted by law and except in the case of fraud, each Party agrees and acknowledges that its only rights and remedies in relation to any representation, warranty or undertaking made or given in connection with this Agreement shall be for breach of the terms of this Agreement, to the exclusion of all other rights and remedies (including those in tort or arising under statute).

34. NOTICES

34.1 Any notice, notification or other communication under or in connection with Schedule 13 (*Permitted Delay Procedure*), Schedule 19 (*Termination*) or any Contract Dispute under or in connection with this Agreement shall be in writing and shall be delivered by hand or recorded delivery or sent by pre-paid first class post to the relevant Party at the address for service set out in clause 34.3, or to such other address in the United Kingdom as each Party may specify by notice in writing to the other Party.

34.2 Any other notice, notification or other communication under or in connection with this Agreement shall be in writing and shall be delivered:

(a) in accordance with clause 34.1; or

(b) by electronic data transfer.

34.3 The address and electronic data transfer details of the TMM, the Operator, the Owner and Eversholt are as follows (or such other address or electronic mail details which may be subsequently notified by the relevant party):

TMM:	Address:	Siemens plc 2 Queen Anne's Gate Buildings Dartmouth Street London SW1H 9BP
	Name:	[]161
	Email:	[]162
Owner:	Address**:**	Cross London Trains Limited (Company no. 07813033) 210 Pentonville Road London N1 9JY
	Name:	[]163
	Email:	[]164

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161 Redaction.

162 Redaction.

163 Redaction.

164 Redaction.

Eversholt:	Address**:**	210 Pentonville Road London N1P 2AR
	Name:	[][165]
	Email:	[][166]
Operator:	Address:	First Capital Connect Hertford House 1 Cranwood Street London EC1V 9QS
	Name:	[][167]
	Email:	[][168]

34.4 Any such notice or other communication shall be deemed to have been received by the Party to whom it is addressed as follows:

(a) if sent by hand or recorded delivery, when delivered;

(b) if sent by pre-paid first class post, from and to any place within the United Kingdom, three Working Days after posting unless otherwise proven; and

(c) if sent by electronic data transfer, upon sending, subject to receipt by the sender of a "delivered" confirmation (provided that the sender shall not be required to produce a "read" confirmation).

34.5 Any notice or communication sent under this Agreement to the Owner shall be copied to Eversholt at the address for service set out in clause 34.3 or such other address as the Owner may specify by notice in writing to the TMM and the Operator.

35. NO OBLIGATION TO VERIFY NOTICES

The TMM shall be entitled to assume that any notice given by the Owner hereunder is properly given and shall not be obliged to carry out any due diligence as to whether the Owner has taken instructions from or consulted with the Operator even where such requirement to do so on the Owner is expressly stated in this Agreement.

36. TMM TO INFORM ITSELF FULLY

The TMM shall be deemed to have inspected and examined all documents and specifications and terms, and all established Applicable Laws and Standards, associated specifications and material requirements and to have obtained for itself all necessary information as to risks, contingencies and other circumstances which may

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[165] Redaction.

[166] Redaction.

[167] Redaction.

[168] Redaction.

influence or affect its ability to perform its obligations under this Agreement. Neither the Owner nor the Operator shall grant any extension of time or additional payment on grounds of misunderstanding or misinterpretation of any such matter, nor, save as provided in clause 18 (*Permitted Delays*) and Schedule 13 (*Permitted Delays*), and without prejudice to the application of the Applicable Variation Procedure in relation to a Change in Law, shall the TMM be released from any of the risks accepted or obligations undertaken by it in relation to this Agreement on the grounds that it did not or could not have reasonably foreseen any matter which might affect or have affected the design, manufacture, testing, certification, commissioning, acceptance, modification, supply of equipment or method of overhaul of the Units.

37. COSTS

Except as otherwise agreed in this Agreement, each Party shall bear its own costs (including legal fees) incurred in connection with the execution of this Agreement.

38. VALUE ADDED TAX

38.1 All payments made or to be made under this Agreement are deemed to be exclusive of any Value Added Tax chargeable thereon or by reference thereto. If any such payment constitutes the whole or part of the consideration for a taxable or deemed taxable supply (whether that supply is taxable pursuant to the exercise of an option or otherwise), the Party making the supply shall provide the Party which receives it with an appropriate Value Added Tax invoice in respect thereof, and an amount shall be paid on demand by the Party which receives the supply to the Party making such supply in addition to that payment which is equal to the amount of Value Added Tax which is chargeable in respect of the taxable or deemed taxable supply in question.

38.2 Where under this Agreement one Party has agreed to reimburse or indemnify another Party in respect of any payment made or cost incurred by the other then the first Party shall also reimburse the VAT paid by such other Party which forms part of its payments made or cost incurred to the extent that such VAT is not available for credit (whether by way of set-off or repayment) by such other Party under sections 24 to 26 (inclusive) of the Value Added Tax Act 1994 or any regulations made thereunder or any similar or equivalent legislation replacing or introduced in addition to the same.

39. LANGUAGE

All documentation or information required or produced in the course of or in connection with a Party's performance of this Agreement shall be in English.

40. ASSIGNMENT AND SUB-CONTRACTING

TMM assignment etc.

40.1 While clause 6 (*Disposal of this Agreement and the Contracts*) of the Umbrella Agreement remains in force, then subject to clauses 6.6, 6.7(c), 6.7(g) and 6.7(h) of the Umbrella Agreement, the TMM may not:

(a) assign or transfer or otherwise dispose of its rights and/or obligations under this Agreement, or sell any Rolling Stock, save by way of a Permitted Contracts Restructuring Arrangement in accordance with clause 6 of the Umbrella Agreement; or

(b) create or agree to create or permit to exist any Security Interest on or over Rolling Stock or this Agreement, without the prior written consent of the Secretary of State.

40.2 If clause 6 of the Umbrella Agreement is no longer in force, then subject to clause 40.3, the TMM shall not assign, transfer or novate its rights and/or obligations under this Agreement or any part thereof without the prior written consent of the other Parties (such consent not to be unreasonably withheld or delayed).

40.3 If clause 6 of the Umbrella Agreement is no longer in force, then the TMM may assign, transfer or novate all (but not part only) of its rights, title and obligations under this Agreement to another member of the TMM's Group, provided that:

(a) all of the TMM's rights, title and obligations under the TSA and the Umbrella Agreement at such time (if any) are assigned, transferred or novated to the same person at the same time, and such member of the TMM's Group executes a deed of accession substantially in the form contained in schedule 1.3 (*Deed of TMM Accession*) of the Umbrella Agreement;

(b) the Operator Guarantee and the Owner Guarantee each remain in full force and effect following the relevant assignment, transfer or novation; and

(c) the relevant assignee, transferee or novatee is not such that the assignment, transfer or novation would have amounted to a breach of clause 7 (*Change of Control*) of the Umbrella Agreement had the ownership and direction of the TMM so changed.

TMM Sub-Contracting

40.4 Subject to clause 40.5, the TMM may and agrees that, in relation to each of the Key Systems listed in Schedule 8 (*Key Systems and Approved Sub-Contractors (MSA)*), it shall only use the Approved Sub-Contractor(s) (MSA) listed against such Key System in Schedule 8 to carry out the TMM's obligations under and performance of this Agreement in relation to that Key System.

40.5 The TMM may and agrees that it shall only sub-contract the carrying out of the TMM's obligations under and performance of this Agreement in relation to Key Systems to:

(a) any Approved Sub-Contractor (MSA) in relation to whom the relevant Key System is not listed in Schedule 8; or

(b) any Sub-Contractor who is not an Approved Sub-Contractor (MSA),

with, in each case, prior written consent from the Owner and the Operator (such consent not to be unreasonably withheld or delayed). In seeking such consent, the TMM shall provide reasonable evidence of the relevant Approved Sub-Contractor's (MSA) or other Sub-Contractor's (as the case may be) qualifications, competence and suitability to carry out the relevant sub-contracted obligations.

40.6 Save as provided in clauses 40.4 and 40.5, the TMM may sub-contract the carrying out of the TMM's obligations under and performance of this Agreement to any Sub-Contractor.

40.7 The TMM shall retain responsibility in full for all of its obligations under this Agreement, and any act, omission, breach of contract or negligence of any of its Sub-Contractors, agents or employees under its control shall for the purposes of this Agreement, be deemed to be the act, omission, breach of contract or negligence of the TMM, save that the TMM's responsibility for such acts, omissions, breaches of contract or negligence to which any relevant provisions of this Agreement or any of the other Contracts (including clause 30.7 of this Agreement or clause 16.3 of the Umbrella Agreement) apply shall be as set out in those provisions, in accordance with their terms.

Owner assignment etc.

40.8 While clause 6 of the Umbrella Agreement remains in force, then subject to clauses 6.7(a), 6.7(b), 6.7(d), 6.7(e) and 6.7(f) of the Umbrella Agreement, the Owner may not:

(a) assign or transfer or otherwise dispose of its rights and/or obligations under this Agreement, or sell any Rolling Stock, save by way of a Permitted Contracts Restructuring Arrangement in accordance with clause 6 of the Umbrella Agreement;

(b) create or agree to create or permit to exist any Security Interest on or over Rolling Stock or this Agreement, without the prior written consent of the Secretary of State; or

(c) subject to clause 40.11, sub-contract its rights and/or obligations under this Agreement or any part thereof without the prior written consent of the other Parties (such consent not to be unreasonably withheld or delayed).

40.9 If clause 6 of the Umbrella Agreement is no longer in force, then subject to clauses 40.10 and 40.11, the Owner shall not assign, transfer, novate or sub-contract its rights and/or obligations under this Agreement or any part thereof without the prior written consent of the other Parties (such consent not to be unreasonably withheld or delayed).

40.10 If clause 6 of the Umbrella Agreement is no longer in force, then the Owner may, without the consent of the other Parties, assign, transfer or novate all (but not part) of its rights and/or obligations under this Agreement to any entity which acquires title to all (but not part) of the Equipment previously owned by the Owner.

Owner Sub-Contracting

40.11 Subject to clauses 40.12 and 40.13, the TMM and the Operator each acknowledge that the Owner proposes to sub-contract the performance of some (but not all) of its obligations under this Agreement to Eversholt pursuant to the Eversholt Services Agreement.

40.12 The Owner shall retain responsibility in full for all of its obligations under this Agreement, and any act, omission, breach of contract or negligence of Eversholt or any other of its sub-contractors, agents or employees under its control shall, for the purposes of this Agreement, be deemed to be the act, omission, breach of contract or negligence of the Owner, save that the Owner's responsibility for such acts, omissions, breaches of contract or negligence to which any relevant provisions of this Agreement or any of the other Contracts (including clauses 30.5, 30.7 or 40.13 of this Agreement or clause 16.3 of the Umbrella Agreement) apply shall be as set out in those provisions, in accordance with their terms.

40.13 [][169]

40.14 [][170]

Operator assignment etc.

40.15 While clause 6 of the Umbrella Agreement remains in force, and save as provided in clause 6.7(d) of the Umbrella Agreement, the Operator may not create any Security Interest over the Rolling Stock or assign or transfer or otherwise dispose (whether by Legislation or any transfer scheme pursuant to any Legislation or otherwise) of its rights and/or obligations under this Agreement, save by way of an Operator Accession or Operator Transfer Scheme that the Secretary of State effects in accordance with his undertaking under paragraph 1.1 of schedule 2.1 (*Section 54 Undertakings*) of the Umbrella Agreement.

40.16 If clause 6 of the Umbrella Agreement is no longer in force, then subject to clause 40.17, the Operator shall not assign, transfer or novate its rights and/or obligations under this Agreement or any part thereof without the prior written consent of the other Parties (such consent not to be unreasonably withheld or delayed).

40.17 If clause 6 of the Umbrella Agreement is no longer in force, then the Operator may, without the consent of the other Parties, assign, transfer or novate all (but not part) of its rights and/or obligations under this Agreement to any person who becomes or is appointed as a Train Operator by the Secretary of State in succession to the Operator, whose arrangements to operate relevant services will involve the use of the Units.

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169 Redaction.

170 Redaction.

Operator Sub-Contracting

40.18 Subject to clause 40.19, the Operator may sub-contract the performance of part (but not all) of its obligations under this Agreement without the prior written consent of the TMM and the Owner, provided that the proposed sub-contractor is:

(a) not a competitor of the TMM or any member of the TMM's Group; and

(b) reasonably experienced and competent in carrying out the relevant obligations, of which the Operator will produce reasonable evidence upon the reasonable request of the TMM or the Owner,

otherwise the prior written consent of the TMM and the Owner shall be required to any sub-contracting by the Operator, such consent not to be unreasonably withheld or delayed.

Operator Responsibility for sub-contractors and sub-lessees

40.19 The Operator shall retain responsibility in full for all of its obligations under this Agreement, and any act, omission, breach of contract or negligence of any of its sub-contractors, agents or employees under its control shall, for the purposes of this Agreement, be deemed to be the act, omission, breach of contract or negligence of the Operator, save that the Operator's responsibility for such acts, omissions, breaches of contract or negligence to which any relevant provisions of this Agreement or any of the other Contracts (including clauses 30.5 or 30.7 of this Agreement or clause 16.3 of the Umbrella Agreement) apply shall be as set out in those provisions, in accordance with their terms.

Operator consent

40.20 It shall be reasonable for the Operator to withhold its consent under clauses 40.2 or 40.9 where any assignment, transfer or novation of any of the rights and/or obligations under this Agreement is to be made to a company which would reasonably be regarded as a competitor of the Operator or its group in connection with its UK railway franchise business or is an Affiliate of such a company.

41. CHANGE OF CONTROL

The provisions of clause 7 (*Change of Control*) of the Umbrella Agreement shall apply in relation to any Change of Control.

42. SURVIVAL

42.1 The parties acknowledge that certain provisions of this Agreement shall survive termination of this Agreement, including each of clauses 1 (*Definitions, Interpretation and Common Terms*), 5.9, 5.10, 8.8, 11.32, 12.6, 17 (*Payments*), 23 (*Termination*), 24 (*Liabilities, Indemnity and Insurance*), 25 (*Limitations of Liability*), 26 (*Intellectual Property Rights*), 30 (*Confidentiality of Information*), 31 (*Illegality*), 32 (*Waiver*), 34 (*Notices*), 38 (*Value Added Tax*), 43 (*Disputes and Expert Determination*), 45 (*Governing Law and Jurisdiction*), 46 (*Contracts (Rights of Third Parties) Act 1999*) and this clause 42 and Schedule 11 (*Schedule of Prices*),

Schedule 12 (*Milestones and Payments*), Schedule 14 (*Design Life, Warranties and MSA Fault Rectification*) (subject to paragraph 10 of that Schedule 14), Schedule 16 (*TMM MSA Insurances*) and Schedule 19 (*Termination*) and any other provision of this Agreement which expressly or by implication is intended to come into or continue in force on or after termination of this Agreement, in each case in accordance with and subject to the terms of the relevant provision.

42.2 Any termination or Partial Termination of this Agreement or the termination of a Party's participation in this Agreement (for whatever cause) shall not affect any accrued rights or liabilities under this Agreement to which any of the Parties may be entitled or be subject as at the date of such termination, which shall remain in full force and effect upon such termination.

42.3 Any Partial Termination of this Agreement shall not affect any rights or obligations of the Parties under this Agreement which shall, subject to any express provision in this Agreement or the Umbrella Agreement to the contrary, continue other than in relation to any Equipment that has not been Accepted at the date on which such Partial Termination has effect.

43. DISPUTES AND EXPERT DETERMINATION

43.1 Save:

(a) where this Agreement provides for the determination of matters by an Expert; or

(b) where otherwise expressly provided for in this Agreement,

any Contract Dispute arising under this Agreement shall be resolved pursuant to the Applicable Dispute Resolution Provisions.

43.2 Where this Agreement provides for the determination of matters by an Expert, the provisions of the Applicable Expert Determination Provisions shall apply.

44. COUNTERPARTS

This Agreement may be executed in any number of counterparts, and by each Party on separate counterparts. Each counterpart is an original, but all counterparts shall together constitute one and the same instrument.

45. GOVERNING LAW AND JURISDICTION

Governing Law

45.1 This Agreement and any non-contractual obligations arising out of or in relation to this Agreement are governed by English law.

Jurisdiction

45.2 Save as expressly provided for in this Agreement, the English courts shall have exclusive jurisdiction in relation to all disputes arising out of or in connection

with this Agreement (including claims for set-off and counterclaims), including, disputes arising out of or in connection with:

(a) the creation, validity, effect, interpretation, performance or non-performance of, or the legal relationships established by, this Agreement; and

(b) any non-contractual obligations arising out of or in connection with this Agreement,

and each Party irrevocably submits to the jurisdiction of the English courts and waives any objection to the exercise of such jurisdiction.

46. CONTRACTS (RIGHTS OF THIRD PARTIES) ACT 1999

The Contracts (Rights of Third Parties) Act 1999 shall not apply to this Agreement, and no person other than the Parties to this Agreement shall have any rights under this Agreement.

IN WITNESS whereof this Agreement has been executed by the TMM, Owner and the Initial Operator on the day and date referred to above.

EXECUTED for and on behalf of **SIEMENS PLC** acting by its duly authorised attorneys:

ATTORNEY:

[][171]

In the presence of:
Witness' Signature: [][172]
Witness' Name: [][173]
Witness' Address: [][174]

[][179]

ATTORNEY:

[][175]

In the presence of:
Witness' Signature: [][176]
Witness' Name: [][177]
Witness' Address: [][178]

[][180]

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171 Redaction.

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173 Redaction.

174 Redaction.

175 Redaction.

176 Redaction.

177 Redaction.

178 Redaction.

179 Redaction.

180 Redaction.

EXECUTED FOR AND ON BEHALF OF
CROSS LONDON TRAINS LIMITED
BY:

DIRECTOR:

[][181]

DIRECTOR/SECRETARY:

[][182]

}

[][183]

[][184]

EXECUTED FOR AND ON BEHALF OF
FIRST CAPITAL CONNECT LIMITED
BY:

DIRECTOR:

[][185]

DIRECTOR/SECRETARY:

[][186]

}

[][187]

[][188]

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[181] Redaction.

[182] Redaction.

[183] Redaction.

[184] Redaction.

[185] Redaction.

[186] Redaction.

[187] Redaction.

[188] Redaction.

SCHEDULE 1

THE SPECIFICATION

Schedule 1.1:	**Train Technical Specification**
Schedule 1.2:	**Train Infrastructure Interface Specification**
Schedule 1.3:	[]189
Schedule 1.4:	[]190
Schedule 1.5:	[]191
Schedule 1.6	**TIIS Interface**

189 Redaction.

190 Redaction.

191 Redaction.

SCHEDULE 1.1

Train Technical Specification

This Schedule is recorded electronically in accordance with clause 4.19

Thameslink Programme	Document Reference Number: ITLR-T20911-003						
	Project Code	Contract Code	Originator Code	Document ID Code	Discipline Code	Sequential Number	Version
							5.1

Thameslink Programme

Train Technical Specification

Prepared for the Department for Transport by: **Interfleet Technology Ltd**

Approved for issue to the TMM

Department for Transport	[ ]1
	[ ]2
Department for Transport	[ ]3
	[ ]4
First Capital Connect	[ ]5
	[ ]6

1 - 6: Redaction.

Table of Contents

1 NOT USED

2 INTRODUCTION

The Thameslink programme is a major element in the development and improvement of the London commuter network. The new Units are intended to operate at a frequency of 24 trains per hour in the peak through the central London Core Area between St Pancras International and Blackfriars, providing inner and outer urban services to destinations to the north of London on the Midland and East Coast Main Lines and via London Bridge and Elephant & Castle to destinations to the south of London on the Brighton Main Line and other routes in Kent, Surrey and Sussex. The Units will have a key role in the success of the overall programme.

The Units must provide higher capacity, improved performance and energy efficiency, higher reliability, improved infrastructure and operational interfaces and provide a higher quality passenger environment compared with that currently offered by existing trains on the Thameslink Network. To deliver these requirements will require rolling stock that exploits advances in technology, adapting optimised solutions developed and proved across the world into a package compatible with the UK infrastructure to provide the following:

- *A train that can accommodate large numbers of passengers for metro style operations in the Core Area but also provides a comfortable environment for longer journeys in the outer suburban areas.*
- *A vehicle and interior design that allows the rapid movement of passengers on and off the train to support the short dwell times which are key to delivering 24 trains per hour (tph) through the Core Area.*
- *A superior onboard experience for passengers through features such as improved temperature regulation and whole journey passenger information.*
- *The traction and braking performance to support 24 trains per hour (tph) in the Core Area, provide enhanced operational flexibility in the outer areas and which will allow automatic train operation (ATO) to be fully exploited.*
- *A single unit train which uses best practice from the point of view of components, system architecture and recovery functions to deliver "best in class" levels of reliability and service performance, measured to industry norms, combined with extremely low levels of "mission critical" failure.*
- *A design that minimises the whole life cost to the railway system through features that reduce energy consumption, that minimise the train's impact upon the track and reduce maintenance and cleaning costs.*
- *Where alternative technical solutions are available which can support the achievement of minimum whole life, whole system cost but are not consistent with current UK industry practice, they should be included in the design but identified by the TMM as challenge points for joint action with the Purchaser to mitigate the risk of non- acceptance through the industry process.*
- *The use of innovative communications and passenger display technology to deliver real time information to passengers, operators and maintenance managers requirements.*

It is important that the train is designed taking full account of the passenger, operational and technical environment within which it will work. The TMM will be expected to cooperate closely with both the Operator and Network Rail to achieve an optimum overall system

design.

The role of this TTS is to define the technical requirements for the Units. The format of the TTS includes both information and requirements. Text shown in italics is for information only, text enclosed in boxes are the specification requirements. Each requirement has a unique identifier in the bottom left of the box which must be used in all communications regarding the requirement.

3 ABBREVIATIONS AND DEFINITIONS

Term	Meaning / Definition
AC	Alternating Current
ASDO	Automatic Selective Door Operation
ATO	Automatic Train Operation
ATOC	Association of Train Operating Companies
ATP	Automatic Train Protection
ATS	Automatic Train Supervision
AWS	Automatic Warning System
CCTV	Closed Circuit Television
Core Area	The section of the Thameslink Network between the new Canal Tunnels Junction and Blackfriars Junction including St Pancras, Farringdon, City Thameslink and Blackfriars stations
CSDE	Correct Side Door Enable
DC	Direct Current
DfT	Department for Transport
DGO	Driver Guard Operation
DMI	Driver Machine Interface
DOO	Driver Only Operation
DPTAC	Disabled Persons Transport Advisory Committee
DSAWD	Depot Shunt Audible Warning Device
EN	Euro Norm
ERTMS	European Railway Traffic Management System
ETCS	European Train Control System
FLU	Full Length Unit (also defined as a Type 1 Unit)
GSM-R	Global System for Mobile Communications – Railways
HMRI	Her Majesty's Railway Inspectorate
HVAC	Heating, Ventilation and Air Conditioning
ISO	International Standardization Organization
JRU	Juridical Recording Unit
MSA	Manufacture and Supply Agreement
NFRIP	National Fleet Reliability Improvement Programme
OTDR	On Train Data Recorder
Performance Core	Those routes or parts of routes on the Thameslink Network that fall within the area bounded by the Recording Points (as defined in the Track Access Agreement) which monitor the timing of trains, located at or most proximate to West Hampstead station, Finsbury Park station, Elephant and

	Castle station and Bermondsey Junction.
PIS	Passenger Information System
PRM	Persons With Reduced Mobility
RAIB	Rail Accident Investigation Branch
RCD	Residual Current Detector
RCF	Rolling Contact Fatigue
RGS	Railway Group Standard
RLU	Reduced Length Unit (also defined as a Type 2 Unit)
RSSB	Rail Safety Standards Board
Rule Book	Railway Group Standard GM/RT8000 as published by RSSB
STM	Specific Trackside Module
TIIS	Train Infrastructure Interface Specification
TMS	Train Management System
TOC	Train Operating Company
tph	Trains Per Hour
TPWS	Train Protection And Warning System
TSI	Technical Specification for Interoperability.
TTS	Train Technical Specification (this document)
Type 1 Unit	The nominal 240 metres formation of outer suburban, dual voltage, electric trains referred to in the document as FLUs
Type 2 Unit	The nominal 160 metres formation of outer suburban, dual voltage, electric trains referred to in the document as RLUs
UIC	Union Internationale des Chemin de fer (International Union of Railways)
Unit	Any Type 1 Unit or Type 2 Unit
VTT	Virtual Test Track

3.1 Operational Loading Definitions.

The following definitions are used specifically for the TTS. The TMM will be expected to apply states of loading throughout their train design which are consistent with the loading definitions in EN 15663:2007, "Railway Application – Vehicle Mass Definitions" and provide comprehensive rationale for all states of loading that are applied in the design to meet Applicable Laws and Standards. It is considered acceptable that the TMM may assume that luggage utility modules are deployed, and payload allowance is given to luggage rather than standing passengers in these areas when deriving the standing area allowance in accordance with EN 15663.

Tare load	The mass of a fully serviceable Unit without any passengers: Tare load is equivalent to the Design Mass in Working Order state of loading in EN 15663.
Full load	The mass of a fully serviceable Unit with all seats occupied plus standing passengers at 4 passengers per m² of usable standing space where the mass of a passenger is 70kg. Full load is equivalent to the Normal Design Payload state of loading in EN 15663.
Crush load	The mass of a fully serviceable Unit with all seats occupied plus standing passengers at 6.4 passengers per m² of usable standing space where the mass of a passenger is 70kg. Crush load is equivalent to the Exception Payload state of loading in EN 15663.

4 STANDARDS, APPROVAL AND ENVIRONMENT

4.1 Standards and Legislation

It is the policy of the Secretary of State to move towards the objectives of the European Interoperability Directives at a rate that is economically practicable within the constraints of the main line British network. So far as the Units are concerned, the Secretary of State wishes to maximise compliance with current and emerging European standards because this is consistent with the objective of the project to use technology and designs from across the world to support improved whole life cost, high capacity and high reliability.

The Units shall comply with the requirements of all applicable British and European Standards, and all relevant European and UK legislation at the time of contract.

TTS 4.1.1

The Units shall comply with the Conventional Railway Locomotive and Passenger Technical Standard for Interoperability (CR LOC&PAS TSI (as defined in schedule 1.4 (Relevant Laws and Standards))).

TTS 4.1.2

The Units shall comply with applicable Euro Norm standards except where otherwise approved and unless required otherwise by UK legislation or through mandatory requirements of the Specification and RGS.

TTS 4.1.3

Where the TMM wishes to propose an alternative standard to a standard listed in schedule 1.4, full justification shall be provided as to the alternative standard's applicability and acceptability.

TTS 4.1.4

Where particular standards are considered applicable, the standard is stated in the relevant part of this specification.

Where a standard is declared in the Specification or the TIIS, the standard shall be deemed mandatory and alternative standards shall not be considered.

TTS 4.1.5

Approval under the RIR (as defined in schedule 1.4 Relevant Laws and Standards) will be required for the Units before operation and entry into service.

TTS 4.1.6

The Units shall comply with the TIIS in order to ensure compatibility with the infrastructure over which they are to operate and in order to support reduced whole life cost for the railway system.

TTS 4.1.7

4.2 Operating Environment

The Department wishes to procure trains which are capable of continuous operation within the full range of ambient and environmental conditions likely to be encountered during their lifetime.

Each Unit shall be capable of continuous operation within the full range of ambient and environmental conditions which will be encountered in service.

TTS 4.2.1

Each Unit and all its constituent parts shall comply with the requirements of climatic zone T1 and altitude range A2 as specified in EN50125-1 1999 Railway Applications – Environmental conditions for equipment.

TTS 4.2.2

Each Unit shall be resistant to the effects of exposure to salt water spray.

TTS 4.2.3

Exposure to salt water spray shall not cause excessive corrosion or degradation of exposed surfaces, components and equipment.

TTS 4.2.4

Each Unit shall be resistant to the effects of any fluids (such as graffiti removal or vehicle washing chemicals) or particles likely to be encountered in the railway environment.

TTS 4.2.5

Each Unit exterior, when all doors and windows are closed, shall prevent the ingress of snow, rain, wash plant spray, noticeable draughts, dust and leaves under all environmental conditions.

TTS 4.2.6

In the vicinity of externally opening windows and doors, all controls, equipment and enclosures shall be designed to ensure continued operation with no adverse effects of local ingress of water, dust, snow and leaves.

TTS 4.2.7

Each Unit shall be capable of operating normally through snow or flood water, up to the maximum depths for normal operation and thereafter (subject to speed restriction) up to the absolute maximum depths for operation, as published in the Rule Book.

TTS 4.2.8

The Unit shall continue to operate within design parameters during overhead line or third rail icing conditions.

TTS 4.2.9

Over the lifetime of the Units the climate in the UK is predicted to change. Further information on the expected climate change impacts in the UK can be found on the UK Climate Impacts Programme (UKCIP) website at www.ukcip.org.uk

Each Unit shall be designed to cope with predicted climate change which may result in more extreme weather conditions, higher summer temperatures and higher winter rainfall.

TTS 4.2.10

5 UNIT REQUIREMENTS

5.1 Unit Configuration

The Units must be optimised to meet a number of potentially conflicting requirements for high capacity, high passenger flow, low track impact and low energy consumption. This specification describes the overall constraints on the configuration of trains and Units but not the internal configuration of Units in terms of numbers of vehicles and lengths.

Units will operate in two different lengths to interface with the differing length platforms on the Thameslink route. There is no operational requirement for such Units to be divisible. Trains will therefore be comprised of FLUs and RLUs.

Each train operating in passenger service shall be comprised of a single Unit.
TTS 5.1.1

Units shall be manufactured, delivered and operated in two different lengths to meet different service requirements.
TTS 5.1.2

FLUs shall not exceed 243m in overall length between coupler faces.
TTS 5.1.3

RLUs shall not exceed 162m in overall length between coupler faces.
TTS 5.1.4

RLUs shall be capable of being extended to FLUs without altering the fundamental system architecture or making structural changes and without detriment to performance or reliability.
TTS 5.1.5

Vehicles of the same type and orientation shall be interchangeable between Units, using the facilities of a maintenance depot.
TTS 5.1.6

5.2 Unit Capacity

The Units must provide for the needs of commuter, suburban and other passengers in terms of the space allowed for luggage and seating, whilst simultaneously providing an adequate width of door, size of vestibule and width of aisle, so that high passenger flows into and out of the Unit can be achieved within the dwell time. Maximum usable space inside the Unit, within the external gauge constraints, will be critical to achievement of these objectives and, is therefore of very high value.

The Secretary of State has established a minimum level of seating, standing and luggage capacity for the Units, set out in requirement 5.2.1, below which satisfactory operation of the

service would not be possible. It is expected that this level of capacity should be readily deliverable within trains of the length anticipated with a relatively conservative design approach.

Additional seating capacity has significant value to the Secretary of State. It is expected that by optimising the design parameters, i.e. door size and position, vestibule layout and seat layout, that a larger number of seats can be provided without compromising the key parameters such as door size and position, which are set and will constrain for the life of the Unit the upper limits to passenger flow within an acceptable dwell time.

Flexibility of interior design is of significant value. It is possible that during its life the Unit may be operated on routes and in conditions where dwell time achievement is less critical and luggage space less important. Each Unit shall provide at least the capacity given in the table below whilst simultaneously meeting the dwell time requirements of clause 6.6.
TTS 5.2.1

	FLU	**RLU**
Standard seats	572	364
1st class seats	48	48
Face to face tables	10 (1st class only)	10 (1st class only)
Luggage module capacity (litres)*	24,000	16,000
Luggage utility modules per vestibule	1	1
Cycle utility modules per Unit	2	2
Standing capacity**	1100	730
Toilets	5 (including 1 universal access toilet)	3 (including 1 universal access toilet)

*not including overhead or underseat luggage storage

** calculated at 4 passengers per square metre of free area

Not used.

TTS 5.2.2

The Unit design shall be flexible so that the Unit could be modified internally without structural alteration to provide additional seating capacity without consideration of the impact on dwell time, and providing for luggage storage only in overhead and under-seat locations.

TTS 5.2.3

The following presumptions shall be made in calculating Unit capacity as above:

'Three plus two seating' arrangements are not permitted in any configuration.

Tip up seats can only be included in the seat count once the minimum number of conventional seats and the space necessary for the minimum standing capacity required by TTS 5.2.1 has been achieved.

The space used by the occupied tip up seat shall be included in the seat count calculations unless it is primarily required for wheelchair passengers or is required for the minimum standing space calculation. It may not be double-counted for seat and standing capacity.

Standing capacity shall be calculated at 4 passengers per square metre of usable standing area. Usable standing area is defined as the aggregate of all areas of floor within the Unit greater than 0.25m² and with no fixed obstruction from the floor to a height of 1800mm and where suitable hand holds are provided to allow passengers to safely stand. When deriving the minimum standing capacity, the TMM shall assume that luggage utility module shelves are deployed and inaccessible to standing passengers.

A 300mm allowance for passenger feet and knees shall be made for all fixed longitudinal seating, for both capacity and loading calculations in accordance with prEN15663, Railway Application - Vehicle Mass Definition, Clause 6. The same allowance shall also apply to occupied tip up seats.

TTS 5.2.4

Each Unit shall provide maximum usable standing capacity consistent with the required minimum seating and luggage capacity.

TTS 5.2.5

Each FLU shall be fitted with five toilets including a universal toilet compliant with the PRM TSI (as defined in Schedule 1.4 (Relevant Laws and Standards)).

TTS 5.2.6

Each RLU shall be fitted with three toilets including a universal toilet compliant with the PRM TSI.

TTS 5.2.7

The PRM accessible accommodation and universal toilet shall be fitted near to the centre of the Unit, so that it is accessible from the same platform area irrespective of the Unit orientation.

TTS 5.2.8

As far as practical, toilets shall be distributed evenly, and in consistent locations from the passenger's perspective through the length of the Units.

TTS 5.2.9

5.3 Unit Mass

The mass of the Unit is a critical parameter which influences the whole life cost of the railway system. Train mass affects energy consumption and also influences the maintenance required to keep the track condition to an acceptable standard. The Secretary of State is seeking solutions which minimise Unit mass and thus offer a reduced whole life cost solution. In order to incentivise this, the MSA makes provision for rewards and liquidated damages to apply according to the final weight of the train design.

The target weights for clauses 5.3.1 and 5.3.2 have been agreed and are noted below.

The tare mass of a FLU shall not be greater than 410 tonnes.

TTS 5.3.1

The tare mass of a RLU shall not be greater than 278 tonnes.

TTS 5.3.2

Not Used.

TTS 5.3.3

Not Used.

TTS 5.3.4

5.4 Floor Height

The floor height adopted for the Unit is a critical parameter which governs the compatibility with new and existing station platforms, has a significant influence on passenger flow through the doors and influences accessibility for Persons of Reduced Mobility. The specified floor height has been adopted by agreement with Network Rail and in consultation with other bodies.

The nominal floor height above the rail at vehicle entry doorways and throughout the Unit shall be 1100mm. Any transition required between the saloon and cab shall not present a tripping hazard.

TTS 5.4.1

The actual static floor height when measured in service under all conditions of load and vehicle state (including wheel wear) shall not exceed 1105mm nor be less than 1080mm.

TTS 5.4.2

There shall not be a vertical step between any exterior doorway tread plate and the Unit floor.

TTS 5.4.3

5.5 Inter Vehicle Gangways

The provision of a safe, secure and pleasant environment in which passengers travel in safety and comfort is an essential objective. Providing an open interior, with wide access between vehicles promoting the free flow of passengers along the Units and maximising internal standing space is part of achieving that objective. A solution which avoids fitting of internal gangway doors is required so as to avoid impeding the free movement of passengers along the Unit during normal operation. Suitable functional and / or design solutions will be necessary to mitigate for any fire safety requirements of current industry codes of practice that could conflict with the aspiration for the easy movement of passengers along the Unit during normal operation. However, to allow train operators to close off part of a Unit when out of service for technical or operational reasons, deployable gangway partitions will be required at certain locations.

Inter-vehicle gangways shall be at least 1350mm wide and with the exception of the gangways fitted with deployable gangway partitions, have sufficient width above floor level to allow at least two 95th percentile adult UK male passengers to pass each other unimpeded.

TTS 5.5.1

Inter-vehicle gangways shall be at least 1900mm high throughout.

TTS 5.5.2

The inter-vehicle gangway floor shall provide level access between vehicles, consistent with the requirements of the PRM TSI and free from step or trip hazards.
TTS 5.5.3

The inter-vehicle gangway area shall be fitted with the necessary grab rails or other hand holds to allow passengers to safely stand in these areas.
TTS 5.5.4

Functional or design solutions shall be implemented as necessary to mitigate any increase in fire risk resulting from the absence of gangway doors.
TTS 5.5.6

Each Unit shall be fitted with two sets of deployable lockable gangway barriers or partitions to close off sections of the Unit for operational purposes, located as far as practical at one third and two thirds positions along the length of the Unit.
TTS 5.5.8

The gangway partitions shall be deployable by Operator staff in service between workings or whilst the train is moving.
TTS 5.5.10

In case of emergency passengers shall be able to access the closed off section of the Unit through the deployable lockable gangway barriers.
TTS 5.5.11

5.6 Multiple Unit Operation

Units will not operate in multiple in normal service. However operation of Units in multiple will be required for train rescue events or the movement of non-service trains from one location to another.

Units shall be capable of automatic mechanical and pneumatic coupling to another Unit under all loading and wheel wear conditions.
TTS 5.6.1

Units shall be capable of operating in pairs for empty stock and rescue purposes, in any RLU or FLU combination.
TTS 5.6.2

Units operating in pairs shall be under the control of a single driver for empty stock purposes.
TTS 5.6.3

When operating in pairs, essential functionality for crew to crew and crew to passenger communications shall be available between Units. Connection between Units shall be via the electrical jumper cable or other interconnection facility (TTS 5.7.6). Passenger information functions need not be provided between Units.
TTS 5.6.5

Units shall automatically recognise a change in configuration when coupled or uncoupled.
TTS 5.6.6

Units shall be capable of operating in pairs for rescue purposes under the control of a single driver in the healthy Unit, with the assistance of a crew member in the defective Unit if required.
TTS 5.6.7

Units shall be capable of operating in pairs for rescue purposes, in any combination of operational loading conditions, with the healthy Unit pulling or pushing.
TTS 5.6.8

5.7 Coupling

The coupling and uncoupling of the Units will be a relatively infrequent event and will not occur in normal service. However, when it does occur, the process of coupling is likely to be undertaken in difficult or stressful situations, particularly in confined tunnel sections and needs to be as straightforward and intuitive as possible and then to occur reliably from both safety and operational perspectives.

The automatic connection of electrical circuits through the coupler is a significant source of unreliability and is not mandated for the Units.

It shall be possible to safely mechanically and pneumatically couple or uncouple Units without the need for the driver(s) to leave the cab.
TTS 5.7.1

The driver shall be provided with an indication that coupling has occurred.
TTS 5.7.2

Each Unit shall be fitted with couplers compatible with the Dellner type 12 at both ends of the Unit.

TTS 5.7.3

The coupler shall be fitted with its centreline 925mm above rail level.

TTS 5.7.4

The coupler system shall be compatible with the track geometry given in RGS guidance note GM/GN2690 appendix 7 for both mainline and non passenger lines.

TTS 5.7.5

Electrical coupling for control and the powering of essential circuits of Units in multiple for both empty stock and rescue purposes shall be achieved in a simple and reliable manner. A jumper cable and receptacle would be acceptable for this purpose.

TTS 5.7.6

Electrical coupling using the jumper cable shall be possible from either side of the Unit when access is restricted to track level or platform level.

TTS 5.7.7

The Unit coupler shall be mechanically and pneumatically compatible with the Class 375 and Class 377, to allow a Unit to rescue a train comprising one or more Class 375 or Class 377 units and vice-versa.

TTS 5.7.8

Coupling adaptors shall be supplied to enable Units to be recovered by a locomotive fitted with any of the following;

- A standard (UIC or RGS) draw hook and shackle.
- A standard (UIC or RGS) draw hook and drop head buckeye coupler.

It is not intended that coupler adaptors are carried on each Unit. Coupler adaptors will be stored at convenient locations around the Thameslink Network for use as required.

TTS 5.7.9

Coupling adaptors shall be suitable for use with a locomotive fitted with a standard air brake system.

TTS 5.7.10

Coupling adaptors shall be supplied to allow the Unit to couple to other multiple units operating over the Thameslink Network equipped with Tightlock couplers. The adaptors must provide the necessary provisions for air operated equipment and ensure fail safe protection is maintained in the event of train division. It is not intended that coupler adaptors are carried on each Unit. Coupler adaptors will be stored at convenient locations around the Thameslink Network for use as required.

TTS 5.7.11

5.8 Rescue

The following requirements to support a rescue need to be met under all operational loading conditions.

It shall be possible for an unpowered Unit to be hauled up to maximum speed provided an air and electrical control or battery supply are available.

TTS 5.8.1

The Unit shall have sufficient battery life to allow an unpowered unit to be hauled or propelled for a minimum of 60 minutes from a fully charged condition.

TTS 5.8.2

In the event of derailment it shall be possible for the Unit to be recovered without consequential damage by agreed methods, aided by wheel skates, rail cranes, jacks and any other tools and equipment considered necessary.

TTS 5.8.3

The Unit shall be compatible with UK standard ‘BR Mk2’ wheel skate for recovery purposes. It is not intended that wheel skates are carried on board the Units.

TTS 5.8.4

It shall be possible for an unpowered Unit to be propelled at a speed of not less than 40km/h provided an air and electrical control or battery supply are available.

TTS 5.8.5

It shall be possible to reconfigure the Unit to be hauled or propelled unbraked at low speed with barrier vehicles/locomotives at each end providing braking force.

TTS 5.8.6

5.9 Automatic Train Operation

Units will operate with Automatic Train Operation (ATO), either from the outset or from early in the service operation. Details of the ATO requirements can be found in the TIIS, Clause 2.5.7.

The Units shall be designed for Automatic Train Operation.

TTS 5.9.1

The Unit's cab controls, equipment layout and traction, braking and door control systems shall be designed for both manually driven and automatic (ATO) operation.

TTS 5.9.2

The Units shall have full manual facilities for use outside of the Core Area and (if necessary) for initial operation.

TTS 5.9.3

6 PERFORMANCE CAPABILITIES

6.1 Running Times

Units are required to meet three related sets of requirements which together will determine the acceleration and braking capability of the train:

a) *Timetabled performance which must be met in both normal and partially degraded operation.*
b) *Enhanced performance which is required for recoverability purposes along the whole Thameslink routes.*
c) *Station reoccupation times in the Core Area under ATO control.*

Each Unit shall be capable of achieving the journey times and duty cycle listed in the train service specification as represented by Annex A and Annex B of this TTS.

TTS 6.1.1

Journey times and duty cycle shall be achieved, taking account of the traction power supply for the relevant routes listed in the TIIS.

TTS 6.1.2

All performance requirements in sections 6.1 and 6.2 shall be achieved in full load conditions (defined in section 3.1).

TTS 6.1.3

Not used.

TTS 6.1.4

All performance requirements in sections 6.1 and 6.2 shall be achieved with half worn wheels.

TTS 6.1.5

The Units shall be capable of achieving timetabled journey times outside the Core Area as in the 2006 timetable, using the May 2007 line speed profiles, with the same stopping patterns as represented by Annex A and Annex B of this TTS.

TTS 6.1.6

The Units shall be capable of achieving, as a minimum, the following sectional running times, for the central London sections encompassing the Core Area stations plus London Bridge and Elephant & Castle,. These times assume stopping at every intermediate station, with a dwell time of 60 seconds, and are based on the May 2007 line speed profiles.

TTS 6.1.7

	Section Running Times	
	Southbound	**Northbound**
Kentish Town to S. Pancras Intl	*3*	*3*
Finsbury Park to St Pancras Intl	*4.5*	*5*
*St Pancras Intl to Blackfriars**	*7.5*	*8.5*
Blackfriars to London Bridge	*4.5*	*4.5*
Blackfriars to Elephant & Castle	*3*	*3*

Units shall be capable of the performance requirements of TTS 6.1.6 and 6.1.7 with one traction subsystem isolated.

TTS 6.1.8

All journey times shall be achievable notwithstanding the limitations of the traction power supply for the relevant routes as listed in the TIIS.

TTS 6.1.9

The TMM is required to undertake train performance journey time simulations to demonstrate compliance with the Specification. The simulation shall be representative of the train functioning normally, i.e. with no equipment or systems isolated.

When functioning normally with all traction systems operating, Units shall be capable of achieving at least a 9.5% reduction on the actual journey running times for the current Thameslink Class 319 unit when operating on the AC power supply network part of a Bedford to Brighton semi-fast service, defined in Annex A. The saving shall be achieved between the relevant sections of the route and not necessarily each and every inter-station point to point journey time.

TTS 6.1.10

When functioning normally with all traction systems operating, Units shall be capable of achieving at least a 3.5% reduction on the actual journey running times for the current Thameslink Class 319 unit when operating on the DC power supply network part of a Bedford to Brighton fast service, defined in Annex A. This reduction shall be achievable with a DC nominal voltage of 750V. The saving shall be achieved between the relevant sections of the route and not necessarily each and every inter-station point to point journey time.

TTS 6.1.11

Not used.

TTS 6.1.12

6.2 Traction and Braking Performance

The traction and braking performance of the Units must deliver the station to station timings and run times required by this TTS. In addition, the performance must allow trains to achieve acceptable platform reoccupation times at Core Area stations and provide sufficient traction performance to allow trains to recover to the timetable without the need to add recovery time to the latter. Energy efficiency will be a key consideration in the train design.

Platform reoccupation time is measured at a station platform and is the time in seconds between the moment when a departing train's wheels start to turn and the moment when the next arriving train's wheels stop turning on arrival at the correct location on the platform. Platform reoccupation time depends critically on both the acceleration performance of the train (until it clears the platform starter) and the braking and accurate stopping performance of the next train, both under ATO control.

Each Unit shall be capable of a maximum speed of 100mph (160km/h) on level tangent track when travelling into a head wind of 60km/h.

TTS 6.2.1

Each Unit shall be able to achieve an acceleration rate sufficient to deliver the running time requirements in section 6.1 and no less than 1m/s² on level track up to a minimum of 30km/h on the AC network and up to the maximum possible speed on the DC network within the constraints of current limits.

TTS 6.2.2

Each Unit shall be capable of achieving a full service brake deceleration rate of at least 1m/s² under all load conditions, from a speed of 65 km/h.

TTS 6.2.3

Each Unit shall be capable of deploying its acceleration and braking capability under ATO control to achieve a platform reoccupation time of 75 seconds at any Core Area station in either direction and must take account of signalling constraints The baseline signalling plan is contained in Network Rail Thameslink Core Area signalling scheme plans: West Hampstead South Jnc to Clerkenwell No 2 tunnel (Drg No 07-SO-05 Sht 1 of 2 Ver AD1), and Clerkenwell No 2 tunnel to Loughborough Jnc/Metropolitan Jnc (Drg No 07-SO-05 Sht 2 of 2 Ver AD1), and the table of marker board presented in Annex C.

TTS 6.2.4

Each Unit shall be capable of pushing a failed Unit of the same or shorter length out of the Core Area.

TTS 6.2.5

Each Unit shall have a jerk rate under all load conditions of not greater than 0.75m/s³. Jerk rate shall be adjustable by maintenance staff between 0.5 m/s³ and 1m/s³.

TTS 6.2.6

6.3 Traction Supply

The traction supply from the Units will be drawn from either the 25kV AC overhead line supply or from the 750V DC third rail supply. For the latter, the current that can be supplied by the system is sometimes limited by the location and ratings of the substations or distribution equipment.

Full details of traction supply systems available on the Thameslink Network, its characteristics and any line current limitations are given in the TIIS section 2.4.

The routes north of the Core Area are electrified at 25kV AC using OLE whilst the routes south of the Core Area are electrified at 750V DC using the third rail system. The OLE is being extended from Farringdon to the south end of City Thameslink station such that the dual electrified (25kV AC and 750V DC third rail) section will extend from the south end of the platforms at City Thameslink to the north end of the platforms at Farringdon.

Full details of the traction supplies available and the line current limitations can be found in the TIIS section 2.4.

Units shall be capable of operating over both the Network Rail 750V DC 3rd rail and 25kV AC electrified systems.

TTS 6.3.1

Units shall be capable of manual and automatic changeover between the 3rd rail DC and 25kV AC electrified systems in accordance with TIIS section 2.4.3, without impacting the performance and reliability requirements of the Specification.

TTS 6.3.2

In instances where a route has line current limitations the Unit shall automatically adjust power consumption to remain within acceptable limits while maximising performance in accordance with TIIS sections 2.4.1.2 and 2.4.2.2.

TTS 6.3.3

6.4 Operational Routes

Units shall be capable of operation on all routes defined in Annex B of the TIIS.

TTS 6.4.1

Units shall be capable of negotiating the minimum horizontal and vertical track curvatures within depots and sidings which may be less than those defined for the designated routes.

TTS 6.4.2

6.5 Operational Configuration Times

The time taken to start up, reverse or reset a Unit has a direct bearing on the ability of the Unit to support an intensive diagram.

The time for reversals at terminal stations directly affects the dwell time whilst the time to reset a failure in service impacts on the severity of any service interruption.

A design is sought which achieves the shortest start up/reconfiguration times without adversely affecting the Unit design in other ways and minimises reset times to a level that is consistent with the targets for service interruptions.

Each Unit shall have an operational departure time of no more than 2 minutes from its normal standby state, with battery supplies switched on, including any time required to set up cab systems such as the passenger information system (PIS).

TTS 6.5.1

Operational departure time shall be measured from standby state with battery supplies switched on, to being able to move with all systems operational, assuming preparation tests have previously been completed, that all doors are initially closed and locked and that sufficient compressed air is already available in the Unit.

Each Unit shall be capable of reversing at terminating stations and sidings, both involving changing of driving position to the opposite end of the Unit, in no more than 2 minutes excluding door open/close times and any walking time between ends.

TTS 6.5.2

To meet the specified targets for minimising service interruptions, the Unit design should provide the driver with the capability to reset or isolate systems which could affect the start-up or reversing of a unit in normal service and to the achievement of rapid recovery from faults.

Resetting or isolating of Unit control and other systems shall be achievable from the operating cab.

TTS 6.5.3

The Unit shall be capable of building up sufficient air pressure for normal operation within 20 minutes starting from having all air reservoirs empty.

TTS 6.5.4

The driver shall be required to login only once when preparing the Unit.

TTS 6.5.5

6.6 Station Dwell Time

The Core Area will operate 24 tph during peak service requiring a Unit to arrive at each platform on average every 2½ minutes. The Core Area section journey time (clause 6.1.3), assumes a station dwell time of 60 seconds; however 15 seconds of this is required as an operational margin, to support 2 minute headways during service recovery.

The 45 second dwell time is measured from the moment a Unit's wheels stop turning on arrival until the moment they start to turn on departure.

To assist with Persons of Reduced Mobility (PRM) access in the Core Area, Network Rail is working with stakeholder groups to develop a solution with raised sections at the centre of platforms in the Core Area to give level access for wheelchair users and avoid the dwell time impact of manually deployed ramps.

Each Unit shall be capable of supporting a 45 second station dwell in the Core Area.

TTS 6.6.1

During this period the expected flows of passengers must be able to move between the Unit and the platform.

The available "doors fully open" time for passenger flow within the 45 second dwell shall be at least 27 seconds under driver control.

TTS 6.6.2

Unit doorways shall be sufficiently wide to allow passengers to pass through unhindered two abreast, each carrying a briefcase or similar size package.

TTS 6.6.3

The design of door and traction control equipment shall be optimised to increase the "doors fully open" time to the maximum practicable under ATO control.

TTS 6.6.4

6.7 Capacities Between Servicing

Certain systems on the Units will require regular servicing, such as toilets and clean water supplies. The capacity of these systems influences the servicing intervals and thus the maintenance costs, whilst also influencing vehicle weight. The Secretary of State is seeking solutions which maximise the intervals between servicing, whilst not adversely affecting the mass of the Unit or requiring excessive storage capacity

For purposes of design, and servicing planning, the maximum daily utilisation shall be taken as 900 miles and 21 hours.

The capacity of the Unit windscreen wash system shall support a minimum of 3 days of Thameslink service operation between top ups.

TTS 6.7.2

The Units shall achieve a minimum service interval of 3 days.

TTS 6.7.3

Levels of clean water, effluent and windscreen wash fluid shall be monitored and reported via the Train Management System (TMS).

TTS 6.7.4

The effluent retention tank for each toilet shall have a capacity sufficient to allow 3 full days of operation, based on the utilisation (above) in between emptying. An external warning indication shall be provided to alert staff when the effluent tank is approximately 75% full. The retention tank shall be fitted with a level gauge and level indicator that gives a pre-defined level indication to the TMS.

TTS 6.7.5

The fresh water tanks shall have sufficient capacity to allow 3 full days of operation of the toilet including routine use of the hand basin, based on the utilisation (above) in between refilling. An external warning indication shall be provided to alert staff when the water tank is approximately 25% full. The fresh water tank shall be fitted with a level gauge and level indicator that gives a pre-defined level indication to the TMS.

TTS 6.7.6

7 RELIABILITY

7.1 General

The Thameslink service represents an intensive operation of a metro style service with high capacity trains operating on short headways. Disruptions in this service, however slight, will lead to congestion on both trains and stations and a rapid deterioration of the quality of service offered. This applies particularly to the Core Area.

The Unit must be designed to achieve a high level of reliability in general service, as demonstrated by the mean distance between service affecting failures.

TTS 7.1.1

The Units shall be designed to achieve an extremely low level of “mission failures” (as defined in section 7.3) in the Core Area and elsewhere.

TTS 7.1.2

Reliability assurance shall be controlled through the EN50126-1:1999 “The Specification and Demonstration of Reliability, Availability, Maintainability and Safety” or an equivalent approved framework from tendering through the design, manufacture, testing, integration and introduction into service phases and through their entire life.

TTS 7.1.3

7.2 Mean Distance Between Service Affecting Failures

The mean distance between service affecting failures of the Units shall be measured in accordance with the NFRIP definition of “miles per 5-min delay", defined as:

- *A 5-min delay is counted where there is a fault on a train causing a delay of 5 or more minutes and the root cause is a technical or maintenance defect on the train. Cancellations and part cancellations also count.*
- *Included are train technical faults: on empty stock moves; on occasions where delay is exacerbated by operational error; and under adverse weather conditions.*
- *Excluded are train technical faults caused by vandalism, by proven infrastructure defects and by other 3rd parties, e.g. suicide damaging a train.*

Each Unit shall be designed to achieve a mean distance between service affecting failures of 50,000 miles in general service on the Thameslink Network overall.

TTS 7.2.1

7.3 Mission Failures

A mission failure is defined as a failure en route that results in the Unit having to be withdrawn from service before it reaches its advertised end of journey, or in a Primary Minutes Delay exceeding 60 minutes.

Failure between stations in the Core Area, requiring detrainment and evacuation of passengers, shall not occur more than once every 10 years across the whole fleet.
TTS 7.3.1

Failure in the Core Area causing a Primary Minutes Delay exceeding 60 minutes and / or requiring detrainment at a station shall not occur more than once every 3 years across all Units.
TTS 7.3.2

Failure on any other part of the Thameslink Network causing a Primary Minutes Delay exceeding 60 minutes and/or requiring detrainment shall not occur more than once every 6 months across all Units.
TTS 7.3.3

7.4 Technical Delays

Technical delay is defined as the Primary Minutes Delay to the Unit's planned journey caused by technical failure, malfunction or reduced performance, defined as:

- *A technical delay is counted when there is a fault on a train causing a delay of 1 minute or more in the Performance Core and 3 minutes or more on all other parts of the network, where the root cause is a technical or maintenance defect on the train.*
- *Technical delays include a "No Fault Found".*
- *Technical delays caused by vandalism, by proven infrastructure defects and by other 3rd parties are excluded.*

The Unit shall be designed with the necessary functionality in both normal and degraded modes to recover from or mitigate for technical failures, malfunction and reduced performance so that technical delays are minimised. Rapid recovery shall be provided for all failure modes which might cause significant technical delays, with minimal interaction by the driver, and avoids the need for the driver to leave the cab.
TTS 7.4.1

Targets for such technical delays shall be established which are consistent with the aims of the Performance Regime.
TTS 7.4.2

7.5 Design for Reliability

It is expected that the Unit design will incorporate appropriate system functions, levels of redundancy and degraded modes of operation to achieve the reliability outputs specified. Failure of a Unit in the Core Area will bring major disruption to the network and it is expected that each Unit will provide guidance to the driver on its state of readiness to enter into the Core Area.

The design of the Unit shall include a fast boot up facility for all systems from a standby state, with battery supplies switched on, following the insertion of a master key.
TTS 7.5.1

The design of the Unit shall include an automatic resetting facility.
TTS 7.5.2

The design of the Unit shall include remote subsystem isolation which allows the driver to manage failures with the minimum of delay.
TTS 7.5.3

TTS 7.5.1, TTS 7.5.2 and TTS 7.5.3 shall be achieved without the driver leaving the cab.
TTS 7.5.4

Each Unit shall have the ability to move with an onboard failure under its own power to the next station where passengers can be detrained except where the failure is of a major mechanical component. This ability shall be available in all circumstances except a failure of the traction supply or a physical obstruction of the track.
TTS 7.5.5

Each Unit shall have the same ability to safely clear the route by reaching a refuge siding in case of any train subsystem failure as two conventional multiple units coupled together of which one has suffered a subsystem failure.
TTS 7.5.6

Each Unit shall be fitted with self monitoring and predictive diagnostic equipment that will advise the driver and ground based operations and maintenance staff on failures of any train subsystem likely to affect the ability to achieve the specified levels of performance and service reliability.
TTS 7.5.7

Where the system design incorporates component redundancy as the method of reducing the consequences of single point failure, such redundancy shall not allow hidden faults to remain undetected.
TTS 7.5.8

The Unit traction system shall redistribute the available power amongst the remaining operational traction sub systems, within the system limits, in the event of one or more traction subsystem failures, so that the impact on performance and energy efficiency is minimised.

TTS 7.5.9

The Unit design shall minimise the risk of complete Unit failure due to loss or lack of air. In particular vulnerable air pipes, valves, cocks and other equipment shall be protected from trackside damage and isolation cocks shall be strategically located to allow isolation of leaking sections to prevent complete failure of the Unit.

TTS 7.5.10

To overcome a potential single point failure, the Unit shall provide a secondary means of speed display in the cab of sufficient accuracy for the Unit to continue in service until it can conveniently be removed.

TTS 7.5.11

8 TRAIN WIDE FUNCTIONS

8.1 Gauge and Track Interaction

The Units are required to be compatible with the infrastructure over which they operate and must thus conform to the required gauge requirements. The Secretary of State is seeking to maximise the interior width of the passenger space, within the confines of the defined swept envelope as well as permitting a high degree of flexibility to provide a range of interior layouts to be adopted.

The Unit gauge profiles shall not exceed those defined in the TIIS Annex A. and referenced in the TIIS section 2.1.1.

TTS 8.1.1

The Unit design shall fully exploit the defined gauge to maximise the internal space.

TTS 8.1.2

The Unit gauge shall be assessed using the methods described in RGS GM/RT2149 “Requirements for Defining and Maintaining the Size of Railway Vehicles” and GE/RT8073 “Requirements for the Application of Standard Vehicle Gauges”.

TTS 8.1.3

The Unit shall be designed to ensure the safe running on twisted track, taking into account specifically the transition phase between canted and levelled track and cross level deviations. The compliance with this requirement shall be verified by the procedure defined in RGS GM/RT2141 “Resistance of Railway Vehicles to Derailment and Roll Over”.

TTS 8.1.4

The running dynamic behaviour of the Unit shall be assessed using methods described in RGS GM/RT2141 “Resistance of Railway Vehicles to Derailment and Roll Over”.

TTS 8.1.5

8.2 Wheel Rail Interface

Minimising the amount of damage caused to the track, by the Unit, will minimise the track maintenance costs and potentially benefit the train operator and maintainer as the amount of RCF and wear generated on the wheels will be reduced, with increased wheel life.

The risk of RCF and wear can be quantified using the contact patch energy term $T\gamma$ which is readily available from the results of vehicle dynamics simulations.

The TIIS, Section 2.2, contains a number of requirements relating to wheel rail interface and the calculations required from TMM.

8.3 Energy Usage and Efficiency

The Secretary of State is seeking Unit designs which minimise the net energy drawn from the 25kV AC and 750V DC power supply systems consistent with the operational performance required. A very high proportion of kinetic energy recovery during braking with its re-use both on board the Unit and by other trains in the area is a key element in improving energy efficiency.

Each Unit shall achieve an improvement of at least 15% in net energy consumption, over current design rolling stock using regenerative braking operating a Bedford to Brighton semi-fast service, defined in Annex A, assuming an ambient external temperature of 21 ºC.

TTS 8.3.1

Net energy consumption is the consumed energy minus the regenerated energy. For the purposes of this calculation, the AC and DC power supply networks shall be considered to be 100% receptive and current design rolling stock shall be assumed to regenerate.

Each Unit shall have an intelligent stabling system which minimises energy consumption during periods out of use.

TTS 8.3.2

The intelligent stabling system shall ensure that Units can re-enter service, without delay, when required ensuring that the train crew and passenger environments are reasonably comfortable for immediate entry into service.

TTS 8.3.3

The intelligent stabling system shall be capable of being activated and de–activated by a control in the cab.

TTS 8.3.4

The intelligent stabling system shall be capable of being activated and de–activated remotely from the Operator's control centre.

TTS 8.3.5

The intelligent stabling system shall be accessible to servicing staff without the need for a driver's master key.

TTS 8.3.6

The Driver Advisory System(DAS) is intended to enable scheduled performance to be achieved in the most energy efficient and economical manner by advising on adjustments to speed and timing based on current performance against the timetable and (when receiving information from the infrastructure) the state of the route ahead. The TMM will be expected to work with Network Rail and the Operator to determine the data exchange interfaces with the infrastructure based traffic management system. The Next Generation Traffic Management Programme is currently starting work in this area and is tasked with defining

data exchange protocols for national application.

The data exchange interfaces with the infrastructure to support the DAS shall be agreed with Network Rail and the Operator.
TTS 8.3.18

A DAS shall be provided that gives train regulation information.
TTS 8.3.7

The DAS shall enable scheduled performance to be achieved in the most energy efficient and economical manner.
TTS 8.3.8

The DAS shall be capable of accepting “look ahead” route occupation and timing information transmitted in real time from the infrastructure anywhere on the Thameslink Network.
TTS 8.3.9

The DAS shall accept regulation information transmitted by the ATO system in the Core Area and its approaches for use when Units are being driven manually.
TTS 8.3.10

The ATO interfaces shall be configured such that operating profiles can be selected and optimised for either maximum throughput of trains or maximum energy efficiency. Train regulation and operating profile for the purposes of maintaining timing through the ATO section shall be determined by the ATS. The DMI must provide the driver with an indication of the operating profile the train is using. Attention is drawn to Annex J of the TIIS, which requires the driver to be able to select reduced adhesion settings when required.
TTS 8.3.11

Each Unit shall be fitted with energy metering equipment compliant with GM/RT 2132.
TTS 8.3.12

The energy consumption measurement shall identify the net energy used over a settable time span.
TTS 8.3.13

Each Unit shall separately measure the energy taken from and regenerated into the AC and DC network.
TTS 8.3.14

Units shall be capable of sending the information to a central data collection point whilst the train is in motion.

TTS 8.3.15

The Secretary of State wishes to consider the future inclusion of an energy storage system for storing and re-using braking energy that cannot be immediately used by the Unit auxiliaries, traction or returned to the traction supply.

The Unit design shall include space provision for an optional energy storage system for storing and re-using braking energy that cannot be used by the Unit auxiliaries or returned to the traction supply.

TTS 8.3.16

The Unit shall be designed for easy future fitment and integration of an energy storage system.

TTS 8.3.17

8.4 Ride Quality

The Thameslink service provides a high occupancy service through the Core Area with a suburban service to outlying stations beyond the Core Area. Passenger comfort is a key objective of the Thameslink programme for all passengers, throughout the Thameslink route.

The Unit ride quality shall achieve a mean comfort index of 2 based on EN 12299:2009 “Ride Comfort for Passengers, Measurement and Evaluation” when evaluated over the VTT track data file.

TTS 8.4.1

Compliance with the ride comfort requirement in clause 8.4.1 shall be assessed using the 95th percentile Simplified Comfort Index in accordance with EN 12299:2009 “Ride Comfort for Passengers, Measurement and Evaluation”.

TTS 8.4.2

The design shall be optimised to ensure that an acceptable level of ride quality is achieved when one or more air springs are deflated.

TTS 8.4.3

The Unit’s ride quality shall not be significantly degraded by wear or ageing of suspension components.

TTS 8.4.4

The ride quality requirements of TTS 8.4.1 shall be demonstrated for both tare and fully laden conditions over a range of speeds up to the maximum speed of the Unit.

TTS 8.4.5

8.5 Aerodynamics and Pressure Effects

The Unit design and construction shall be in accordance with RGS GM/RT2100, Issue 4, to ensure that passengers and/or staff do not experience significant discomfort due to internal pressure changes when operating over the designated route, including:

- in single bore/track tunnels.
- with trains passing in twin track tunnels.

TTS 8.5.1

The TMM shall ensure that the Unit's resistance to overturning in gales is adequate.. GM/RT2142 Issue 2 allows a risk-based approach to be adopted for trains which do not meet the intrinsic criterion of the standard. In the event that a risk-based approach is adopted, the absolute method detailed in GC/RT 5521 provides an appropriate starting point if appropriately adapted to the Thameslink case, with operation within the normal range of cant deficiencies rather than EPS cant deficiencies, and adapted tolerability criteria. This approach offers the possibility of considering a limited number of 'high risk' locations in lieu of complete network data.

Each Unit shall meet the requirements of RGS GM/RT2142 "Resistance of Railway Vehicles to Roll Over in Gales".

TTS 8.5.2

8.6 Noise and Vibration

The Units will operate a high frequency service on tight curves often in close proximity to dwellings, therefore the minimisation and control of noise is very important.

Measures to prevent the initiation or sustained generation of flange squeal or wheel ringing due to flange contact on small radius curves will be important in reducing noise. Such measures are envisaged as including flange lubrication or suitable proven wheel damping solutions.

Measures to maintain wheel running surfaces in good condition will also be important. Such measures are envisaged as including minimisation of wheel flats and similar damage.

Further requirements for exterior noise are defined in the TIIS section 3.5.

Each Unit shall comply with the requirements of the Noise Technical Standard for Interoperability (NOISE-TSI (as defined in Schedule 1.4 Relevant Laws and Standards)).

TTS 8.6.1

The Units must be designed to provide a comfortable environment for passengers on both short journeys in the Core Area and longer journeys in the outer suburban areas. Minimising interior noise and preventing irritating tones and vibration is considered crucial to this.

The Unit's interior noise levels shall not exceed;

74 dB (A) at the centre of each vehicle at 100mph in open air with all traction and auxiliary systems operating when measured in accordance with EN ISO 3381:2005 "Railway Applications Acoustics measurement of noise inside railbound vehicles".

76 dB (A) above floor level in each vestibule and gangway areas at 100 mph in open air with all traction and auxiliary systems operating when measured in accordance with ISO 3381:2005.

TTS 8.6.2

Each Unit's maximum internal noise levels under stationary condition in open air with all auxiliary systems operating normally shall not exceed 62 dB (A) anywhere along the Unit length when measured in accordance with EN ISO 3381:2005.

TTS 8.6.3

Units shall minimise the emission of prominent harmonics or discrete tones in all operating modes or conditions.

TTS 8.6.4

Interior fittings and components shall not produce noise at any time through the life of the Unit.

TTS 8.6.5

Units shall incorporate means for reducing flange squeal and wheel ringing on tight radius curves.

TTS 8.6.6

Units shall incorporate means for ensuring that wheel running surfaces are maintained in good condition.

TTS 8.6.7

8.7 Fire Safety

The Units will operate in tunnel sections and the approach to the design, in respect of fire risk mitigation and management must reflect that.

The presence of open intermediate gangways will require special attention to ensure that an adequate level of safety is achieved at all times and in all scenarios. Further risk mitigation may be required to achieve this adequate level of safety.

The TMM shall develop a Unit design that is acceptable overall from a fire safety perspective. The TMM must determine what additional safety measures are required. A most important consideration is for the Unit to reach a place of safety rapidly and for passengers to be able to escape easily. Whether automatic or manual deployment of additional safety measures is appropriate depends on the type and reliability of equipment proposed and the impact it might have on both driver workload and the ability of passengers to escape rapidly if deployed at an inappropriate time.

The Unit design shall adequately mitigate the risk of fire and its products of combustion when operating across the Thameslink Network.

TTS 8.7.1

The Units shall comply with the Safety in Railway Tunnels Technical Standard for Interoperability (SRT_TSI (as defined in Schedule 1.4 Relevant Laws and Standards)) and meet the specific requirements of fire safety category A as a minimum.

TTS 8.7.2

There are no tunnels on the Thameslink Network that exceed 5km in length and running times between places of safety in the Core Area are less than 4 minutes. SRT_TSI defines that the maximum allowable running time to a safe area permitted for a category A vehicle is 4 minutes. Although this can be achieved, it is considered that a longer specified running time will provide valuable additional safety support in both tunnel and open sections on the Thameslink Network. These requirements do not however negate the need to comply with any other European or national standards or legislation applicable to this contract.

To be fully compatible with the demands of the Thameslink infrastructure, the Unit running time requirement in the event of a fire shall be extended to a minimum of 8 minutes.

TTS 8.7.3

As a minimum the Unit materials shall comply with the requirements of BS6853:1999 “Code of practice for fire precautions in the design and construction of passenger carrying trains”, for a category 1b vehicle.

TTS 8.7.4

The Unit will be required to include systems capable of controlling the air flow in and out of the Vehicle to minimise the effects of smoke and toxic fumes on the safety of passengers and crew, ensuring that their ability to escape is not impaired. Unit systems will also be required to provide alarm information to the driver and the operational control centre to assist in the

management of fire incidents.

The Unit shall demonstrate an appropriate level of safety for a vehicle with open intermediate gangways through the application of appropriate qualitative and quantitative fire engineering techniques.

TTS 8.7.5

Any necessary response of the Unit HVAC system to the detection of an onboard fire shall be initiated without increasing driver workload.

TTS 8.7.6

8.8 Human Factors and Ergonomics

The application of human factors techniques and ergonomic assessments to the design of passenger vehicle interiors, including the crew areas, is an established and necessary part of the normal design process.

Ergonomic and human factors criteria and techniques shall be applied to the design of passenger and crew areas of the Units using applicable anthropometric data for passengers, train crew and maintenance personnel.

TTS 8.8.1

Each Unit shall present a safe, secure, user-friendly and comfortable environment for passengers, crew and maintenance staff with features and interface that are intuitive to users and minimises adverse effects from human errors.

TTS 8.8.2

8.9 Security, Anti Social Behaviour and Vandalism Resistance

The design of modern passenger vehicles needs to consider the security of passengers and their belongings in the context of the intended operation. The requirements already described for an open interior design, together with an on board CCTV system, will increase the passengers' sense of security.

The Unit shall be capable of being made secure when stabled without compromising the need to maintain accessibility for emergencies.

TTS 8.9.1

The interior bodyside windows and glazed surfaces shall be designed to optimise passenger safety.

TTS 8.9.2

The saloon to cab door shall be secure such that the cab is inaccessible to passengers during normal operation.

TTS 8.9.3

The contractor will be required to work closely with the Train Operator to ensure the functionality of the saloon to cab door provides adequate levels of access in normal and emergency operation.

The Unit interior shall be sufficiently robust to minimise damage from vandalism and misuse.

TTS 8.9.4

Tamper-proof fixing arrangements shall be fitted where necessary. Fasteners shall not be visible or accessible to passengers as far as practicable.

TTS 8.9.5

All interior bodyside windows and glazed surfaces shall incorporate a means to minimise the damage from vandalism by etching or scratching.

TTS 8.9.6

Internal and external finishes shall permit the easy removal of graffiti by trained personnel using proprietary graffiti cleaning chemicals, and the surfaces shall not readily degrade as a result of the removal process.

TTS 8.9.7

The Unit interior shall, as far as reasonably practical, be free from gaps and crevices where litter, sharp objects or any other items could be concealed or lodged. Any equipment, such as litter bins and luggage modules fitted behind seats shall be adequately designed to eliminate gaps or hidden voids.

TTS 8.9.8

Soft furnishings shall be resistant to damage by sharp objects and be designed to be economical and easy to replace when deemed necessary.

TTS 8.9.9

All Unit interior equipment within the passenger areas including PIS screens shall be resistant to vandalism.

TTS 8.9.10

8.10 Flexibility

The Unit's branding, exterior livery and interior design are aspects which prospective operators are likely to wish to change as the needs of the Thameslink service changes or as Units are moved to other duties. It is thus important that the Unit design provides a high level of flexibility in the interior layout and finish to cater for such change.

The Unit interior layout and interior components including the seats, tables, grab poles, draught screens, luggage modules and luggage racks shall be reconfigurable in an operational depot to allow for changes in capacity ratios.

TTS 8.10.1

The saloon floor area shall be kept clear of under-seat equipment that could limit interior flexibility.

TTS 8.10.2

The interior draught screens and other intermediate partitions shall not be structural.

TTS 8.10.3

The Unit wiring shall, as far as reasonably practical, be accessible without significant disassembly of the interior.

TTS 8.10.4

The Unit shall also include provision for additional control and communications cabling to be added at a later date with minimal disruption to the interior or underframe equipment.

TTS 8.10.5

The Unit shall be capable of having all transverse seating throughout the Unit replaced by longitudinal seating without major structural changes or significant change to interior equipment.

TTS 8.10.6

The Unit architecture shall be flexible to allow for formation changes, redeployment or route upgrade throughout the Unit's life.

TTS 8.10.7

The Unit architecture shall be flexible to allow for future train formation changes, redeployment or route upgrade.

The flexibility required is as follows;

- the reduction in length of a FLU to a nominal 200m Unit.
- the increase in length of a RLU to a nominal 200m Unit.

TTS 8.10.8

8.11 Recyclability

The Unit shall be designed for a minimum of 90% recyclability.

TTS 8.11.9

9 GENERAL VEHICLE DESIGN

9.1 Vehicle Design

The Unit shall have a design life of not less than 35 years, in accordance with paragraph 4 of MSA Schedule 14.
TTS 9.1.1

The Unit structures and equipment shall be designed for the currently defined fatigue loadings and service duty cycles under UK operating conditions.
TTS 9.1.2

The structural design shall take account of ATO service operation of the Unit.
TTS 9.1.3

The Unit design shall provide the driver with the necessary collision survival space requirements in accordance with prEN 15227, whilst maximising the saloon space available for passengers.
TTS 9.1.4

9.2 Exterior Requirements

Each Unit shall have smooth body contours as far as practical to allow efficient automatic or manual washing.
TTS 9.2.1

The Unit livery shall be agreed with the Owner and Operator.
TTS 9.2.2

The Unit shall be painted and be capable of being fitted with vinyl film in addition to the painted finish.
TTS 9.2.3

The paint finish shall be capable of withstanding the effect of any detergents used in the cleaning process.
TTS 9.2.4

The external paint and finishes shall have a high quality of detailing and finish, which shall remain durable and colour-fast for a life of not less than 12 years in service.

TTS 9.2.5

The number of different window sizes shall be minimised.

TTS 9.2.6

The bodyside windows shall be designed to enable maximum viewing for interior seated and standing passengers.

TTS.9.2.7

Extensive research undertaken by RSSB on behalf of the industry has concluded that the structural integrity of the glass within bodyside windows is essential for maintaining survivability during accidents and incidents. The Unit design should make use of this research in ensuring that the risk to rail passengers from being ejected from the Unit or hit by a projectile coming into the Unit through a window is reduced as far as reasonably practicable. Specific guidance on the use of laminated and toughened glass in double glazed assemblies is available in RGS guidance note GM/GN2687 issue 1 draft 1j June 2008, "Guidance for Rail Vehicle Interior Structure and Secondary Structural elements".

The Unit bodyside windows including door glazing shall use laminated glass in accordance with RGS GM/RT2100 issue 4, “Structural Requirements for Railway Vehicles”).

TTS 9.2.8

9.3 Interior Design

The Units will provide a service to differing groups of passengers, with different needs, as they operate over the route length and through the operating day. The design process will need to fully understand the needs of all the passengers and to ensure that they are addressed by the design. Critical factors in the interior design will be;

- *Maximised internal space for seated and standing passengers relative to overall Unit length.*
- *Free flow of passengers, with wide standbacks at external doorways to allow easy access so that the dwell time requirements can be met.*
- *Flexible internal layout, allowing refurbishment and/or relocation of interior furniture at minimal cost by ensuring the design permits work to be completed quickly.*
- *A comfortable and secure passenger and crew environment consistent with other modern suburban rolling stock.*

The Unit interior fittings shall be robust and minimise damage due to scuffing and abrasion damage from contact with passenger luggage or wheelchairs, etc.

TTS 9.3.1

All materials and components shall be resistant to fading and scratching and as far as reasonably practical shall be sufficiently durable to withstand heavy usage for the life of the Unit.

TTS 9.3.2

All interior panels, fixtures and fitting shall be designed to eliminate drumming, rattles and squeaks.

TTS 9.3.3

All glass panels used in the interior shall use laminated glass. This requirement need not apply to glass used in overhead luggage racks.

TTS 9.3.4

The floor covering shall be anti-slip, suitable for wet and dry conditions and hard wearing. Carpet shall not be used.

TTS 9.3.5

The floor covering shall be laid in such a way to prevent liquids seeping beneath the covering.

TTS 9.3.6

The floor covering in the vestibules shall be capable of coping with moisture from incoming passengers and rain and snow entering from open doors.

TTS 9.3.7

The Unit interior design shall include a system of grab poles, grab rails and aisle seat back grab handles, intuitively positioned to provide safe and comfortable support to passengers standing and walking through the Unit, whilst not impeding passenger flow.

TTS 9.3.8

The first class area shall be segregated and clearly discernable from other areas of the Unit, be free of standing areas and be fitted with a higher quality floor covering. Carpet shall not be used. It is considered that to provide sufficient segregation and provide the Operator with the flexibility to control access a door should be fitted, however alternative innovative solutions will be considered.

TTS 9.3.9

All interior areas of the Unit which facilitate standing or walking passengers shall be fitted with appropriate means of support to maximise the safety of passengers in all normal and emergency modes of operation.

TTS 9.3.10

The Unit interior floor shall be free from any fixed components that will obstruct, hinder and complicate cleaning.

TTS 9.3.11

9.4 Seating Provision

The TMM will be required to work closely with the Operator in providing seat types and arrangements appropriate for all users, and to ensure that seat construction and installation meets requirements for passenger comfort, maintenance and cleaning.

TTS 9.4.1

The seat back shall be sufficiently rigid to avoid discomfort to the passenger from being knocked or disturbed by passengers behind, or use by other passengers of the handhold or grab rail or movement of fold down tables where fitted.

TTS 9.4.2

The seat headrest shall be shaped to provide comfortable lateral support. The headrest shall be maximum height at the seat centre but be sympathetically shaped at either side to enable good vision between seats and a peripheral view of the horizon through windows on both sides from every seat possible.

TTS 9.4.3

Priority seats shall be easily discernable to all passengers.

TTS 9.4.5

Priority seats shall be designed and configured to maximise the ease of access and egress.

TTS 9.4.6

When unoccupied, tip-up seats shall, without assistance, return to the stowed position.

TTS 9.4.7

Not Used.

TTS 9.4.8

Longitudinal seating or any other non-transverse layout configuration shall only be offered if supported by evidence of being essential for achieving capacity or dwell time targets.
TTS 9.4.9

Seating shall be arranged to optimise the ability for passengers to view their stowed luggage.
TTS 9.4.10

Transverse seating configuration is preferred throughout the Unit to provide a suitable environment for leisure and regional commuter markets.
TTS 9.4.11

Draught screens shall be provided between stand backs and adjacent seating.
TTS 9.4.12

The seating layouts shall be consistent between different Unit configurations as far as practicable.
TTS 9.4.13

Not Used.
TTS 9.4.14

First class accommodation shall be provided in two segregated areas, one at each end of the Unit.
TTS 9.4.15

First class seating shall be provided in 2+2 configuration in both bay (with tables) and unidirectional seating layouts, except where this is not practical in the rows adjacent to the cabs and the first class partition door.
TTS 9.4.16

First class seats shall be of high quality, be trimmed in leather or a fire resistant equivalent and be equipped with folding arm rests and antimacassars.
TTS 9.4.17

All airline style first class seat positions shall be equipped with a laptop size fold down table.
TTS 9.4.18

All first class seats shall have access to a 240V power point for laptop and mobile phone use.

TTS 9.4.19

The floor area around standard and first class seats shall be designed to avoid obstruction to passengers' feet.

TTS 9.4.20

Pitch efficiency and seat widths shall be optimised between the requirement to achieve passenger flow through aisles, and the needs of the individual passenger for easy access and egress from the seat and journey comfort. The contouring of seat cushioning shall be designed to achieve defensible space for the seated passenger, avoiding the need for armrests if practicable.

TTS 9.4.21

The seat width shall be maximised up to the bottom of the headrest without unnecessary tapering, but within the limitations of the Persons with Reduced Mobility Technical Standard for Interoperability (PRM-TSI) throughway requirements. There shall be no gaps large enough between adjacent seats, through which a passenger in the seat behind can easily put their hand or other items.

TTS 9.2.22

9.5 Toilets

All Units shall be fitted with controlled emission toilets, capable of fully retaining all waste and odour between servicing on all Thameslink Network routes and service patterns.

TTS 9.5.1

Toilets shall be spaced as described in clause 5.2.9 of thisTTS.

TTS 9.5.2

One universal toilet shall be fitted within each Unit, which shall be accessible from all wheelchair spaces within the Unit.

TTS 9.5.3

All toilets shall incorporate a high level of resistance to becoming blocked due to misuse and overfilling.

TTS 9.5.4

The Unit interior shall be free from toilet odours at all times.
TTS 9.5.5

All toilets and cubicles shall be designed to avoid dirt traps and to allow efficient and effective cleaning.
TTS 9.5.6

All toilet modules shall be completely sealed.
TTS 9.5.7

All toilet modules shall incorporate appropriate features to prevent fluid leakage into the saloon or vehicle underframe.
TTS 9.5.8

The toilet module shall be capable of being removed and replaced by seating, or other interior features, without the need for major structural changes.
TTS 9.5.9

The installation of an additional standard toilet shall be possible without the need for major structural changes.
TTS 9.5.10

Toilet waste retention tanks shall be sited to facilitate ease of cleaning.
TTS 9.5.11

Toilet retention tanks shall be capable of being 100% drained during normal servicing.
TTS 9.5.12

Toilet door lock operation shall be clearly perceptible to all passengers and intuitive to the user providing unambiguous feedback as to whether the door is locked or unlocked.
TTS 9.5.13

All toilet doors shall incorporate a device to allow the door to be overridden and opened by Operator staff when ‘locked’.
TTS 9.5.14

The design of the toilet access door unlocking device, intended for the Operator staff, shall be sufficient to avoid the device being used or tampered with by passengers.
TTS 9.5.15

The device shall be designed to ensure that in the event of failure, passengers are not locked in the toilet module.

TTS 9.5.16

All toilet doors shall incorporate a means for staff to lock the door out of use.

TTS9.5.17

Means shall be provided to clearly identify to passengers that the toilet is 'locked out of use'.

TTS 9.5.18

An illuminated sign shall be provided in each vehicle to inform passengers of the location and status of the nearest toilets.

TTS 9.5.19

In addition to any mandatory equipment, each toilet shall be fitted with the following:

- A toilet bowl lid catch that holds up the lid when the train is in motion.
- A flush device that is visible when the toilet seat is in the raised position.
- A device to freshen the air by the addition of a pleasant fragrance.
- A sink and a tap that provides warm water at a temperature suitable for hand washing.
- A warm air hand drying facility that effectively dries hands within 15 seconds.
- A mirror with tamper proof fixings.
- A soap dispenser.
- A toilet tissue dispenser.
- A system for disposal of sanitary towels.
- A nappy changing facility.
- Two hooks for coats and bags.
- A litter bin.
- Support grab handles.
- Suitable lighting.

TTS 9.5.20

It shall be possible for maintenance staff to remove and replace the toilet bowl and associated equipment within 30 minutes.

TTS 9.5.21

9.6 Luggage and Cycle Stowage

The Units will provide services to a wide range of passenger types. Passengers travelling to and from airports and those travelling by Eurostar services will need luggage stowage that is easy to use and has the minimum impact on other users.

The Secretary of State is seeking solutions which:

- *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 through suitable design and location.*
- *do not obstruct the movement of passengers or crew during normal or emergency situations.*

A system of utility modules shall be provided which can accommodate luggage, bicycles, and shopping. There shall be two types of utility modules:

Luggage utility modules.

Cycle utility modules.

TTS 9.6.1

The luggage utility module solution shall ensure that items cannot be concealed.

TTS 9.6.2

The luggage utility module solution shall ensure that luggage can be easily identified by passengers and the Operator's staff.

TTS 9.6.3

Luggage utility modules shall provide safe and secure luggage stowage at two height levels; the lower shelf which may be the floor and an upper shelf.

TTS 9.6.4

Not Used.

TTS 9.6.5

Cycle utility modules shall provide storage for two bicycles, standing on the floor or base, and include a means of securing each cycle to prevent movement. The cycle module shall be designed to avoid damage to the interior from the storage of cycles. When not in use the module area shall be designed to accommodate seated passengers through the provision of tip-up seats.

TTS 9.6.6

The utility modules shall be evenly distributed throughout each Unit so there is at least one module adjacent to each vestibule. Two utility modules in each Unit shall be cycle utility modules. These shall be in the end vehicles of the RLU, and the equivalent position in the FLU so that cycle users can board and alight at the same platform position irrespective of Unit type.

TTS 9.6.8

Overhead luggage racks shall, where practicable, be provided above all seated areas of the train.

TTS 9.6.10

The design of the luggage rack shall ensure that airline sized hand luggage (560x450x250 mm) can be securely stowed with the longest edge parallel to the direction of travel.

TTS 9.6.11

Luggage stowed in the overhead rack shall be visible from seated positions directly below.

TTS 9.6.12

Luggage stowed in the overhead rack shall be visible by staff walking through the Unit.

TTS 9.6.13

Luggage stowed in the overhead rack shall as far as reasonably practicable be visible by CCTV cameras within the saloon.

TTS 9.6.14

All longitudinal overhead luggage racks shall be designed to maximise the retention of passenger luggage during normal conditions as well as during a collision.

TTS 9.6.15

The luggage utility modules (not including overhead luggage racks) shall provide secure storage for the luggage types given in the table below;

TTS 9.6.16

Luggage	Dimensions
Small Bags	560 x 450 x 250 mm
Large Bags/ Folding bicycles	850 x 650 x 400 mm
Full size, single, foldable pushchair (folded)	950 x 500 x 400mm

Appropriate signage solutions should be utilised to ensure that luggage is stowed in a safe manner, in accordance with the Operator's safety plan.

TTS 9.6.17

Under seat luggage stowage shall be provided which meets the following;

- Space for an airline sized briefcase/backpack under the seat in front (for airline style seating only).

TTS 9.6.18

9.7 Signage

All non-mandatory signs shall be designed in accordance with ATOC guidelines.

TTS 9.7.1

The unit shall be fitted with A4 sized magazine racks and A3 sized poster frames.

TTS 9.7.2

Not Used.

TTS 9.7.3

Statutory signage shall conform to the Applicable Laws and Standards.

TTS 9.7.4

Signage shall be durable and resistant to picking and malicious removal.

TTS 9.7.5

Bodyside panelling shall be designed with discrete features to allow for signage and poster frames to be visible and in consistent locations throughout the Unit.
TTS 9.7.6

Unique vehicle and unit numbers allocated by the Rolling Stock Library shall be displayed externally and internally. Door positions shall be identified through signage.
TTS 9.7.7

9.8 Catering

It is a desirable requirement that all Units have provision for deployment of shore based trolley catering services. A dedicated trolley storage facility need not be provided.
TTS 9.8.1

9.9 Litter

Litter/recycling bins shall be conveniently distributed throughout the Unit.
TTS 9.9.1

Litter/recycling bins shall be easily identifiable by passengers and capable of being rapidly emptied by cleaning staff.
TTS 9.9.2

9.10 Cleanability

Each Vehicle shall be fitted with a 240V, metal clad, RCD protected power point for a commercial vacuum cleaner.
TTS 9.10.1

Lighting and other interior assemblies shall be sealed against the ingress of dust and dirt.
TTS 9.10.2

Interior panels, covings and lighting shall be simply shaped to allow easy cleaning and have no visible gaps between sections that could act as water or dirt traps.
TTS 9.10.3

All interior materials shall be resistant to cleaning chemicals including chemicals required to kill pathogens and remove graffiti.
TTS 9.10.4

All heating and air conditioning ducts shall be designed to minimise the build up of dust, dirt and combustible detritus, and shall be fitted with suitable covers to both allow easy access for cleaning yet prevent against access by passengers.
TTS 9.10.5

It shall be possible to complete the daily standard clean, including the floor for an FLU interior, in no more than 3 man hours. It is understood that in exceptional conditions of soiling, more time will be needed.
TTS 9.10.6

It shall be possible to complete the daily standard clean, including the floor for an RLU interior, in no more than 2 man hours. It is understood that in exceptional conditions of soiling, more time will be needed.
TTS 9.10.7

It shall generally be possible to complete a periodical heavy clean for an FLU interior in no more than 42 man hours. It is understood that in exceptional conditions of soiling, more time will be needed.
TTS 9.10.8

It shall generally be possible to complete a periodical heavy clean for an RLU interior in no more than 28 man hours. It is understood that in exceptional conditions of soiling, more time will be needed.
TTS 9.10.9

The Vehicle layout shall allow the use of industrial floor cleaning machines to access all areas of floor. Floor cleaning shall not require the use of secondary sealing products.
TTS 9.10.10

9.11 PRM Requirements

Accessibility for Persons of Reduced Mobility (PRM) is an important issue for the Secretary of State. Such accessibility must be provided to meet the requirements of the PRM TSI without impacting the ability to deliver the Thameslink capacity requirements in terms of Unit passenger capacity or in terms of train throughput through the Core Area.

To assist PRM access in the Core Area, Network Rail is working with stakeholder groups to develop a solution with raised sections at the centre of platforms in the Core Area to give level access for wheelchair users and avoid the dwell time impact of manually deployed ramps. It is envisaged that the Units will have two wheelchair accessible doors on each side, each giving access to wheelchair spaces and to the universal toilet. It is important for dwell time reasons that wheelchair accessible doors always stop opposite the same location on the platform, regardless of Unit orientation.

Wheelchair exterior accessible doorways shall be accessible from the same location(s) at the centre of station platforms, regardless of Unit orientation.
TTS 9.11.3

The wheelchair accessible doorways shall meet the requirements of the manually deployed wheelchair ramps currently used on the Thameslink Network.
TTS 9.11.4

Level access platforms will not be achieved at all stations.

Spaces for wheelchairs shall be accessible from access doors located on each side of the Unit.
TTS 9.11.5

Tip-up seats shall be fitted where practicable within each wheelchair space for the use of other passengers when the wheelchair space is unoccupied.
TTS9.11.6

Tip-up seats shall not encroach on the dimensional requirements of the wheelchair space when in the stowed position.
TTS 9.11.7

The TMM will be required to liaise with the Operator and DPTAC to ensure the internal layout meets the needs of PRM groups as far as reasonably practicable without compromising other aspects of the design.
TTS 9.11.8

9.12 Cab Design

Each Unit shall have a fully-functional and identical driving cab at each end.
TTS 9.12.1

The driver's field of view from the seated position in the Unit cab shall be maximised on both sides of the train and as a minimum be fully compliant with the signal sighting requirements given in CR LOC & PAS TSI (as defined in Schedule 1.4 Relevant Laws and Standards).
TTS 9.12.2

Each cab shall have access doors on each side within the confines of the cab.
TTS 9.12.3

The route from the cab to the side access doors shall not be via an adjacent vestibule, allowing DOO in accordance with RGS GM/RT2162.

TTS 9.12.4

Access and emergency egress via the side access door shall be possible when the Unit is electrically dead and the air system is discharged.

TTS 9.12.5

It shall be possible for the driver to access and egress the cab and open and close the side access door, either from platform level or when standing 300mm below rail level.

TTS 9.12.6

Steps and handrails shall be provided with suitable non-slip surfaces to permit safe and easy access and egress without strain, symmetrically aligned with the doorway.

TTS 9.12.7

Each cab shall be fitted with a door between the driving cab and the saloon which shall be inaccessible to passengers in all circumstances.

TTS 9.12.8

The door between the driving cab and the saloon shall be accessible from the cab.

TTS 9.12.9

The door between the driving cab and the saloon shall be rapidly accessible by the driver as an escape route to survival space (if required by the design).

TTS 9.12.10

Ergonomics and human factors techniques shall be applied to design a cab with minimal hazards and with controls in easy reach. The design features and position of all controls and indicators shall be optimised to enable the driver to operate the Unit safely and efficiently.

TTS 9.12.11

Design and layout of equipment and controls shall be such to avoid inadvertent damage or activation by the driver, train crew, or maintenance personnel whilst occupying entering, leaving or moving about in the cab.

TTS 9.12.12

The cab traction/ brake controller shall be configured for push forward to apply the brake and drawn backwards to apply traction consistent with current UK rolling stock.

TTS 9.12.13

Cab instrumentation and controls shall be integrated to optimise cab layout and minimise cab equipment.

TTS 9.12.14

Cab interior surfaces shall be coloured and finished to minimise glare and provide appropriate levels of contrast for controls.

TTS 9.12.15

The cab design, including driver's seat, second man seat and means of access / egress, shall accommodate a range of drivers from small (5th percentile) females to large (95th percentile) males.

TTS 9.12.16

The TMM will be required to work closely with the Operator in the development of the cab design, layout and functionality to ensure that the cab complies with accepted custom and practice.

TTS 9.12.17

10 SYSTEM FUNCTIONS

10.1 Power Supply Changeover

The traction supply for the Units will be drawn from either the 25kV AC overhead line supply or from the 750V DC third rail supply. In addition to the requirements below, further requirements are detailed in the TIIS section 2.4.3. The normal mode of operation when operating in the Core Area will be automatic. Automatic changeover will be required whether or not the train is under the control of ETCS Level 2 infrastructure. Manual changeover is required as a backup for when the automatic system has failed, or where there is a change in traction supply on other routes.

Each Unit shall be capable of initiating changeover between power supplies at the appropriate location automatically.

TTS 10.1.1

Manual operation of the power supply changeover function shall be possible in the event of failure.

TTS 10.1.2

Each Unit shall be capable of changing over from a DC 3rd rail power supply to a 25kV AC power supply and vice versa while on the move.

TTS 10.1.3

Each Unit shall be capable of changing over from a DC 3rd rail power supply to a 25kV AC power supply and vice versa while stationary, with doors open and closed.

TTS 10.1.4

Automatic and manual power supply change over when stationary shall be completed without impacting the 45 seconds station dwell time specified in clause 6.6 of this TTS.

TTS 10.1.5

Power supply change over shall not cause any system data loss or require system reconfiguration or re-boot.

TTS 10.1.6

10.2 Regenerative Braking

The maximum line current that can be drawn or regenerated into the traction supply by a Unit will vary according to its length and location. TIIS provides requirements in this respect.

The implementation of regenerative braking capability on both AC and DC network

infrastructure by Network Rail is nearing completion. The design of the Units is expected to optimise the use of regenerative braking to support energy efficiency targets.

Each Unit shall be fitted with a traction and regenerative braking system which is designed to support achievement of the energy efficiency objectives of this Specification and optimised to deliver maximum benefit for the duty cycle that the average Unit will encounter in service.
TTS 10.2.1

The system shall be consistent with standards for the avoidance of fault masking on DC routes as defined in requirement TIIS 1719.
TTS 10.2.2

10.3 Auxiliary Power Supply

Each Unit's auxiliary power supply capacity shall be continuously rated at 10% over the calculated design loading so that additional features can be fitted during the life of the Unit.
TTS 10.3.1

The Unit's batteries shall maintain essential and emergency systems, for at least 90 minutes, for the full range of environmental conditions experienced by the Unit in the event of external power failure.
TTS 10.3.2

The Unit's essential and emergency systems shall include, but not be limited to:

- Reduced and emergency lighting (for cab, saloon and emergency egress).
- Ventilation fans.
- Tail and marker lamps.
- Internal emergency signage.
- Public address systems.
- Communications systems.
- Train control systems.
- Door control system.
- Traction and braking control.
- Windscreen wipers.
- Forward facing CCTV systems.

TTS 10.3.3

In the event of a short term power interruption of 30 seconds or less, all systems that may be sustained by battery power shall remain powered.

TTS 10.3.4

In the event of a power supply system changeover, all systems that may be sustained by battery power shall remain powered.

TTS 10.3.5

All Units shall include shore supply receptacles to enable the collection of traction and auxiliary power from a trolley mounted 750V DC jumper.

TTS 10.3.6

All Units shall include battery charging receptacles that enable an external battery charging supply to be connected.

TTS 10.3.7

The Unit design shall ensure that a single flat battery whether caused by a failure of a battery charger or voltage regulator or otherwise shall not disable the Unit.

TTS 10.3.8

10.4 Braking System

In addition to the requirements below, the TIIS section 2.5.7 includes further requirements for the braking system.

Not used.

TTS 10.4.2

The braking system shall be designed to allow exploitation of the full capability of ATO to reduce approach times to station stops and achieve precision stopping.

TTS 10.4.3

The Unit shall be capable of achieving an enhanced braking curve in order to allow full exploitation of the ATO.

TTS 10.4.4

The Unit must be capable of holding and safe starting on gradients without rolling back on the maximum gradient on the Thameslink Network.

TTS 10.4.5

The Unit parking brakes shall automatically apply and release using a bleed on/ bleed off system from the main reservoir pipe (MRP) and be capable of holding the Unit on the maximum gradient on the Thameslink Network.

TTS 10.4.6

Not Used.

TTS 10.4.7

10.5 Wheel Slip and Slide Control

The management of variable rail adhesion conditions is a key factor in the safe and reliable operation rolling stock during changing seasonal conditions. The Unit wheel slip and slide control system should take account of industry research and experience in this area. Details of industry experience and rail adhesion conditions foreseeable in the UK can be found in the RAIB Autumn Adhesion Investigations reports (reference 070108_R252006) available at www.raib.gov.uk

Each Unit shall include a proven slip / slide control system that shall operate effectively and efficiently.

TTS 10.5.1

The wheel slip / slide control shall maximise the use of available adhesion under both traction and braking conditions in all reasonably foreseeable UK wheel rail conditions making use of sand as appropriate.

TTS 10.5.2

Adequate traction and braking performance in all reasonably foreseeable UK environmental conditions will require a sanding system to be fitted to the Units, which shall be compliant with GM/RT2461. It is acknowledged however that some intrinsic requirements of this standard are inappropriate for a long, fixed formation train. The Secretary of State will support an application for a partial derogation from GM/RT2461 provided that a suitable case is made for the proposed points and rates of application of sanding and that these proposals are consistent with the relevant section of the CR CCS TSI (as defined in Schedule 1.4 Relevant Laws and Standards).

Each Unit shall be fitted with a sanding system to deliver sand to appropriately assist traction and braking in all reasonably foreseeable UK environmental conditions. The TMM shall propose appropriate points and rates of sand application to support compliance with appropriate standards.

TTS 10.5.3

10.6 Vigilance System

Not Used.

TTS 10.6.1

10.7 Door Systems

Each Unit door control system shall permit driver only operation (DOO).

TTS10.7.1

Each Unit door control system shall permit driver guard operation (DGO).

TTS 10.7.2

The control positions for DGO must be suitably located to allow the guard to perform his or her duties; located in the cab back wall and conveniently distributed throughout the Unit. The DGO control positions throughout the Unit interior shall be at one third and two thirds locations along the Unit, at both sides of the deployable gangway location to allow convenient use if a section of the Unit is out of service. At each location, DGO controls shall be fitted to control the doors on both sides of the Unit.

TTS 10.7.3

In ATO mode, all doors shall open automatically on arrival.

TTS 10.7.5

In driver operated mode, door opening shall be selectable as driver or guard initiated or driver or guard enabled and passenger initiated according to the table below;

TTS 10.7.6

	ATO		**Driver operation**	
	Open	**Close**	**Open**	**Close**
Core Area	Automatic on arrival.	Driver all doors together.	Driver all doors together.	Driver/ guard
Non Core Area	N/A	N/A	Passenger (individual)	Driver/ guard

Each Unit door control system shall automatically select the control mode option based on Unit location (e.g. open all doors in the Core Area).

TTS 10.7.7

The door control system shall include the functionality to minimise heat and cooling loss during waiting time at stations.

TTS 10.7.8

The door system shall provide an optimised method of obstruction detection that ensures the safety of boarding and alighting passengers including when a portable ramp is in use.

TTS 10.7.9

The door system shall minimise the impact of obstruction detection on the station dwell time.

TTS 10.7.10

When an obstruction is detected the door system shall provide appropriate information to the driver and passengers to assist in reducing the impact of obstruction detection on the station dwell time.

TTS 10.7.11

It shall be possible to isolate and lock out of service a section of the Unit doors on both sides corresponding to the section of the Unit closed off with the deployable gangway partition (TTS 5.5.8).

TTS 10.7.12

The section door isolation and lighting shall be operable by train crew from a control conveniently located next to the deployable gangway partition or from the nearest DGO facilities.

TTS 10.7.13

10.8 Selective Door Operation

Automatic Selective Door Operation (ASDO) is needed at a number of locations on the Thameslink Network where the diagrammed Unit is longer than the platform and a platform extension is not economically justified. Correct Side Door Enable (CSDE) is needed wherever it is planned to open all doors simultaneously. Initially this will only be in the Core Area, but it is possible that loadings will require this functionality to be extended to other key stations in the future.

The TMM should note the requirements of RSSB guidance note GE/GN 8577 for the design and application of Automatic Selective Door Operation Systems.

The Units shall be fitted with an Automatic Selective Door Operation (ASDO) system, consistent with HMRI requirements, to allow for the use of short platforms.

TTS 10.8.1

The ASDO system shall permit only doors which are positioned over a safely accessible platform area to open at any station. Correct Side Door Enable (CSDE) shall be automatically enforced wherever all doors can be opened simultaneously (see TTS 10.7.6).

TTS 10.8.2

The ASDO system shall be integrated into or interfaced with the ATO system and door control system so that a logical and simple set of controls are presented to operators.

TTS 10.8.3

Controls shall cover operation in both ATO and non ATO areas.

TTS 10.8.4

The ASDO system shall interface with the passenger information system (PIS) to provide passengers with guidance on where to exit the Unit prior to, and at times of, selective door operation.

TTS 10.8.5

The ASDO system shall interface with the passenger information system (PIS) to provide passengers with guidance on which side of the train doors will open at any station.

TTS 10.8.6

10.9 Heating Ventilation and Cooling

Each Unit shall be fitted with a heating, ventilation and cooling system which is compliant to EN14750-1 2006 Railway Applications – Air Conditioning for Urban and Suburban Rolling Stock for a category A vehicle.

TTS 10.9.1

The system shall deliver a comfortable environment and be capable of regulating the temperature of all passenger saloons, vestibules, toilets and open wide gangways in a uniform manner.

TTS 10.9.2

The interior set point temperature shall be adjustable by maintenance staff over the range 20℃ to 25℃.

TTS 10.9.16

Interior temperature regulation shall be in accordance with the regulation curve defined in EN14750.

TTS 10.9.17

The system shall provide emergency ventilation in the event of failure.

TTS 10.9.3

The emergency ventilation shall include smoke detection to provide control of air flow to minimise the effects of smoke.

TTS 10.9.4

The heating, ventilating and cooling system shall be designed to minimise mass and energy consumption.

TTS 10.9.5

The system shall be capable of maintaining a comfortable passenger environment in all likely UK ambient weather conditions, consistent with the environmental conditions set out in Section 4.2 of the TTS.

TTS 10.9.6

The system shall minimise temperature changes within the vehicle when the doors are opened.

TTS 10.9.7

The system shall vary the volume of air which is moved within the vehicle according to passenger load. (e.g. when few passengers are on board the air flow should be the minimum).

TTS 10.9.8

A cab heating, ventilating and cooling system shall be independent of the saloon system and be capable of maintaining a temperature range within the cab of 18°C to 26°C in all UK ambient weather conditions, consistent with the environmental conditions set out in Section 4.2 of the TTS and provide a mix of fresh and return air in all operating modes for a safe and comfortable working environment for the driver.

TTS 10.9.9

The cab system shall be designed to take account of the requirement to minimise the economic and environmental impact of its operation.

TTS 10.9.10

In the event of failure of the cab heating ventilating and cooling system there shall be an independent fresh air forced ventilation system with variable volume and direction control. When not in use this system shall not cause draughts.

TTS 10.9.11

The cab and saloon system shall include a standby mode that allows the chosen temperature set point to be altered to reduce energy consumption when the Units are not in normal operational service.

TTS 10.9.12

The driver shall have control of the cab temperature by an adjustable thermostat.

TTS 10.9.13

It shall be possible to switch on and off the cab system by means of a switch in the cab.
TTS 10.9.14

The cab standby mode temperature range shall be 16°C to 22°C with the set point adjustable by maintenance staff.
TTS 10.9.15

10.10 Warning Horns

The Unit warning horns shall comply with the requirements of RGS GM/RT2484 "Audibility Requirements for Trains". Operation of the horn shall not cause noise discomfort to the driver.
TTS 10.10.1

To minimise the noise nuisance to depot neighbours, an alternative depot shunt audible warning device (DSAWD) is required in addition to the normal Unit warning horns to warn depot staff of impending train shunt movements.

Each Unit shall be fitted with a DSAWD at each end.
TTS 10.10.3

All elements of the DSAWD, including its actuator within the cab, shall be independent of the main warning horn system.
TTS 10.10.4

The sound level from the DSAWD shall be adjustable up to 95dB(A) ± 2 dB measured 5m from the front of the Unit along the centre line of the track at the same height as the horn over a ground covering of ballast. In this context, the 'front of the Unit' is the extreme front edge of any of the following: couplers, buffers, structures and vehicle profile.
TTS 10.10.5

The fundamental frequency of the DSAWD shall be either 311 Hz ± 20 Hz, or 680 Hz ± 20 Hz.
TTS 10.10.6

The sound level shall be adjustable as a maintenance function.
TTS 10.10.7

The positioning of the cab controls for the DSAWD shall be designed to minimise the risk of confusion with the controls of the normal warning horn system and shall be agreed with the Operator and Owner through the design review process.
TTS 10.10.8

Operation of the DSAWD shall be recorded on the Unit's data recorder (OTDR).
TTS 10.10.9

10.11 Exterior Lights

The Unit headlights shall comply with the requirements of CR-PAS LOC TSI.
TTS 10.11.1

10.12 Interior Lighting

Each Unit shall use high efficiency lighting to provide interior illumination levels in accordance with applicable standards.
TTS 10.12.1

The interior lighting distribution in the passenger saloon including gangways shall be arranged to create a safe, secure and pleasant environment. Lighting shall cover the ceiling including the luggage racks.
TTS 10.12.2

The interior lighting shall comprise General, Standby, and Emergency lighting as defined in GM/RT 2130.
TTS 10.12.3

When battery charging has ceased the Standby Lighting System shall provide a reduced level of lighting for a period of 90 minutes.
TTS 10.12.9

The Emergency Lighting system should provide the levels of lighting at specific locations as defined in RGS GM/RT 2130 Issue 3, and withstand the crash pulse defined in RGS GM/RT 2100 Issue 4.
TTS 10.12.10

Lighting enclosures shall be tamper proof, prevent the ingress of dust and be sealed to IP54 (EN 60529 “Specification for Degrees of Protection Provided by Enclosures”).

TTS 10.12.4

The interior lighting system shall be compatible with the requirements of the saloon CCTV system.

TTS 10.12.5

The interior lighting system shall fully complement the passenger information system and interior signage such that there is no significant glare or reflections from any part of the Unit during any ambient light conditions.

TTS 10.12.6

The interior lighting shall be controllable by train crew.

TTS 10.12.7

The interior lighting shall include energy saving features, including where practicable to automatically reduce or switch off lighting in unoccupied areas. Unoccupied areas should include areas closed off to public use.

TTS 10.12.8

10.13 Passenger Information and Communications

Successful delivery of the Thameslink programme outputs requires the transfer of large numbers of passengers between platform and train within short station dwell times. Accurate, relevant and timely passenger information coordinated between station and train must be provided to ensure that the service can operate reliably.

Communication with passengers through the audio and visual means available will need to be readily assimilated by all persons including those unfamiliar with the route, those with disabilities and those with a limited understanding of English.

The Thameslink Network routes have both unusually complex routing for a high capacity urban railway and complex interfaces with other services. The passenger information system must allow passengers to make informed choices about their journey during times of disruption. The Thameslink operational control centre will make appropriate information available to the Unit on a real time basis. This information will typically be sourced from Network Rail, London Underground, the Police and other TOCs.

It is envisaged that the Units will be fitted with a system which communicates in real time with the infrastructure, enabling information relating to service conditions, connections, interchanges and disruptions to be communicated through a combination of audio and visual means to passengers on the train and for key information including train loading status to be communicated to passengers on the platform.

The PIS shall provide all necessary information to meet legislative requirements.
TTS 10.13.1

The PIS shall enable passengers to position themselves for alighting at the next station by indicating in advance which side the doors will open.
TTS 10.13.2

The PIS shall enable passengers to minimise hesitation during alighting by indicating in advance which direction the platform exits and interchange connecting routes are located at the next station.
TTS 10.13.3

The PIS shall provide destination and stopping pattern information for the Unit, presented in both audio and visual format.
TTS 10.13.4

Visually presented destination and stopping pattern information shall be capable of being rapidly assimilated by every passenger having entered the Unit.
TTS 10.13.5

The PIS shall provide information to passengers on the availability of space on the Unit.
TTS 10.13.6

The on-board PIS shall be capable of receiving information from the Operator and displaying to passengers delays and service status information on the Thameslink Network routes, other routes and London Underground routes with which the Thameslink Network route interchanges.
TTS 10.13.7

The PIS shall provide adequate information to all passengers, including those with disabilities and those with a limited understanding of English, with the functionality to display graphic and colour-coded symbols.
TTS 10.13.8

The PIS shall be capable of delivering departure information for en route airport, Eurostar and main line station connections, and deliver high quality corporate announcements, information and movies provided by the Operator.
TTS 10.13.9

The PIS shall be capable of delivering high quality advertising movies.
TTS 10.13.10

The system shall accept and process information transmitted from the Operator allowing passengers to make informed choices about their journey both normally and during times of disruption.
TTS 10.13.11

The Unit shall be capable of selectively presenting to passengers only that information that is most relevant to the current location in the current journey.
TTS 10.13.12

Each Unit shall be fitted with a system that automatically makes audio and visual announcements.
TTS 10.13.13

Each Unit shall allow the driver to select emergency or other announcements to meet the requirements of standards, legislation, customer service and good practice.
TTS 10.13.14

The system hardware shall be capable of displaying text, pictograms and high quality video information.
TTS 10.13.15

The system hardware shall be large enough to display the necessary information in accordance with the requirements of PRM TSI, as a minimum.
TTS 10.13.16

The system hardware shall be situated such that the information is visible to up to 80% of seated and standing passengers, depending on vehicle and seat layout.
TTS 10.13.17

The system hardware shall include exterior bodyside displays, in accordance with PRM TSI distributed along the length of the Unit such that they can be read by passengers on the platform.
TTS 10.13.18

The system shall provide public address facilities from the cabs and interior DGO control positions that gives a high quality output with volume levels automatically adjusted for the background noise level.
TTS 10.13.19

The system shall provide full duplex communications both between cabs and between the cabs and interior DGO control positions.
TTS 10.13.20

The system shall provide passenger emergency alarm facilities that shall provide discrete two-way voice communication between the driver and the passenger at that alarm location.
TTS 10.13.21

The system shall include call for aid units that shall provide discrete two-way voice communication between the driver and the passenger at that alarm location.
TTS 10.13.22

The passenger emergency alarm units shall be designed as far as practicable to deter malicious or accidental operation.
TTS 10.13.23

When the selective door operation system is in use, the PIS shall make specific announcements in the affected vehicles in advance of arrival at the relevant station.
TTS 10.13.24

The operation control centre shall be able to broadcast announcements within the Unit in the event of driver incapacitation during DOO operation.
TTS 10.13.25

The Unit design shall ensure that mobile telephones work effectively at any location in the Unit, by avoiding the significant attenuation of mobile phone signals.
TTS 10.13.26

All necessary off train software and equipment required to send, receive, process, configure, print and interpret PIS data shall be provided.
TTS 10.13.27

The PIS shall be capable of delivering short messages in up to three alternative languages prior to selected stops where international traffic is high.

TTS 10.13.28

10.14 Storage of Investigative Data

The storage of investigative data may be achieved by applying an integrated approach for the data recording devices, including the functions of the OTDR and ETCS JRU, provided that the requirements of the applicable standards are met. Such an approach would need to include a suitable method of providing links between active and rear cabs which preserves the integrity of the investigative data.

Each Unit shall be equipped with an OTDR that complies with applicable standards.

TTS 10.14.1

In addition to the mandatory requirements, the OTDR shall monitor and record Unit brake controls status, wheel slide protection status, Door status, Emergency GSMR calls made, Emergency GSMR call received, leading bogie brake cylinder pressure, horn operation and operation of sanders.

TTS 10.14.2

Each Unit shall be provided with facilities for monitoring and storing ETCS and ATO operational data for incident investigation purposes.

TTS 10.14.3

It shall be possible to download data from the OTDR remotely.

TTS 10.14.4

All necessary off train software and equipment required to receive, process, print and interpret OTDR data shall be provided.

TTS 10.14.5

The OTDR software supplied by the TMM shall allow for the creation of template reports for standard incidents e.g. SPADs.

TTS 10.14.6

It shall be possible to download from the OTDR using contemporary memory storage.

TTS 10.14.7

10.15 Train Management System

The Unit will require a comprehensive Train Management System (TMS) to support the driver, Operator and TMM with the information necessary to achieve the required performance and manage disruptions with the minimum impact on the service. The TMS will need to provide greater functionality than such systems currently provide. In addition to the typical train status, fault information and system isolation functions currently provided, the system will need functionality to support the Performance Regime. This will include the capability to monitor and record train progress against the timetable and to monitor and record key performance parameters such as dwell time.

The TMS must be fully integrated with other on board sub systems to provide consistent synchronised information and must exploit the functionality available from the latest data communications technology to simplify the regular extraction and updating of operational data stored on the Unit.

Each Unit shall be equipped with a train management system (TMS).

TTS 10.15.1

The TMS shall be capable of generating, receiving and storing information on the train status and location.

TTS 10.15.2

The TMS shall be capable of managing failure of a Unit subsystem with the objective of minimising service disruption.

TTS 10.15.3

The TMS shall be capable of identifying failures of both service affecting and passenger facing systems (such as PIS, toilets etc) to the maintenance centre so that repair and maintenance work can be planned.

TTS 10.15.4

The TMS shall be capable of identifying repair and maintenance work.

TTS 10.15.5

The TMS shall provide a common source of time, date and train location information for all subsystems that require it.

TTS10.15.6

The TMS shall be capable of transmitting selected information on train location and status to the operational control centre.

TTS 10.15.7

The TMS shall monitor and record Unit progress against the timetable to support the Performance Regime.

TTS 10.15.8

The TMS shall monitor and record all delays exceeding one minute, including the date, location and, where practicable, the cause.

TTS 10.15.9

The TMS shall monitor and record key capability performance parameters (e.g. door open/ close time, power supply change over time), to support the Performance Regime.

TTS 10.15.10

The TMS shall record energy consumption data provided by the onboard energy measurement system.

TTS 10.15.11

The TMS shall monitor and record driving performance and timing data.

TTS 10.15.12

The TMS shall monitor and display relevant information to the driver in the cab.

TTS 10.15.13

The TMS shall provide a method for maintenance staff to monitor Unit status information in the driving cab without interfering with the normal driving displays. Should the proposed solution rely on an interface to a maintenance PC, the method of connecting the PC must be robust and connection must be possible at any time without affecting the operation or functionality of the on-train systems. The maintenance PC must be capable of displaying real time information as would be available via the cab TMS monitors as well as taking downloads.

TTS 10.15.14

The TMS shall provide a simple data download capability without the need for specialist software.

TTS 10.15.15

The TMS shall send and receive information in real time to and from the operational control centre and maintenance depot.

TTS 10.15.16

All necessary off train software and equipment required to receive, process, print and interpret TMS data shall be provided.

TTS 10.15.17

The TMS shall be based on the standardised Train Control Network bus system.

TTS 10.15.18

10.16 Passenger Counting System

Passenger loading information is valuable to Train Operators for both long term planning and short term operational control purposes. Modern trains are all fitted with load weighing systems and it is envisaged that a combination of this technology with door counting systems on a subset of trains will provide a system which can deliver both requirements.

Each Unit shall include a system to measure and record passenger loadings in each Vehicle to an accuracy of 10% based on an average weight of 80kg per person**.** It shall be possible for the Operator to recalibrate the system for changes to average weight per person.

TTS 10.16.1

25% of Units in the fleet shall include a system to count passengers boarding and alighting the Unit at each station to an accuracy of 5%.

TTS 10.16.2

The system shall record headcode / reporting number of the train, service code, passenger counts and vehicle loading against individual journey, time and date for which the information applies.

TTS 10.16.3

Vehicle loading information shall be available for transmission in real time to the operational control centre.

TTS 10.16.4

Intelligent vehicle loading information shall be generated on-board the Unit, taking data from the passenger counting systems, for interfacing with the PIS and platform customer information system to guide passengers to Vehicles with lighter loadings.

TTS 10.16.5

Combined passenger counts and vehicle loading information shall be accessible via a remote download system capable of operation whist the train is in motion.

TTS 10.16.6

10.17 Forward Facing CCTV

Each Unit shall be fitted with a forward facing CCTV camera and image recording system that is optimised to identify track, signals and any approaching features of interest on the track. Further requirements are defined in the TIIS section 2.6.1.

TTS 10.17.1

10.18 Driver Only Operation CCTV

The ability of drivers to monitor passenger flow through the doors, in both ATO and driver controlled operation will be critical to achievement of the specified station dwell time.

Each Unit shall be equipped with a DOO CCTV system, compatible with RGS GE/RT 8060 "Technical Requirements for Dispatch of Trains from Platforms" with cameras that allow the driver to monitor all passenger doors on a train with a minimum of one camera per two adjacent doors. The system shall not be energised in DGO mode, except when under ATO control.

TSS 10.18.1

The DOO CCTV system shall provide images of sufficient size, quality and resolution to enable doorway images to be displayed on two colour cab monitors.

TSS 10.18.2

Images shall be presented in a logical and intuitive order that reflects the location of the image along the Unit.

TTS 10.18.3

The DOO CCTV system shall support DOO dispatch effectively during all operating conditions and hours with ambient lighting conditions from bright sunlight to night time within the infrastructure defined in TIIS section 3.2.

TSS 10.18.4

The DOO CCTV system shall support DOO dispatch effectively for all environmental conditions experienced within the infrastructure defined in TIIS section 3.2.

TSS 10.18.5

The DOO CCTV system shall be capable of supporting DOO dispatch in all conditions of high, low and varying contrast along the Unit such that the driver can observe any door being obstructed.

TTS 10.18.6

The DOO CCTV system shall include functionality to compensate, as far as reasonably practical, for variable lighting levels along the length of the Unit due to limitations or failure of the infrastructure defined in TIIS section 3.2.

TTS 10.18.7

The DOO CCTV system shall provide 72 hours of image recording including recording for 30 seconds after the doors have closed. As a minimum, the output from the DOO cameras shall be recorded from the moment the wheels stop (or the doors are unlocked if earlier) until the tail of the Unit has left the station area.

TTS 10.18.8

The DOO CCTV system shall provide simple data download capability to a laptop PC without the need for specialist software.

TTS 10.18.9

The camera enclosure shall be designed to minimise the build up of dirt and debris on the enclosure lens and aid cleaning both manually and using wash plant equipment.

TTS 10.18.10

The camera and camera enclosure shall be designed to avoid the effects of glare and condensation, frost and snow.

TTS 10.18.11

The cab monitors shall be ergonomically situated to enable all drivers to view the images from the normal seated position.

TTS 10.18.12

The cab monitors shall automatically adjust for the prevailing lighting conditions.

TTS 10.18.13

The image display on the monitor shall include an active indicator to identify that live images are being displayed and the image is not frozen.

TTS 10.18.14

Not Used.

TTS 10.18.15

Not Used.

TTS 10.18.16

When in ATO control, CCTV images from the on-train cameras shall be displayed from the moment the wheels stop (or the doors are unlocked if earlier) until the tail of the Unit has left the station.

TTS 10.18.17

When in manual control, CCTV images, from the on-train cameras, shall only be displayed on the CCTV monitor when the Unit is stationary.

TTS 10.18.17a

All necessary off train software and equipment required to extract, view, print and interpret DOO CCTV images shall be provided.

TTS 10.18.18

10.19 Internal Saloon CCTV

Each Unit passenger saloon shall be fitted with a full colour CCTV system.

TTS 10.19.1

The CCTV system shall have sufficient cameras to give full coverage of the Unit interior (except toilets), including gangways.

TTS 10.19.2

The cameras shall minimise the view outside the train where possible to prevent fast changing scene and light conditions.

TTS 10.19.15

The cameras shall be located in such a way that each camera is viewed by at least one other.

TTS 10.19.16

Images from the CCTV system throughout a Unit shall be available in the driving and rear cabs for review by the driver or guard or BTP on site, subject to suitable security safeguards.

TTS 10.19.3

For the normal recording rate the system shall record images in the specified areas at the frame rates specified in the table below as a minimum.

TTS 10.19.4

Relevant Area of Train	Frames Per Second (fps)
Carriage entrances and exits	8 fps
All other passenger areas	8 fps

In the event of a CCTV trigger event (e.g. operation of a passenger emergency alarm, fire/ smoke detection), the system shall operate at a higher recording rate where all images shall be recorded at a higher frame rate than for normal service suitable for detailed analysis of the incident.

TTS 10.19.5

In the event of passenger emergency alarm activation the internal CCTV feed shall be capable of being shown to the driver for the area of activation.

TTS 10.19.19

This higher recording rate shall be for 10 minutes before and 30 minutes after the event.

TTS 10.19.6

The CCTV system shall provide a minimum of 1 month of recording capacity for the normal recording rate based on Thameslink train service requirements and assuming 1 CCTV trigger event requiring the higher recording rate during this period. Alternatively, the CCTV images shall be securely and automatically downloaded every 24 hours to a central database that has a six month storage capacity for the fleet of Units.

TTS 10.19.7

The system shall comply with the CCTV Operational Requirements Manual, Publication 55/06 produced by the Home Office Police Scientific Development Branch. (reference www.hosdb.homeoffice.gov.uk)

TTS 10.19.8

The output produced by the CCTV system at both normal and high recording rates shall be capable of being admissible in any UK court of law.

TSS 10.19.9

The CCTV system recording and retrieval functions shall give a secure auditable trail of data that satisfies the requirements of evidential continuity to prove that the data has not been tampered with in any way.

TTS 10.19.10

All necessary off train software and equipment required to extract, view, print and interpret CCTV images shall be provided.
TTS 10.19.11

It shall be possible to view any of the recorded images on a Unit via a single diagnostic port.
TTS 10.19.17

It shall be possible to view a minimum of 4 simultaneous cameras feeds from the same diagnostic port.
TTS 10.19.18

The CCTV system shall be linked to the fire detection system (TTS 10.20 if fitted), so that in the event of fire detection images from the location of the detection are available in the driving and rear cabs.
TTS 10.19.12

The physical on-train storage device shall be located such that it is easily accessible by the Operator's staff; however, it shall not be identifiable to passengers. The device's location shall be secure to prevent unauthorised access.
TTS 10.19.13

It shall be possible to quickly remove the storage device without the need for technical expertise
TTS 10.19.14

10.20 Fire Detection System

Each Unit shall be equipped with a fire and smoke detection system if it is deemed necessary to meet the requirements of section 8.7 or the emergency ventilation requirements of section 10.9. If it is deemed unnecessary justification shall be provided.
TTS 10.20.1

If a fire and smoke detection system is fitted on detection of fire or smoke, the information, including the location within the Unit shall be provided to the driver in real time.
TTS 10.20.2

On detection of fire or smoke, the information, including the location within the Unit shall be provided to the operational control centre in near real time.
TTS 10.20.3

10.21 Infrastructure Monitoring System

In addition to the infrastructure monitoring equipment specified in TIIS section 2.6, there is a requirement for the Units to visually monitor the behaviour of the current collection pantographs.

Each Vehicle with a pantograph shall be equipped with a roof mounted CCTV camera to monitor the behaviour of the pantograph.

TTS 10.21.1

The pantograph CCTV camera shall be fixed and have a clear field of view covering the full range of normal pantograph movement from retracted to maximum extension required to cover the full range of wire positions specified by the TIIS..

TTS 10.21.2

The pantograph CCTV camera system shall include a means of illumination so as to permit the pantograph to be continuously monitored in darkness (either in tunnels or at night).

TTS 10.21.3

The pantograph CCTV camera and its enclosure shall comply with the gauging requirements of the dynamic upper gauge profile in section 2.1 of the TIIS.

TTS 10.21.4

The performance of the pantograph CCTV camera, image quality, dynamic response, frame rates, etc, and requirements for recorded data, storage and retrieval of recorded data shall be as specified for the forward facing and rearward facing CCTV (FFRF CCTV) system.

TTS 10.21.5

The camera and its enclosure shall be designed to be maintained during normal Unit maintenance intervals.

TTS 10.21.6

The pantograph CCTV system shall have the capability of presenting real time images of the pantographs to the train driver on demand.

TTS 10.21.7

10.22 Traction Control

The Unit shall be equipped with a hill start function, which must be suitable for both manual driving and ATO.

TTS 10.22.1

Not Used.

TTS 10.22.2

The Unit shall be equipped with a slow speed shunting mode that controls the speed in stepped increments of 1km/h +/- 0.5km/h up to a maximum 10km/h for operation in sidings and wash plants.

TTS 10.22.4

The slow speed shunting controls in the cab shall be independent from the service traction controller, and capable of being used up to 10km/h in the event of failure of the traction controller in service.

TTS 10.22.5

The slow speed shunting mode shall be capable of being interfaced with a radio remote control system providing full functionality of the shunting speed controls without the need for a driver on board, controlled from a control centre or local pendant. Space should be made for the future fitment of the radio control system.

TTS 10.22.6

The Unit shall be capable of reverse operation at speeds of up to 25km/h using forward facing CCTV, driving from the rear cab.

TTS 10.22.3

10.23 Windscreen Wiper System

The Unit shall be fitted with a wiper system in accordance with the Applicable Laws and Standards. The windscreen wiper system shall include an intermittent wipe facility.

TTS 10.23.1

11 SIGNALLING AND TRAIN COMMUNICATIONS

11.1 Signalling and Control

In addition to the requirements below, further requirements and details of the signalling and control systems are provided in the TIIS section 2.5.

Each Unit shall be capable of operating in the current train management and control environment based on multi-aspect signalling and TPWS.

TTS 11.1.1

Each Unit shall be capable of operating in the future national signalling environment based on ERTMS Baseline 2.3.0d or Baseline 3.

TTS 11.1.2

Each Unit shall be equipped with ERTMS Level 2 train control equipment in addition to AWS and TPWS. The AWS and TPWS functions shall be integrated with the ETCS trainborne equipment.

TTS 11.1.3

Each Unit shall be capable of operating in a mixed environment with some multi-aspect signalling and some ERTMS areas.

TTS 11.1.4

Each Unit shall be equipped with GSM-R radio equipment configured for DOO.

TTS 11.1.5

Each GSM-R installation shall include space provision for the future installation of a filter to each of the GSM-R voice and data radios. As a minimum, a space of 230 x 110 x 70mm shall be provided for each filter and the GSM-R antenna cable routed through the space with sufficient spare cable available to enable any necessary connections to be made.

TTS 11.1.15

Each Unit shall be fitted with automatic train operation (ATO) equipment for use in the Core Area of the Thameslink Network.

TTS 11.1.6

The AWS visual display and reset button shall be positioned in front of the driver in the primary control area. The visual display shall be integrated into the ETCS DMI, which shall also be used for the controls (if practicable).

TTS 11.1.7

Any detected failure of the AWS, its actuating mechanism or control system shall result in a fail-safe condition that inhibits traction power and applies the brakes, and the brakes remain applied. A manual override to the fail-safe system shall be provided which the driver can operate from the cab.

TTS 11.1.8

The TPWS system shall be capable of detecting failure both during service operation and as part of the system's self test. In both instances, the system shall indicate the fault to the driver in the same manner.

TTS 11.1.9

The TPWS driver indications shall be located in a prominent position such that they are clearly visible to the driver at all times. The visual display shall be integrated into the ETCS DMI, which shall also be used for the controls (if practicable). The TPWS shall comply with the requirements of RGS GM/RT8030.

TTS 11.1.10

The layout shall minimise the risk of drivers inadvertently resetting the TPWS following a system trip.

TTS 11.1.11

The Units shall be fitted with Driver's Reminder Appliances (DRA) with a plunger type switch.

TTS 11.1.12

When the DRA is deactivated, there shall be a warning to the driver in the form of a recorded voice message "DRA off – Driver check signal."

TTS 11.1.13

The Unit ETCS on-board systems shall be made compliant with the *ETCS Baseline 3 (Level 0, Level STM, Level 1 & Level 2) specification* when issued.

TTS 11.1.14

11.2 Track to Train Data Communications

All protocols used for communications between track and train shall be compatible with communications industry standards.

TTS 11.2.1

The Unit shall be equipped with track to train and train to track data communications equipment that supports passenger information system requirements, train management system and other requirements in this TTS and the TIIS for communications between train and ground-based shore locations.

TTS 11.2.2

12 MAINTENANCE AND OPERATIONS

12.1 Unit Maintenance

Each Unit shall be designed for ease of maintenance, servicing, cleaning and repairability, this shall include the design of interior panelling and other items prone to vandalism.
TTS 12.1.1

The Unit design shall incorporate features which enable maintenance and repairs to be carried out quickly and effectively.
TTS 12.1.2

The Unit design shall be such that the length of time Units are out of service for maintenance, overhaul and repair is minimised.
TTS 12.1.3

The Unit design shall be such that light maintenance can be accommodated in times that are outside of the peak service requirement.
TTS 12.1.4

Not used
TTS 12.1.5

The Unit shall incorporate simple to change modular equipment with simple to manage train diagnostics, condition monitoring and train data systems.
TTS 12.1.6

Each Unit design shall take account of the need to ensure the long term availability and quality of all spare parts and consumables for the life of the Unit.
TTS 12.1.7

Unit major component and sub system parts including interior panelling and exterior trim shall be uniquely coded and labelled so that replacement parts can be easily identified.
TTS 12.1.8

All interior cupboard doors and panels shall incorporate retention devices as appropriate to minimise the risk of injury to passengers or to staff.
TTS 12.1.9

Suitable test and condition monitoring software and equipment to allow testing, fault diagnosis and repair of all Unit sub systems shall be provided in accordance with the MSA provisions for Special Tools.
TTS 12.1.10

All necessary off train software and equipment required to send, receive, process, configure, print and interpret Unit sub system data shall be provided in accordance with the MSA provisions for Special Tools.
TTS 12.1.11

All necessary special tools and equipment required to maintain and repair Unit equipment and sub systems shall be provided in accordance with the MSA provisions for Special Tools.
TTS 12.1.12

Unit external service connection points shall be located to ensure that only a minimum of trackside servicing points are required for the FLU and RLU regardless of the orientation of the Unit. Connection points shall be safe, durable, simple and quick to use and capable of repeated use in the harsh conditions to be expected at servicing locations. They shall be capable of being changed easily and quickly, in the event of failure.
TTS 12.1.13

12.2 Unit Repairs

Each Unit shall be designed and constructed so that, as far as reasonably practical the time required to repair exterior collision damage is minimised, this is particularly important for front end damage.
TTS 12.2.1

Each Unit shall be designed and constructed so that, as far as reasonably practical, the time to repair vandalism and to replace damaged interior components is minimised.
TTS 12.2.2

Each Unit shall be designed and constructed so that the windscreen shall be exchangeable within 6 hours, including any curing time.
TTS 12.2.3

Each Unit shall be designed and constructed so that bodyside windows shall be exchangeable within 4 hours, including any curing time.
TTS 12.2.4

Each Unit shall be designed and constructed so that bodyside door windows shall be exchangeable within 5 hours, including any curing time.

TTS 12.2.5

It shall be possible to replace failed exterior lamps within 15 minutes by maintenance staff standing 300mm below rail level without the need for Special Tools.

TTS 12.2.6

Where failed exterior lamps cannot be replaced in 15 minutes they shall be of a suitable LED technology designed with a lifetime similar to the Unit.

TTS 12.2.7

Not used

TTS 12.2.8

There shall be a method for Operator's staff to temporarily secure a broken or cracked bodyside window, to allow the Unit to continue in service to the end of the day.

TTS 12.2.9

Not Used.

TTS 12.2.10

12.3 Not Used

12.4 Documentation

Complete maintenance and overhaul information, which has been optimised to minimise Unit down time and costs will be essential if the Units are to meet the demanding requirements for the Thameslink Programme.

The Unit supplier shall provide comprehensive maintenance documentation covering the maintenance and overhaul requirements for the life of the vehicles, repair procedures, test procedures and fault-finding procedures.

TTS 12.4.1

The Unit supplier shall provide comprehensive overhaul documentation covering the maintenance and overhaul requirements for the life of the Units.

TTS 12.4.2

The TMM shall provide comprehensive parts information, including an illustrated parts catalogue showing all parts, their description, part numbers, ordering details etc.
TTS 12.4.3

The TMM shall provide all drawings related to the construction and maintenance of the Units, including schematics, wiring diagrams, structural drawings, general arrangements etc.
TTS 12.4.4

The TMM shall provide detailed technical descriptions of the Unit and its operation.
TTS 12.4.5

The TMM shall provide easy to read fault finding guides for drivers.
TTS 12.4.6

The above documentation shall be provided in hard copy and in an agreed electronic format.
TTS 12.4.7

The electronic information shall include comprehensive cross-referencing (enabling easy navigation between documents and parts of the same document).
TTS 12.4.8

Electronic information shall be readily accessible by the Operator to enable updating.
TTS 12.4.9

12.5 Not Used

13 MOCK UPS

13.1 General

Mock ups will be used by the Operator to evaluate the Unit interior against Operator requirements and gain acceptance with relevant stakeholders and user groups. The mock ups will also be used and may be modified during the design phase for ergonomic and human factors evaluation before refinement of the final design features and delivery as the final mock-ups. The unit supplier shall construct any additional breadboard mock-ups, prototypes, models and 3D visualisations that are necessary for ergonomic and human factors evaluation, including assessment of maintainability.

The final Mock ups shall be delivered and stored at an agreed location in the United Kingdom.

TTS 13.1.1

13.2 Cab Mock Up

A full size representative cab internal Mock up shall be provided.

TTS 13.2.1

13.3 Saloon Mock Up

A transportable full size interior saloon Mock up shall be provided incorporating the floor, bodyside and ceiling section for a length of seats equivalent to one end bay up to and including the vestibule and doorway. The Mock up shall include seats, luggage racks, utility modules, grab poles and draught screens, and showing the location and form of PIS displays and signage.

TTS 13.3.1

The Mock up shall also include the wheelchair areas, standard and universal toilet.

TTS 13.3.2

The Mock up shall also include a vestibule area with full width floor area and ceiling structure to show grab pole arrangements.

TTS 13.3.3

The Mock up shall also include a saloon end to show the wide gangway and a representative section of first class saloon.

TTS 13.3.4

The mock up will be used by the purchaser to assess and approve the final vehicle interior and schedule of finishes in combination with interior renderings and signage.

The lighting and seat comfort shall be as per the finished build.

TTS 13.3.5

13.4 Front End Scale Model

The front end shall be developed through a CAD process or constructed in a scale 1:3 clay (American wax) model up to the mid point of the leading bogie. The clay model shall include a ureol hard points buck (the structure and all other inviolable items for example sightlines, coupler, regulatory lighting positions and windscreen area). Allowance should be made for fine tuning with the client and then coated in DiNoc before sign off. The model shall then be digitised for product definition.

TTS 13.4.1

ANNEX A – CLASS 319 JOURNEY TIMES

Class 319 Journey Times – Bedford to Farringdon – semi fast diagram

STATION	TIME (mins)
BEDFORD	
	8.48
FLITWICK	
	3.68
HARLINGTON	
	4.96
LEAGRAVE	
	3.18
LUTON	
	2.26
LUTON AIRPORT PARKWAY	
	4.81
HARPENDEN	
	4.83
ST ALBANS	
	12.99
WEST HAMPSTEAD THAMESLINK	
	6.18
ST PANCRAS INTERNATIONAL	
	3.32
FARRINGDON	

Class 319 journey times Farringdon to Brighton – semi fast diagram.

STATION	TIME (mins)
FARRINGDON	
	1.53
CITY THAMESLINK	
	1.45
BLACKFRIARS	
	5.07
LONDON BRIDGE	
	11.73
EAST CROYDON	
	13.47
GATWICK AIRPORT	
	3.60
THREE BRIDGES	
	5.12
BALCOMBE	
	4.31
HAYWARDS HEATH	
	3.57
WIVELSFIELD	
	1.83
BURGESS HILL	
	2.97
HASSOCKS	
	6.03
PRESTON PARK	
	2.79
BRIGHTON	

Class 319 journey times Brighton to Farringdon – semi fast diagram.

STATION	TIME (mins)
BRIGHTON	
	2.78
PRESTON PARK	
	6.05
HASSOCKS	
	2.88
BURGESS HILL	
	1.76
WIVELSFIELD	
	3.68
HAYWARDS HEATH	
	4.70
BALCOMBE	
	5.11
THREE BRIDGES	
	3.37
GATWICK AIRPORT	
	13.60
EAST CROYDON	
	12.12
LONDON BRIDGE	
	5.10
BLACKFRIARS	
	1.08
CITY THAMESLINK	
	1.45
FARRINGDON	

Class 319 journey times Farringdon to Bedford – semi fast diagram.

STATION	TIME (mins)
FARRINGDON	
	3.27
ST PANCRAS INTERNATIONAL	
	6.27
WEST HAMPSTEAD THAMESLINK	
	13.40
ST ALBANS	
	5.03
HARPENDEN	
	4.81
LUTON AIRPORT PARKWAY	
	1.80
LUTON	
	3.29
LEAGRAVE	
	4.60
HARLINGTON	
	3.40
FLITWICK	
	8.29
BEDFORD	

ANNEX B – ROUTE DATA

Station Distances

Distance (miles)	Station
51.78750	BEDFORD
42.20000	FLITWICK
39.25000	HARLINGTON
34.72500	LEAGRAVE
32.20625	LUTON
31.21250	LUTON AIRPORT PARKWAY
26.61250	HARPENDEN
21.86250	ST ALBANS
17.18750	RADLETT
14.41250	ELSTREE & BOREHAMWOOD
11.32500	MILL HILL BROADWAY
8.96250	HENDON
7.08750	CRICKLEWOOD
5.88750	WEST HAMPSTEAD THAMESLINK
3.50000	KENTISH TOWN
2.13750	ST PANCRAS INTERNATIONAL
0.76250	FARRINGDON

Distance (miles)	Station
0.00000	FARRINGDON
0.38750	CITY THAMESLINK
0.68750	BLACKFRIARS
1.96250	LONDON BRIDGE
12.28750	EAST CROYDON
15.30000	PURLEY
23.56250	EARLSWOOD
28.52500	GATWICK AIRPORT
31.20000	THREE BIRDGES
35.73750	BALCOMBE
39.67500	HAYWARDS HEATH
42.58750	WIVELSFIELD
43.42500	BURGESS HILL
45.46250	HASSOCKS
51.20000	PRESTON PARK
52.55000	BRIGHTON

Bedford to Farringdon curve data.

Start (miles)	End (miles)	Radius (m)
51.45866	51.67297	489
42.08611	42.22336	715
32.47173	32.62859	705
32.32794	32.41944	1225
32.17108	32.32794	1165
31.89003	32.10840	885
31.54392	31.89003	1145
30.72009	30.94231	1035
30.23644	30.43905	1165
29.19722	29.32794	800
27.19722	27.39330	1055
7.06700	7.15100	1185
5.45866	5.61552	1164
3.47173	3.56323	835
3.39330	3.47173	1396
3.27565	3.39330	1135
3.17108	3.27565	885
2.91046	3.00376	700
2.84428	2.89657	605
2.70588	2.72660	580
2.51634	2.68627	1080

2.25490	2.40522	686
1.84313	2.09150	200
1.73202	1.84313	186
1.62745	1.73202	216
1.45750	1.49019	1080
1.33987	1.42157	937
1.20915	1.26144	905
1.10457	1.20915	537
1.02614	1.10457	574
0.96078	1.02614	189
0.92157	0.96078	343
0.84500	0.92157	654
0.77777	0.81046	485

Bedford to Farringdon gradient data.

Start (miles)	End (miles)	Gradient
51.68088	51.97500	205
51.47173	51.68088	-214
51.39330	51.47173	-2625
51.22990	51.39330	192
50.98807	51.22990	-163
50.28870	50.98807	-184
49.97500	50.28870	178
49.67434	49.97500	530
49.51094	49.67434	0
49.19722	49.51094	-293
48.64820	49.19722	-342
48.39983	48.64820	-255
48.19722	48.39983	-180
47.90963	48.19722	-480
47.38676	47.90963	-222
45.73970	47.38676	-200
45.52402	45.73970	-168
45.21029	45.52402	-222
43.85081	45.21029	-200
43.63513	43.85081	-344
43.34101	43.63513	337

Start (miles)	End (miles)	Gradient
42.92271	43.34101	-338
42.66781	42.92271	-715
42.50768	42.66781	200
42.41291	42.50768	750
42.21029	42.41291	0
41.91617	42.21029	-574
41.68741	41.91617	-377
41.52402	41.68741	-223
41.36715	41.52402	-151
35.88022	41.36715	-202
35.74624	35.88022	0
35.41290	35.74624	383
35.24951	35.41290	0
35.01748	35.24951	880
34.82467	35.01748	-388
34.68088	34.82467	-890
34.63839	34.68088	0
34.38023	34.63839	940
33.53055	34.38023	642
33.19722	33.53055	264
32.87369	33.19722	185
32.67434	32.87369	214
32.31487	32.67434	271
32.06323	32.31487	0

Start (miles)	End (miles)	Gradient
31.73970	32.06323	250
31.35408	31.73970	-250
31.17108	31.35408	-151
30.32794	31.17108	-209
29.77892	30.32794	180
29.37369	29.77892	168
29.21683	29.37369	276
29.02729	29.21683	226
28.81160	29.02729	160
28.66454	28.81160	286
28.15147	28.66454	-182
27.05016	28.15147	-206
26.65473	27.05016	176
26.39983	26.65473	396
26.07304	26.39983	176
25.32794	26.07304	-200
24.90310	25.32794	179
24.70049	24.90310	0
24.37369	24.70049	-214
24.30180	24.37369	0
23.45212	24.30180	176
23.17435	23.45212	-200
22.80179	23.17435	300
22.23644	22.80179	176

Start (miles)	End (miles)	Gradient
22.02402	22.23644	167
21.82467	22.02402	285
20.12533	21.82467	177
19.93578	20.12533	167
19.57630	19.93578	195
18.90310	19.57630	163
18.67434	18.90310	193
18.42598	18.67434	-180
18.12533	18.42598	-260
17.83774	18.12533	0
17.77238	17.83774	460
17.67434	17.77238	185
17.52402	17.67434	149
17.39983	17.52402	220
17.13513	17.39983	0
14.79852	17.13513	-200
14.60245	14.79852	-235
14.39003	14.60245	-450
14.26258	14.39003	-400
12.30180	14.26258	176
12.08938	12.30180	0
11.60245	12.08938	188
11.30180	11.60245	270
11.05997	11.30180	164

Start (miles)	End (miles)	Gradient
10.87695	11.05997	154
10.56323	10.87695	191
10.09265	10.56323	161
9.97500	10.09265	235
9.27565	9.97500	166
9.15800	9.27565	-374
9.01095	9.15800	0
8.89003	9.01095	220
8.79852	8.89003	275
8.30180	8.79852	191
8.19195	8.30180	0
7.06323	8.19195	-196
6.82467	7.06323	375
6.55016	6.82467	0
6.32140	6.55016	420
5.56323	6.32140	195
4.77238	5.56323	180
4.58938	4.77238	201
4.39983	4.58938	166
4.30833	4.39983	371
4.21029	4.30833	188
4.08938	4.21029	108
3.99461	4.08938	326
3.90310	3.99461	131

Start (miles)	End (miles)	Gradient
3.72009	3.90310	235
3.58937	3.72009	146
3.49787	3.58937	799
3.32794	3.49787	190
3.15801	3.32794	1560
3.03055	3.15801	224
3.02402	3.03055	121
2.84428	3.02402	-378
2.70588	2.84428	70
2.60130	2.70588	58
2.54900	2.60130	61
2.48366	2.54900	55
2.46078	2.48366	43
2.43137	2.46078	89
2.30065	2.43137	56
2.15033	2.30065	66
2.07843	2.15033	-6000
2.03268	2.07843	341
1.92810	2.03268	2050
1.83660	1.92810	-517
1.77124	1.83660	117
1.71895	1.77124	-71
1.59477	1.71895	950
1.51634	1.59477	108

Start (miles)	End (miles)	Gradient
1.48366	1.51634	44
1.33987	1.48366	-1504
1.10457	1.33987	97
1.01961	1.10457	113
0.97386	1.01961	58
0.94771	0.97386	333
0.87250	0.94771	-33
0.82680	0.87250	-29
0.76250	0.82680	0

Farringdon to Brighton curve data.

Start (miles)	End (miles)	Radius (m)
0.03750	0.08125	200
0.08125	0.11250	2000
0.11250	0.43125	1000
0.43750	0.45625	649
0.50000	0.55000	244
0.55000	0.56250	609
0.56250	0.58750	436
0.58750	0.64375	367
0.64375	0.73350	320
0.91250	1.03750	380

Start (miles)	End (miles)	Radius (m)
1.48750	1.52810	520
1.59180	1.86390	960
1.97200	2.09340	900
2.82550	3.02810	1060
3.44050	3.64950	15140
3.64950	3.76750	840
3.76750	4.10750	2520
4.10750	4.66250	760
4.68250	4.82650	1200
5.15750	5.32350	1560
5.32350	5.76250	2520
6.27750	6.47350	1760
7.25150	7.88550	1500
7.88550	8.27750	1440
8.62350	8.80050	1760
8.88550	9.00250	1320
9.43450	9.69550	1320
10.64950	10.95050	1920
11.57500	12.08750	940
12.08750	12.43750	1820
12.90000	13.00000	10400
13.68750	14.07500	1820
14.07500	14.72500	1900
14.72500	14.96250	6000

Start (miles)	End (miles)	Radius (m)
15.37500	15.70000	3520
15.70000	15.93750	5200
16.56250	16.63750	1200
16.87500	16.93750	240
16.93750	17.08750	4520
17.08750	17.32500	4800
17.38750	17.68750	2900
17.85000	18.15000	2880
18.15000	18.46250	960
18.56250	18.73750	1020
18.73750	19.33750	1760
20.31250	20.61250	1500
20.61250	20.77500	2900
20.77500	20.87500	2120
20.87500	21.02500	2580
21.02500	21.21250	2240
21.21250	21.76250	1500
21.76250	22.15000	1560
22.22500	22.62500	1560
23.10000	23.20000	800
23.20000	23.98750	2660
23.98750	24.21250	2000
24.21250	24.52500	4800
24.52500	24.63750	9400

Start (miles)	End (miles)	Radius (m)
24.63750	24.83750	4800
24.83750	26.12750	6000
31.00000	31.06250	2600
31.12500	31.18750	1600
31.36250	31.43750	1100
31.43750	31.51250	1200
33.43750	34.01250	920
34.62500	34.98750	1440
34.98750	35.43750	500
35.43750	35.57500	1600
35.85000	36.47500	1700
36.78750	37.41250	2400
37.65000	38.06250	1920
38.33750	38.45000	3340
38.45000	38.57500	4040
38.91250	39.53750	1900
42.33750	42.68750	1900
45.51250	45.71250	6400
46.36250	46.51250	1340
47.71250	47.90000	1540
48.38750	49.13750	1640
49.37500	49.67500	1640
50.15000	50.26250	1080
50.26250	50.43750	1220

Start (miles)	End (miles)	Radius (m)
50.43750	50.93750	1600
51.31250	51.58750	2000
51.58750	51.68750	600
51.76250	51.90000	940
51.90000	52.06250	600
52.17500	52.31250	500
52.43750	52.52500	280

Speed limits.

Farringdon to Bedford (Down)		
Start (miles)	End (miles)	Speed (mph)
0.76250	0.80000	15
0.80000	3.78750	30
3.78750	4.22500	50
4.22500	7.22500	75
7.22500	9.60000	90
9.60000	9.91250	60
9.91250	13.45000	90
13.45000	14.03750	75
14.03750	21.26250	90
21.26250	21.78750	80
21.78750	22.15000	65

22.15000	22.86250	80
22.86250	26.45000	90
26.45000	26.95000	85
26.95000	28.45000	75
28.45000	31.71250	85
31.71250	32.31250	70
32.31250	32.36250	55
32.36250	32.96250	85
32.96250	39.08750	90
39.08750	39.28750	70
39.28750	39.37500	80
39.37500	42.08750	90
42.08750	42.22500	70
42.22500	44.21250	90
44.21250	44.62500	75
44.62500	50.35000	90
50.35000	51.47500	75
51.47500	51.78750	50

Bedford to Farringdon (Up)		
Start (miles)	**End (miles)**	**Speed (mph)**
51.78750	51.47500	50
51.47500	50.97500	75
50.97500	44.62500	90
44.62500	44.21250	75

44.21250	42.22500	90
42.22500	42.08750	70
42.08750	39.37500	90
39.37500	39.28750	80
39.28750	39.08750	70
39.08750	32.96250	90
32.96250	32.36250	85
32.36250	32.16250	55
32.16250	32.08750	15
32.08750	31.71250	70
31.71250	27.18750	85
27.18750	26.95000	75
26.95000	26.45000	85
26.45000	22.86250	90
22.86250	22.15000	80
22.15000	21.78750	65
21.78750	21.26250	80
21.26250	14.03750	90
14.03750	13.45000	75
13.45000	9.82500	90
9.82500	9.38750	60
9.38750	7.22500	90
7.22500	4.26250	75
4.26250	3.78750	50
3.78750	0.80000	30
0.80000	0.76250	15

Farringdon to Brighton curve data.

Start (miles)	End (miles)	Radius (m)
0.03750	0.08125	200
0.08125	0.11250	2000
0.11250	0.43125	1000
0.43750	0.45625	649
0.50000	0.55000	244
0.55000	0.56250	609
0.56250	0.58750	436
0.58750	0.64375	367
0.64375	0.73350	320
0.91250	1.03750	380
1.48750	1.52810	520
1.59180	1.86390	960
1.97200	2.09340	900
2.82550	3.02810	1060
3.44050	3.64950	15140
3.64950	3.76750	840
3.76750	4.10750	2520
4.10750	4.66250	760
4.68250	4.82650	1200
5.15750	5.32350	1560
5.32350	5.76250	2520
6.27750	6.47350	1760
7.25150	7.88550	1500

Start (miles)	End (miles)	Radius (m)
7.88550	8.27750	1440
8.62350	8.80050	1760
8.88550	9.00250	1320
9.43450	9.69550	1320
10.64950	10.95050	1920
11.57500	12.08750	940
12.08750	12.43750	1820
12.90000	13.00000	10400
13.68750	14.07500	1820
14.07500	14.72500	1900
14.72500	14.96250	6000
15.37500	15.70000	3520
15.70000	15.93750	5200
16.56250	16.63750	1200
16.87500	16.93750	240
16.93750	17.08750	4520
17.08750	17.32500	4800
17.38750	17.68750	2900
17.85000	18.15000	2880
18.15000	18.46250	960
18.56250	18.73750	1020
18.73750	19.33750	1760
20.31250	20.61250	1500
20.61250	20.77500	2900

Start (miles)	End (miles)	Radius (m)
20.77500	20.87500	2120
20.87500	21.02500	2580
21.02500	21.21250	2240
21.21250	21.76250	1500
21.76250	22.15000	1560
22.22500	22.62500	1560
23.10000	23.20000	800
23.20000	23.98750	2660
23.98750	24.21250	2000
24.21250	24.52500	4800
24.52500	24.63750	9400
24.63750	24.83750	4800
24.83750	26.12750	6000
31.00000	31.06250	2600
31.12500	31.18750	1600
31.36250	31.43750	1100
31.43750	31.51250	1200
33.43750	34.01250	920
34.62500	34.98750	1440
34.98750	35.43750	500
35.43750	35.57500	1600
35.85000	36.47500	1700
36.78750	37.41250	2400
37.65000	38.06250	1920

Start (miles)	End (miles)	Radius (m)
38.33750	38.45000	3340
38.45000	38.57500	4040
38.91250	39.53750	1900
42.33750	42.68750	1900
45.51250	45.71250	6400
46.36250	46.51250	1340
47.71250	47.90000	1540
48.38750	49.13750	1640
49.37500	49.67500	1640
50.15000	50.26250	1080
50.26250	50.43750	1220
50.43750	50.93750	1600
51.31250	51.58750	2000
51.58750	51.68750	600
51.76250	51.90000	940
51.90000	52.06250	600
52.17500	52.31250	500
52.43750	52.52500	280

Farringdon to Brighton gradient data.

Start (miles)	End (miles)	Gradient
0.00000	0.20625	0
0.20625	0.30000	62
0.30000	0.35625	50
0.35625	0.46250	32
0.46250	0.48750	0
0.48750	0.59750	29
0.59750	1.48750	0
1.48750	1.81150	128
1.81150	1.96250	-109
1.96250	2.12500	-134
2.14590	2.27380	2200
2.27380	2.49870	1080
2.49870	3.50000	1232
3.50000	3.72150	1591
3.72150	3.79350	917
3.79350	4.12050	-885
4.12050	4.15950	570
4.15950	4.92450	-1037
4.92450	5.04850	85
5.04850	7.47350	100
7.47350	7.54550	228

Start (miles)	End (miles)	Gradient
7.54550	7.65650	723
7.65650	7.85950	-1253
7.85950	8.07450	589
8.07450	8.37550	-789
8.37550	8.74750	597
8.74750	8.85250	0
8.85250	9.28390	694
9.28390	9.34930	-1222
9.34930	9.61050	416
9.61050	10.21250	-1927
10.21250	10.47350	1150
10.47350	10.69550	-185
10.69550	11.78750	-620
11.78750	12.01250	264
12.01250	12.38750	-165
12.38750	12.45000	195
12.45000	16.93750	263
16.93750	17.06250	100
17.06250	17.28750	125
17.28750	17.35000	300
17.35000	17.47500	126
17.47500	18.02500	630
18.02500	18.12500	142
18.12500	18.77500	169

Start (miles)	End (miles)	Gradient
18.77500	19.31250	160
19.31250	20.33750	-203
20.33750	21.18750	-230
21.18750	22.72500	-190
22.72500	23.02500	-162
23.02500	23.25000	-190
23.25000	24.31250	-230
24.31250	24.76250	-350
24.76250	25.35000	-245
25.35000	25.86250	-290
25.86250	26.12500	-200
26.12500	26.47500	-255
26.47500	27.10000	-272
27.10000	27.28750	-925
27.28750	27.47500	880
27.47500	27.86250	621
27.86250	28.25000	527
28.25000	28.52500	804
28.52500	29.12500	380
29.12500	29.73750	283
29.73750	33.67500	255
33.67500	35.53750	-264
35.53750	35.75000	-193
35.75000	36.06250	-330

Start (miles)	End (miles)	Gradient
36.06250	37.06250	-275
37.06250	37.93750	-255
37.93750	39.11250	-264
39.11250	39.70000	-293
39.70000	40.53750	-330
40.53750	41.45000	-264
41.45000	41.97500	-298
41.97500	43.23750	282
43.23750	43.41250	-3000
43.41250	43.90000	750
43.90000	44.27500	4000
44.27500	44.80000	-460
44.80000	45.05000	265
45.05000	45.36250	240
45.36250	45.61250	207
45.61250	45.82500	220
45.82500	46.06250	319
46.06250	47.76250	272
47.76250	52.10000	-264
52.10000	52.93750	0

Speed limits.

Farringdon to Brighton(Down)		
Start (miles)	**End (miles)**	**Speed (mph)**
0.00000	0.12500	15
0.12500	0.75000	25
0.75000	1.60000	15
1.60000	2.22500	20
2.22500	3.50000	60
3.50000	3.62500	35
3.62500	3.86250	45
3.86250	5.00050	60
5.00050	10.75050	70
10.75050	11.78750	60
11.78750	12.02500	60
12.02500	12.41250	45
12.41250	13.28750	60
13.28750	23.08750	90
23.08750	23.50000	80
23.50000	28.66250	90
28.66250	30.85000	100
30.85000	31.37500	90
31.37500	33.12500	100
33.12500	33.43750	90

33.43750	33.96250	80
33.96250	49.93750	90
49.93750	51.93750	75
51.93750	52.18750	45
52.18750	52.55000	25

Brighton to Farringdon (Up)		
Start (miles)	**End (miles)**	**Speed (mph)**
52.55000	52.18750	25
52.18750	51.93750	45
51.93750	49.93750	75
49.93750	33.96250	90
33.96250	33.43750	80
33.43750	33.12500	90
33.12500	31.37500	100
31.37500	30.85000	90
30.85000	28.66250	100
28.66250	23.50000	90
23.50000	23.08750	80
23.08750	13.28750	90
13.28750	12.41250	60
12.41250	12.02500	45
12.02500	11.78750	60
11.78750	10.75050	60
10.75050	5.00050	70

5.00050	3.86250	60
3.86250	3.62500	45
3.62500	3.50000	35
3.50000	3.10000	60
3.10000	2.78750	40
2.78750	2.68750	30
2.68750	2.22500	60
2.22500	1.60000	20
1.60000	0.75000	15
0.75000	0.12500	25
0.12500	0.00000	15

ANNEX C – REQUIRED MARKER BOARD POSITIONS

Road	Direction	Location Information	Location	Plan
Up Moorgate	Up	WH1023+105m	7567	07-SO-05 Sht 1
Up Moorgate	Up	WH1025+65m	7700	07-SO-05 Sht 1
Up Moorgate	Up	WH1029+65m	7843	07-SO-05 Sht 1
Up Moorgate	Up	WH1031+65m	7979	07-SO-05 Sht 1
Dn Snow Hill	Dn	VS1045+65m	9835	07-SO-05 Sht 2
Dn Snow Hill	Dn	VS1045+122m	9892	07-SO-05 Sht 2
Dn Snow Hill	Dn	VS1057+55m	10469	07-SO-05 Sht 2
Dn Snow Hill	Dn	VS1057+132m	10546	07-SO-05 Sht 2
Dn Snow Hill	Dn	VS1069+55m	11099	07-SO-05 Sht 2
Dn Snow Hill	Dn	VS1069+125m	11169	07-SO-05 Sht 2
Dn Snow Hill	Dn	VS1075+65m	11422	07-SO-05 Sht 2
Dn Snow Hill	Dn	VS1075+142m	11499	07-SO-05 Sht 2
Dn Snow Hill	Dn	VS1077+67m	11643	07-SO-05 Sht 2
Dn Snow Hill	Dn	VS1079+65	11770	07-SO-05 Sht 2
Blackfriars Reversible	Dn	TL4235+89m	11914	11-SO-017/3
Up Holborn Fast	Up	VS1082+180m	12457	07-SO-05 Sht 2
Up Holborn Fast	Up	VS1080+143	12054	07-SO-05 Sht 2
Up Holborn Slow	Up	VS1274-71m	12025	07-SO-05 Sht 2
Down Holborn Fast	Up	VS1340+82m	11872	07-SO-05 Sht 2
Up Holborn Fast	Up	VS1078+132m	11822	07-SO-05 Sht 2
Up Holborn Slow	Up	VS1274+175m	11779	07-SO-05 Sht 2
Up Snow Hill	Up	VS1072+65m	11517	07-SO-05 Sht 2
Up Snow Hill	Up	VS1070+65m	11360	07-SO-05 Sht 2
Up Snow Hill	Up	VS1070+132m	11293	07-SO-05 Sht 2
Up Snow Hill	Up	VS1068+64m	11157	07-SO-05 Sht 2
Up Snow Hill	Up	VS1066+55m	11038	07-SO-05 Sht 2
Up Snow Hill	Up	VS1060+55m	10723	07-SO-05 Sht 2
Up Snow Hill	Up	VS1060+130	10648	07-SO-05 Sht 2
Up Snow Hill	Up	VS1046+55	10093	07-SO-05 Sht 2
Up Snow Hill	Up	VS1046+112	10036	07-SO-05 Sht 2
Up Snow Hill	Up	VS1044+65m	9882	07-SO-05 Sht 2
Dn Moorgate	Dn	WH1024+65m	7920	07-SO-05 Sht 1
Dn Moorgate	Dn	WH1024+130m	7855	07-SO-05 Sht 1
Dn Moorgate	Dn	WH1022+65m	7715	07-SO-05 Sht 1
Dn Moorgate	Dn	WH1020+65m	7584	07-SO-05 Sht 1
Up Canal Tunnel	Up	WH1118+65m	7506	11-NE-0001 Sht 1

SCHEDULE 1.2

Train Infrastructure Interface Specification

This Schedule is recorded electronically in accordance with clause 4.19

Thameslink Programme

Train Infrastructure Interface Specification

Prepared by:			
Signature	[ ] 1	Name	[ ] 2
		Position	[ ] 3
		Date	7th September 2012
1st Approval:			
Signature	[ ] 4	Name	[ ] 5
		Position	[ ] 6
		Date	12th September 2012
2nd Approval:			
Signature	[ ] 7	Name	[ ] 8
		Position	[ ] 9
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Authorised by:			
Signature	[ ] 10	Name	[ ] 11
		Position	[ ] 12
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1 - 12: Redaction.

Published & Issued by: Network Rail, Thameslink Programme, James Forbes House, 27 Great Suffolk Street, London, SE1 0NS.

Issue Record

Issue	Date	Comments
1.0	23/09/08	Issue 1 for approval
2.0	20/11/08	Issue 2 for TRSP ITT
2.1	03/09/10	Draft changes for Issue 3 for review
2.2	01/10/10	Draft changes for Issue 3, following DfT review
3.0	09/11/10	Issue 3 for TRSP re-issue to bidders.
3.1	04/08/11	Draft changes for Issue 4 for NR review
3.2	01/09/11	Draft changes for Issue 4 for DfT & TOC review
3.3	02/09/11	Draft changes for Issue 4 for DfT & TOC review
3.4	11/11/11	Draft changes for Issue 4 for review, no UGMS, UOMS etc
3.5	18/11/11	Draft changes for Issue 4 following stakeholder review
3.6	25/11/11	Draft changes for Issue 4 following stakeholder review
3.7	15/12/11	Draft changes for Issue 4 following stakeholder review
3.8	21/12/11	Draft changes for Issue 4 including TTCS on-board requirements as an Annex
3.9	26/01/12	Draft changes for Issue 4 status of referenced standards checked
4.0	08/06/12	Version 4 of the TIIS was produced, but not issued, with amendments to align with the preferred bidder's accepted technical proposal, to reflect the outcome of technical negotiations with the preferred bidder and to incorporate relevant requirements from the TTCS into a new Annex J. Requirements relating specifically to the bid submission were also deleted. Amendments included increasing the minimum platform lighting level for satisfactory performance of the onboard DOO camera system, from the low level previously specified (intended to avoid the need for additional platform lighting works), to align with the relevant Standard for platforms.
5.0	07/09/12	For Version 5 further amendments have subsequently been made at the DfT's request to align terminology with that used in the MSA and to ensure consistent use of defined terms in the rolling stock contract. One technical change has also been made to increase the tolerance on the ATO stopping 'window' for automatic door opening at stations in the Thameslink core (the target stopping window for ATO remains unchanged), this now aligns with the agreed stopping 'window' in manual driving for the driver to open all the doors at stations in the Thameslink core.

Table of Contents

1 Introduction

This TIIS has been created using the Dynamic Object Orientated Requirement System (DOORS) requirements management tool. It has been exported from DOORS into Microsoft WORD. DOORS remains the master repository of the requirements. All requirements in this document are present in boxes and are identifiable by their unique object identifier. Unique identifiers are alpha-numeric, starting with the prefix “TIIS-“ followed by a number. This unique identifier is generated by DOORS and stays with the requirement throughout its lifecycle to delivery and acceptance. Unique identifiers must be used in all future communications regarding the requirements.

1.1 Purpose

The purpose of this TIIS is to:

Set out the technical characteristics of the infrastructure interfaces with which the new Thameslink rolling stock (referred to from this point forward as the 'Unit') will be compatible from the date of their placing into service.

Where applicable set out the acceptance criteria against which the Unit will be demonstrated to be compatible.

Support the development of the best whole life, whole system solutions consistent with obtaining best value.

Generally, not to repeat or restate Railway Group Standards or other Applicable Laws and Standards that the Units will comply with in accordance with the train technical specification, except where they conflict or there are options.

1.2 Scope

This TIIS sets out the technical characteristics of the infrastructure interfaces with which the Unit (FLU or RLU) will be compatible from the date of their placing into service.

This TIIS also sets out the minimum required interfaces for systems and commissioning arrangements for those systems which are planned for implementation on the Thameslink routes after the introduction of the Unit into service.

The infrastructure described in this TIIS over which the Unit will operate is not necessarily fully compliant with the European Technical Specifications for Interoperability (TSI) and in almost all cases it will not have certified conformity to these specifications as the Interoperability legislation does not apply retrospectively.

Systems that need both trainborne and infrastructure fitted equipment to function correctly e.g. European Train Control System (ETCS) are listed in this TIIS and details provided for the TMM to ensure compatibility of the Unit with the infrastructure fitted equipment.

This TIIS relates to compatibility with Network Rail infrastructure. There are sections of the network managed by Network Rail which adjoin infrastructure controlled by others (e.g. LUL); these are not covered by this document.

This TIIS does not address depots, or servicing and stabling location, although requirements for self test facilities that would be used on entrance and exit, such as a health check from these locations are included. No gauge assessment work has been undertaken for any sidings, depots or approach to depots.

A number of systems on the Unit include a requirement for the system to apply controls or to limit parameters depending on the confirmed location of the train. Within this TIIS such control has been referred to as 'geospatial control'. It is anticipated that the geospatial control will use a system architecture similar to that described for ASDO within GE/GN8577 and within this TIIS, i.e. the system will operate usually from GNSS-derived positioning information, but using Eurobalise for the positioning infill where satellites are not visible (e.g. in tunnels) or where discrimination between adjacent running lines is not possible using GNSS and route maps.

A list of abbreviations and definitions are provided in Annex F.

2 Infrastructure Train Interfaces

2.1 Gauge

Suburban rolling stock operates over relatively short distances, stopping and starting frequently, carrying high volumes of passengers. Rolling stock of this type is required to maximise passenger capacity.

In order to maximise the available gauge for the Unit and therefore the interior space, Network Rail carried out two studies. The first study developed a modern Class 319 ClearRoute™ model based upon a new modern Kinematic Envelope (KE) of the Class 319 rolling stock.

The second study was undertaken, on the basis of the likely service and diversionary routes, to determine the optimal space available within the existing infrastructure to accommodate the new rolling stock. This study has considered clearances to lineside structures, and also passing clearances with other vehicles likely to operate over the sections of route operating on the adjacent tracks and through switches and crossings, as well as clearances to platforms (but not detailed stepping arrangements).

A single limiting 'gauge profile' identified from these studies for the 20m vehicle is provided in Annex A.

All the dynamic movements and behaviours of the Unit shall fit within the gauge profile provided in Annex A.
TIIS-1584

The design and validation of the Unit size shall be in accordance with Railway Group Standard GM/RT2149 Requirements for Defining and Maintaining the Size of Railway Vehicles.
TIIS-42

The Unit shall be fitted with non retractable 3rd rail shoe gear.
TIIS-1585

Network Rail will clear the routes listed in Annex B north of the river Thames to allow for non-retractable shoe gear to be fitted to the Unit.

2.1.1 Gauge Profile

Annex A contains a gauge limit defining the maximum vehicle dynamic movement at body centre line derived for a 20m vehicle travelling along a section of track with cant deficiency up to and including 150 mm.

Drawing BBRT-9372-E-003 shows the gauge down to 160m curve radii applicable to any point along 20 metres of the vehicle centred midway between bogie pivots.

Dynamic Upper Gauge Profile (bounded by the co-ordinates 1R, 2R, etc): the effects of curve overthrow down to 160m curve radius are excluded (they are included in Network Rail's gauging development work). Below that curve radius, the TMM shall consider end tapers for curve overthrow down to 125m curve radius for the vehicle length of 20m.
TIIS-1937

Dynamic Lower Gauge Profile (bounded by co-ordinates 1D, 2D, etc): all dynamic movement of the items contained in the lower vehicle gauge, including suspension failure conditions, shall be contained within the area bounded by the coordinates incorporating dynamic movements. This includes:

a) Full lateral suspension travel and wear limits

b) Lateral curve overthrows as follows:

≥ 360 m radius 0 mm (2700 mm maximum width)

< 360 m ≥ 200 m radius 60 mm (2820 mm maximum width)

< 200 m ≥ 160 m radius 100 mm (2900 mm maximum width)

c) Full downward vertical suspension movements to bumpstop condition and wear

d) Vertical curve overthrows in underclearance planes at 75, 100 and 135mm ARL (points 1D to 5D in the Annex A gauge profiles) when on a vertical curve of 500m radius

e) Parts of the vehicle should not come within 25mm of line joining points 4D and 5D in the Annex A gauge profiles, under normal conditions, unless it can be demonstrated that under failure conditions this line cannot be infringed

f) Radial wheel wear.

This does not include:

a) Vehicle roll movements

b) Wheel flange wear and wheel / rail clearance.

TIIS-1938

The TMM shall demonstrate by the derivation of a Kinematic Envelope that the developed Unit (including all physical features such as underframe equipment, footsteps, bogies, door light indicators, buttons, plates, DOO cameras, roof mounted antennae and stowed pantograph) and all movements and behaviours (including operation in all degraded conditions) can be accommodated completely within the appropriate gauge profile in Annex A.
TIIS-1591

The Kinematic Envelope for the Unit shall include the profile for the lower sector gauge.
TIIS-1921

The Kinematic Envelope of the Unit shall be provided at defined stages during its development to Network Rail.
TIIS-1592

The TMM shall define the stages of Kinematic Envelope development for the Unit.
TIIS-1593

The Kinematic Envelope for the Unit shall be provided in electronic format, i.e. as a 'Vampire' KE or equivalent, in ClearRoute™ format in addition to drawings.
TIIS-1756

In addition, the vehicle drawings for the gauging portfolio for the Unit shall be provided as a CAD file compatible with the Thameslink Engineering CAD Procedure N000-01000-NRT-PRO-EG-000005 3.0.
TIIS-1757

If the Kinematic Envelope for the Unit is updated during the development of the design, the TMM shall identify the changes to Network Rail and indicate whether the new KE is larger or smaller than the previous version in the area concerned.
TIIS-1758

The TMM shall carry out gauge assessment work for any stabling sidings, depots or approach to depots for the Unit that is not Network Rail controlled infrastructure.
TIIS-1597

2.1.2 Platforms

New platforms and extensions will be built to GI/RT7016 Interface between station platforms, track and trains.

In order to support the design of the Unit to achieve compliant stepping distances, access will be granted to the National Gauging Database for platform profile data for the Thameslink routes.

2.1.2.1 Platform Stepping Distances

The Unit will be required to cope with large volumes of passengers boarding and alighting at stations (especially in the “Core Area”). It is therefore important that the design of the Unit is optimised to enable the flow of passengers boarding and alighting to be completed safely and efficiently.

The TMM shall demonstrate how the design of the Unit complies with the requirements stated in GM/RT2149 using the platform data contained within the National Gauging Database.
TIIS-1737

2.1.2.2 Platform Length

The maximum distance between the front of the Unit and the rear edge of the rearmost passenger door shall be 237.5m, for the FLU, such that the Units can be accommodated within existing platform lengths.
TIIS-1555

2.2 Wheel-Rail Interface

2.2.1 Contact Patch Energy

The Unit shall generate minimum damage to the track, including Rolling Contact Fatigue (RCF) and wear as far as reasonably practicable.
TIIS-57

The Unit shall be equipped with an automatic wheel flange lubrication system to reduce wear on all Thameslink routes including the Core Area.
TIIS-1759

Minimising the amount of damage caused to the track will benefit the Operator and TMM as the amount of RCF and wear generated on the wheels will also be reduced and increase wheel life.

The risk of RCF and wear can be quantified using the contact patch energy term, $T\gamma$, which is readily available from the results of vehicle dynamics simulations. Figure 1 shows upper boundary limits of $T\gamma$ (as a function of track curvature) for the Unit. The curves provided show the limits of $T\gamma$ when running at cant equilibrium and 120mm cant deficiency. At each curve radius the curves show the maximum $T\gamma$ of the tread and flange contact. These curves were calculated using the $T\gamma$ algorithms used in the Vampire vehicle dynamics software.

The TMM shall provide curves of $T\gamma$ for the Unit in the TTD.
TIIS-1600

The TMM shall provide to Network Rail updated curves of $T\gamma$ for the Unit at appropriate stages during development of the design.
TIIS-1977

The TMM shall validate the predicted curves of $T\gamma$ for the Unit based on as-built measurable parameters.
TIIS-1978

The curves of $T\gamma$ for the Unit shall lie below those shown in Figure 1 for each of the specified operating conditions.
TIIS-1601

Predicted $T\gamma$ curves for the Unit shall be provided by the TMM taken from the leading wheel on the high rail of the curve.
TIIS-59

The $T\gamma$ 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.
TIIS-1603

Separate $T\gamma$ results shall be supplied for all Unit bogie types with heaviest axle loads.
TIIS-1604

The calculations shall use the following modelling assumptions:
The wheel-rail friction coefficient shall be 0.45
The wheel profiles shall be as new (design)
The rail profiles shall be CEN60E1 (design)
TIIS-1740

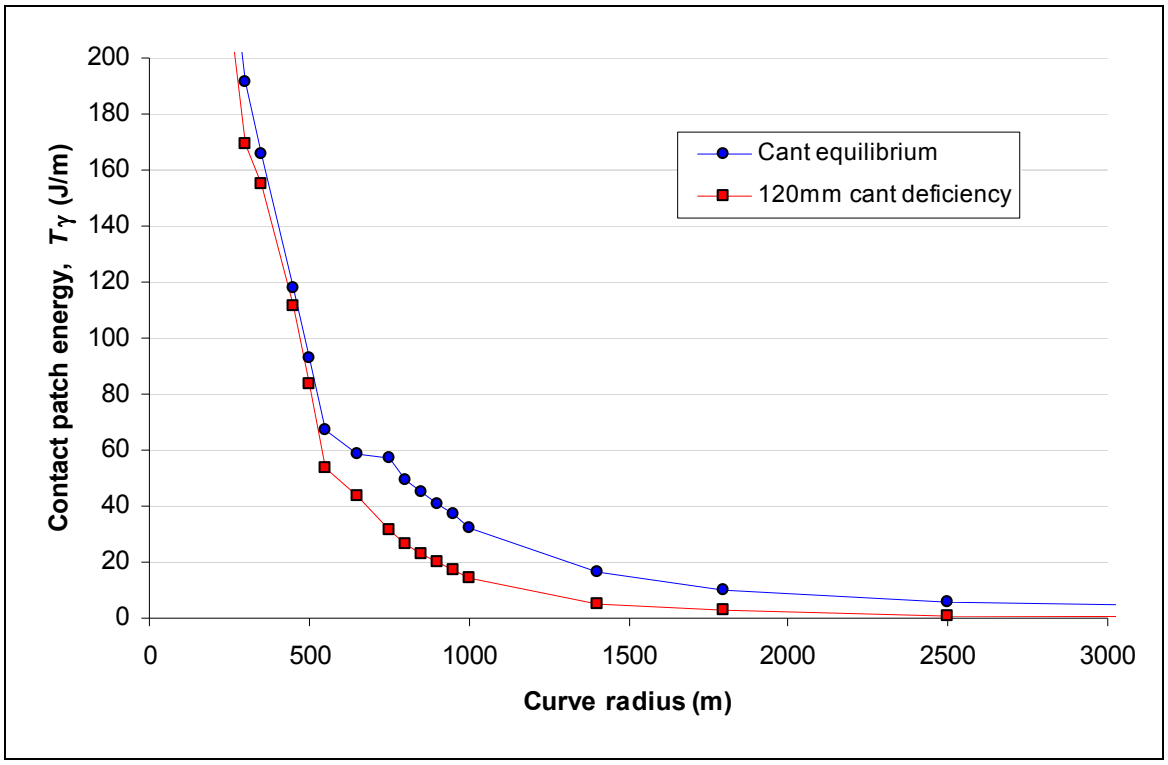


Figure 1 Tγ limits for Thameslink KO2

Please refer to Annex H for the Tγ curve definition.

2.2.2 Track Geometry Data

Composite track geometry data files, referred to as “Virtual Test Track” (VTT) files are provided for sample routes drawn from those currently identified for the operation of Thameslink KO2 services. These show track geometry values against the key parameters of vertical and lateral alignment, and gauge and twist together with curvature and super elevation.

These VTT files cover:

- Good quality track on the parts of the Thameslink Network shared with other inter-city and express services
- Track on suburban services generally characterised by lower operating speeds and tighter radius curves
- Track on the Core Area of the Thameslink route.

Each VTT has been created by the sampling of raw geometry data over an entire route while still ensuring that it contains a representative proportion of all the features in terms of incidence and magnitude likely to be encountered. They therefore represent a powerful test bed for examining the predicted dynamic behaviour of the Units, and for identifying the main geometry features that shape this.

The track geometry information provided in the form of VTT track geometry files shall be applied to the design to allow the definition of representative fatigue load cases, with a view to the TMM reducing bogie and vehicle mass.
TIIS-1169

The track geometry information provided in the form of VTT track geometry files shall be applied to the design to identify the particular features of the track geometry, or combinations of features, which impact critically upon the designed bogie and vehicle mass.
TIIS-1607

The TMM shall provide details of the defining features of their bogie and vehicle design, in respect of their interaction with the track geometry in their proposal for possible whole life, whole system optimisation.
TIIS-1608

As a result of this approach, it should be possible for the likely vehicle ride and behaviours to be more readily assessed, and for particular geometric track irregularities or amplitudes that significantly affect the designed mass of bogie and Unit based upon future fatigue life to be identified and re-examined. Taken with the emerging experience of the practical effects of the enhancements to the monitoring of track geometry, this will facilitate further co-operation in reviewing opportunities for overall improvements by greater attention to particular vehicle and track geometry features.

The TMM shall supply Network Rail the results of vehicle dynamics simulations of their vehicles on each of the VTT track geometry files provided.
TIIS-1173

The TMM shall provide to Network Rail the results of further vehicle dynamics simulations of their vehicles on each of the VTT track geometry files at appropriate stages in the development of the design.
TIIS-1979

The TMM shall validate the results of the vehicle dynamics simulations based on as-built measurable parameters on a test track with known track geometry.
TIIS-1980

As requested for the $T\gamma$ analyses, the simulations shall be conducted using the following modelling parameters:
The wheel-rail friction coefficient shall be 0.45
The wheel profile shall be as new (design)
TIIS-1813

The results of vehicle dynamics simulations shall be supplied in an electronic data file to Network Rail for each wheel set for all the Unit bogie types for both the left and right wheel/rail contacts.
TIIS-1174

The results of vehicle dynamics simulations shall cover:
Contact patch energy ($T\gamma$) for tread and flange
Lateral wheel forces
Vertical wheel forces
TIIS-1611

The Unit shall be designed to operate with the minimum curve radii stated in Railway Group Guidance Note GM/GN2690 Appendix 7 (status: withdrawn as of 05/03/2011).
TIIS-1736

The TMM shall identify the limiting minimum curve radii if the proposed design for the Unit is not compatible with the minimum curve radii stated for non-passenger lines and sidings.
TIIS-1755

2.3 Structures

The TMM shall provide details of the bogie centres, bogie wheelbase and axle loads or vehicle weights (for the tare and crush laden conditions) for the Unit, as required by GM/RT2149 Appendix F.
TIIS-1831

The Unit shall have a maximum axle loading under all operating conditions no higher than that required to achieve a Route Availability rating of RA4.
TIIS-1939

2.4 Energy

The Unit shall be dual voltage capable of operating on 25kV AC overhead line system and the 750V DC 3rd rail system.
TIIS-234

It is desirable that the Unit will be energy efficient such that the power drawn from the traction supply is minimised when the Units are in operation or stabled.

The TMM shall identify the energy efficient features of their Unit design as part of the TTD.
TIIS-1743

The Unit shall be designed in accordance with the management process mandated in the Railway Group Standard GE/RT8023 to ensure compatibility between the Units and the electrification system.
TIIS-237

2.4.1 25kV AC

2.4.1.1 Maximum and Minimum Electrification System Voltages

The Unit shall be capable of operating on traction power supplies within the range of voltages and frequencies defined in Network Rail Company Standard NR/GN/ELP/27010.
TIIS-238

2.4.1.2 Line Current Limits

During the service introduction phase or during the subsequent life of the Unit it is anticipated that further power supply enhancements will be delivered to upgrade the capability of the 25kV AC network.

The enhancements will be delivered progressively with a high current zone covering the Midland Main Line and core area, but the East Coast Main Line routes may initially be restricted to the base level or intermediate level current limit. The location of any current limit change will be provided by NR on completion of each enhancement stage, such that there will be no more than two changes of current limit during a single journey.

The Unit shall be equipped with a geospatial control system that automatically selects the appropriate line current limit on the AC network.
TIIS-1964

The Unit geospatial control system to select the appropriate line current limit shall be capable of being reprogrammed to update the permitted current limit for sections of route / current limit boundaries by authorised TMM or Operator staff.
TIIS-1965

The intermediate level line current limits applicable to the Unit shall be:
170A - for the RLU
250A - for the FLU.
TIIS-1967

The base level (default) line current limits applicable to the Unit shall be:
140A - for the RLU
200A - for the FLU.
TIIS-1966

The high current level line current limits applicable to the Unit shall be:
200A - for the RLU
300A - for the FLU.
TIIS-1092

2.4.1.3 Fault Level

The maximum short circuit current shall be 15,000 Amps at 27.5 kV as described in BS EN 50388:2005, section 11.2.
TIIS-240

If the main protection failed this fault current could be present for up to 1 second until cleared by trackside protection.

2.4.1.4 Overhead Line Equipment / Pantograph Parameters

2.4.1.4.1 Current Collection

The FLUs and RLUs shall be equipped with at least two pantographs to provide redundancy in the event of a pantograph fault.
TIIS-1785

The pantograph fitted to the Unit shall comply with the characteristics requirements for pantograph configuration stated in British Standard BS EN 50206-1:1998.
TIIS-1098

The pantograph head profile for the Unit shall comply with either:
the standard TSI pantograph head profile (1600mm length to BS EN50367 Appendix A clause A.2); or
the standard BR head profile (BS EN50367 Appendix B figure B.7).
TIIS-1560

The maximum pantograph head width (carbon spacing) for the Unit shall be 260mm.
TIIS-1561

The pantograph head for the Unit shall not be equipped with insulated horns.
TIIS-1562

The pantograph for the Unit shall be designed to have contact forces in the range:
60N - 90N static
90N - 120N dynamic mean
250N maximum (dynamic).
TIIS-244

The pantograph for the Unit shall be equipped with a 'height limit' device to fully lower the pantograph when the height limit of 6240mm is reached.
TIIS-247

The pantograph for the Unit shall be equipped with an “auto drop” device to lower the pantograph if damage occurs to contact strips that is liable to cause subsequent damage to the overhead line, in accordance with British Standard BS EN 50206-1:1998.
TIIS-1096

The Unit shall be equipped with a system to automatically report pantograph Auto Drop Device (ADD) activation to Network Rail Operations Control.
TIIS-1862

The ADD reporting system fitted to the Unit shall report for each ADD activation:
GNSS location at the time of ADD activation
Train speed at time of ADD activation
Location of the stopped train (for driver's verbal report to signaller)
Track ID at time of ADD activation (whenever available).
TIIS-1863

The ADD reporting system fitted to the Unit shall report each ADD activation and its location to Network Rail Operations Control using public GPRS.
TIIS-1864

The pantograph for the Unit shall be equipped with metallised carbon contact strips as currently approved for use on Network Rail infrastructure.
TIIS-1097

The TMM shall provide details of the Unit pantograph design as part of the TTD.
TIIS-1841

The pantograph fitted to the Unit shall be accommodated within the roof profile when lowered, as far as reasonably practicable, to avoid the possibility of snagging low hanging foliage when on the DC network.
TIIS-1754

The Unit shall be equipped with AVI tags meeting the requirements of Network Rail Standard NR/PS/ELP/21072 Trackside Pantograph Monitoring Equipment.
TIIS-1793

2.4.1.4.2 Contact Wire Height

The nominal contact wire height on Thameslink routes is between 4700 mm and 4880 mm.

The pantograph for the Unit shall be designed to operate with the range of contact wire height between a minimum height of 3925 mm (between Kentish Town and Farringdon) and a maximum permissible of 5940 mm static (6200 mm dynamic).
TIIS-1751

2.4.1.4.3 Lateral Deviation of Contact Wire

The pantograph for the Unit shall be designed to operate with a maximum lateral deviation of the contact wire of 560mm at 4.7m, with respect to the nominal position of the track.
TIIS-253

The Unit shall be designed such that the pantograph sway remains within the limits specified in the Railway Group Standard GM/RT2149.
TIIS-1558

2.4.1.4.4 Distances between Multiple Pantographs - Current Collection

The Unit will be permitted to operate with up to three pantographs for the FLU or two for the RLU (emulating 3x4-car or 2x4-car EMU operation).

On the Unit, where multiple pantographs are in use simultaneously, the pantographs locations shall be distributed along the train no closer than 74m, corresponding to the locations on an equivalent 3x4-car or 2x4-car EMU formation.
TIIS-260

The TMM shall identify the pantograph locations on the vehicle diagrams for the Unit (as part of the gauging portfolio submitted in compliance with Railway Group Standard GM/RT2149).
TIIS-1765

2.4.1.4.5 Compatibility with Positions of Signals and Booster Transformer Overlap or Neutral Sections

For train and infrastructure performance reasons, the positions of the pantographs on the Unit relative to signals and both overhead line neutral sections and booster transformer overlaps needs to be considered. The risks associated with pantographs coming to rest in a non-preferred location shall be minimised by locating the pantograph in the equivalent location to 8-car or 12-car multiple unit trains currently operating on Thameslink routes - i.e. for a train formed of 20m vehicles, at the inner end of the 2nd/outer end of the 3rd vehicle, inner end of the 6th/inner end of the 7th vehicle, outer end of the 10th/inner end of the 11th vehicle.
TIIS-268

2.4.1.5 Automatic Power Control (APC)

The Unit shall be equipped with APC receivers compatible with the APC infrastructure equipment installed in accordance with section 4.10 of the Network Rail Company Standard NR/GN/ELP/27010.
TIIS-1213

The Unit shall be designed to permit future geospatial control of Automatic Power Control (APC) at neutral sections using GPS or Eurobalise.
TIIS-1570

2.4.1.6 Regenerative Braking on 25kV AC

Regenerative braking is permitted throughout the Thameslink 25kV AC electrified routes.

The regenerative braking system on the Unit shall be fully blended with the friction/alternative braking systems.
TIIS-1571

The regenerative braking system on the Unit shall be designed such that the regenerative braking on 25kV AC can be isolated by the driver independently from regenerative braking on 750V DC.
TIIS-1572

On the Unit the regenerative braking control system shall automatically switch to friction/alternative braking if the system is not receptive (or using power to assist auxiliaries).
TIIS-1573

When regenerating the Unit shall comply with the parameters defined in Network Rail Company Standard NR/GN/ELP/27010.
TIIS-1719

When regenerating the maximum current returned to the AC network by the Unit shall not exceed the permitted limit for traction current on that section of route.
TIIS-1940

2.4.2 750V DC 3rd Rail

2.4.2.1 Maximum and Minimum Electrification System Voltages

The Unit shall be capable of operating on traction power supplies within the range of voltages described in Network Rail Company Standard NR/GN/ELP/27010.
TIIS-1106

2.4.2.2 Line Current Limits

During the service introduction phase or during the subsequent life of the Unit it is anticipated that further power supply enhancements will be delivered to upgrade the capability of the 750V DC network.
The enhancements will be delivered progressively with a high current zone covering the Core Area, through an intermediate current zone to a base level current zone at the outer ends of each route, or certain routes, such that there are in the order of 3 changes of current limit during a single journey. The location of the current limit changes will be provided by NR on completion of each enhancement stage.

The Unit shall be equipped with a geospatial control system that automatically selects the appropriate line current limit on the DC network.
TIIS-1575

The Unit geospatial control system to select the appropriate line current limit shall be capable of being reprogrammed to update the permitted current limit for sections of route / current limit boundaries by authorised TMM or Operator staff.
TIIS-1971

The base level (default) line current limits applicable to the Unit shall be:
3000A - for the RLU
4000A - for the FLU.
TIIS-1574

The intermediate level line current limits applicable to the Unit shall be:
3750A - for the RLU
5000A - for the FLU.
TIIS-1576

The high current level line current limits applicable to the Unit shall be:
4500A - for the RLU
6800A - for the FLU.
TIIS-1110

If the line voltage falls below 600V, the Unit shall automatically adjust the maximum line current, including the train auxiliary current, so that the line current is reduced in proportion to the reduction in voltage below 600V such that at 400V the line current is reduced to 25% of the value at 600V. Below 400V the line current shall be zero.
TIIS-1116

2.4.2.3 Regenerative Braking on 750V DC

Where permitted on the DC network, regenerative braking on the Unit shall be enabled using a geospatial control system.
TIIS-1701

The regenerative braking system on the Unit shall be fully blended with the friction/alternative braking systems.
TIIS-1702

The regenerative braking system on the Unit shall be designed such that the regenerative braking on 750V DC can be isolated by the driver independently from regenerative braking on 25kV AC.
TIIS-1703

On the Unit the regenerative braking control system shall automatically switch to friction/alternative braking if the system is not receptive (or using power to assist auxiliaries).
TIIS-1704

When regenerating the Unit shall comply with the parameters defined in Network Rail Company Standard NR/GN/ELP/27010 subject to the amendments set out in TIIS-1969 and TIIS-1970:
TIIS-1118

Regeneration should cease within 100ms if the impedance of the conductor rail as seen from the shoegear is less than the value defined by the load line corresponding to 0.1Ω in Appendix D of NR/GN/ELP/27010.
TIIS-1969

Regenerative braking shall not be attempted if the line voltage is less than 550V. If regenerating already, the equipment shall cease to regenerate if the voltage falls below 500V.
TIIS-1970

When regenerating the maximum current returned to the DC network shall not exceed the permitted limit for traction current on that section of route.
TIIS-1708

2.4.2.4 Current Collector Performance

The 3rd rail shoegear shall be isolated but not earthed when the Unit is operating on 25kV AC.
TIIS-1709

The Unit shall be designed with shoegear distributed along the length of the Unit to minimise the impact of 3rd rail gaps and the risk of the Unit or individual traction packs from being 'gapped'.
TIIS-1710

The TMM shall identify the shoegear locations on the vehicle diagrams for the Unit (as part of the gauging portfolio submitted in compliance with Railway Group Standard GM/RT2149).
TIIS-1766

The shoegear on the Unit shall be designed to comply with the requirements set out in Network Rail Company Standard NR/GN/ELP/27010.
TIIS-1718

In connection with shoegear and traction system performance, it is not guaranteed that the conductor rail is maintained free from accumulated snow or ice.

The shoegear shall be designed to make good current collection when the height of the conductor rail above the running rail is 76mm +40/-20mm under all dynamic conditions.
TIIS-1717

2.4.3 AC/DC Changeover

The routes north of the Core Area are electrified at 25kV AC using OLE while the routes south of the Core Area are electrified at 750V DC using the 3rd rail system.

As part of the Thameslink infrastructure works the OLE is being extended from Farringdon to the south end of City Thameslink station such that the dual electrified (25kV AC OLE and 750V DC 3rd rail) section will extend from the south end of the platforms at City Thameslink to the north end of the platforms at Farringdon.

2.4.3.1 Proposed Arrangements

All service trains are expected to stop at both City Thameslink and Farringdon stations in both directions. Hence the proposed arrangements are that during normal operation southbound trains will change over from AC to DC during the stop at Farringdon, while northbound trains will change over from DC to AC during the stop at City Thameslink.

If a southbound train is unable to take traction on DC but can continue on AC the train will work forward to City Thameslink where passengers will be de-trained. The train will then reverse and return north as empty stock on AC (or pick up a timetable working from Farringdon).

If a northbound train is unable to take traction on AC but can continue on DC passengers will be detrained at City Thameslink. The train will then be worked forward to Smithfield Sidings (subject to an 8-car limit) or to Farringdon to reverse via the crossover and return south as empty stock on DC (or pick up a timetable working from City Thameslink).

2.4.3.2 Changeover on the Move

The Unit shall be capable of performing an AC to DC or DC to AC changeover without stopping.
TIIS-1216

The Unit shall be capable of performing an AC to DC or DC to AC changeover within 30 seconds.
TIIS-1869

2.4.3.3 Automatic Changeover

While the TTS requirement for the power changeover to be initiated automatically at the appropriate location applies equally to changeovers while stationary and while moving, the following TIIS requirements are applicable only to normal service operation through the Thameslink Core.

The Unit shall be equipped with a system to automatically initiate the AC to DC, or DC to AC, changeover in the Thameslink Core as soon as it has come to a stand at the defined stopping point (for the FLU or the RLU) at the appropriate station with no intervention required by the driver.
TIIS-1720

The Unit shall be capable of performing an AC to DC, or DC to AC, changeover without impacting on the Core Area station dwell time.
TIIS-1721

The Unit shall be capable of receiving and recognising Packet 44 power changeover messages transmitted in telegrams from track mounted Eurobalise.
TIIS-1783

The Unit Specific Transmission Module (STM) shall send a command to the automatic AC/DC power changeover system to initiate a power changeover on receipt of a Packet 44 power changeover message from track mounted Eurobalise.
TIIS-1784

The Unit automatic changeover system shall identify that the Unit has entered the AC/DC changeover zone (i.e. north end of Farringdon to south end of City Thameslink).
TIIS-1482

The Unit automatic changeover system shall confirm that the Unit has stopped and is correctly positioned in the appropriate platform (i.e. Farringdon southbound, City Thameslink northbound).
TIIS-1483

The Unit automatic changeover system shall initiate and control the power changeover sequence (i.e. open the main circuit breaker(s)/contactor(s), deselect the pantograph/shoegear, reconfigure the traction equipment for DC or AC as appropriate, select shoegear or deploy the pantograph as appropriate, confirm the traction equipment is configured correctly for the appropriate system and that line volts are present, and close the main contactor(s)/circuit breaker(s) as appropriate).
TIIS-1484

The Unit automatic changeover system shall confirm the traction system has correctly configured and ready to take power.
TIIS-1485

The Unit automatic changeover system shall provide an indication to the driver and an input to the ATO, to confirm the traction system is correctly configured and healthy.
TIIS-1486

The Unit automatic changeover system shall provide a warning to the driver and an input to the ATO, should the changeover have failed.
TIIS-1752

The failure warning is to instruct the driver to manually select either AC or DC and continue to the next station where the train can be reversed - i.e. to proceed as if a manual changeover had been unsuccessful.

It shall be possible for the Unit driver to inhibit the automatic AC to DC, or DC to AC, changeover should operational circumstances require the changeover not to take place, e.g. if a northbound train was proceeding empty to Smithfield Sidings.
TIIS-1722

The Unit power changeover system shall not adversely affect any other system on the Unit, nor cause any system data loss, nor require system reconfiguration or re-boot, at any time.
TIIS-1221

2.4.3.4 Changeover while Stationary

It shall be possible for the Unit driver to manually initiate an AC to DC, or DC to AC, changeover while the Unit is stationary, e.g. if it is diverted away from the Core Area route for empty stock movements.
TIIS-1834

2.5 Train Control Systems

During the train service life it is planned to incrementally change the train control systems on many of the routes. In anticipation of this, the Unit will be required to interface with all these systems (lineside signalling with AWS, TPWS and ETCS L2 as defined within the TTS and TIIS) at different times and will be able to dynamically switch between systems during a journey without service interruption.

The Unit shall operate on multi-fitted journeys on Network Rail infrastructure where different train protection and warning systems are in operation.
TIIS-323

The Unit shall be able to switch between different train protection and warning systems during a journey without service interruption.
TIIS-1437

2.5.1 Signalling

The Unit shall run on existing conventionally signalled routes as well as renewed and enhanced areas equipped with modern conventional signalling systems.
TIIS-1622

Conventionally signalled routes should be taken to be those with lineside signalling, ranging from semaphore signals with mechanical interlocking through to LED multiple aspect signalling with computer based interlocking, and with AWS, TPWS or ETCS L2 train protection as defined within the TTS and TIIS).

The Unit shall use ETCS Baseline 2 (V2.3.0d) or Baseline 3 from the first operational use even if the infrastructure initially only demands Level STM, STM National (SN) Mode operations.
TIIS-1744

The driver will utilise the ETCS Driver Machine Interface from the first day of operation.

Over the lifetime of the Units, it is anticipated that a large proportion of the infrastructure may be subject to upgrade to systems compatible with European Train Control System (ETCS) Baseline 2 (V2.3.0d), Baseline 3, or later variants. In the wide area of operation, it is anticipated that various mixes of system level and integration with lineside equipment are possible.

The on-board ETCS system shall be capable of working in ETCS Level STM, Level 1 and Level 2 modes.
TIIS-1780

In areas where existing national train protection systems are fitted (TPWS and AWS) and the ETCS system is operating in Level 1 or 2, the system shall suppress the AWS and TPWS indications so as not to confuse the driver.
TIIS-1781

2.5.2 Driver-Signaller Communication

The Unit shall be fitted with operational GSM-R Cab Radio equipment for voice communication from the outset in addition to the two GSM-R data radios required for ETCS communication.
TIIS-1626

The primary means of voice communication between drivers of the Unit and signallers shall be using the GSM-R cab radio.
TIIS-1746

The Unit driver's access door shall be positioned to align with standard signal post telephone walkways not less than 8m long.
TIIS-1747

2.5.3 Signalling Principles

2.5.3.1 Acceleration

The performance of the Unit will be greater than current vehicles using Thameslink routes. Therefore it may be possible for Unit to over-accelerate compared to the design assumptions used in designing the existing signalling system. Typically this affects train protection calculations used in laying out the TPWS and can also affect strike-in at automatic level crossings. Acceleration curves for the Unit will need to be compared to those used as design assumptions in existing signalling design and may lead to special operating restrictions in some cases.

2.5.3.2 Braking

The Core Area high-capacity signalling spacing has been designed using the methodology detailed in Railway Group Standard GK/RT0034 Appendix E, using measured braking data recorded in MPD/TL2/TR/90 (Technical Report 90).

The Unit braking performance shall be designed, for speeds up to 40mph, to comply with the stopping distance requirements highlighted in Table 1 below - Curve TL KO2 Stock'
TIIS-1786

Table 1 stopping distance requirements

Initial Speed		**mph**	**20**	**25**	**30**	**35**	**40**
Stopping Distance	GM/RT2044 Curve Y	m	246	246	246	246	246
Stopping Distance	GM/RT2044 Curve A3	m	205	205	205	205	205
Stopping Distance	**Curve TL KO2 Stock**	**m**	**57**	**80**	**110**	**148**	**190**
Stopping Distance	GM/RT2044 Curve B3	m	38	55	76	99	126

TIIS-1838

The Unit braking performance shall be designed for speeds above 40mph to comply with the stopping distance requirements stated in Railway Group Standard GM/RT2044, Curve A3.
TIIS-1748

2.5.4 Train Detection Systems

Train detection will be implemented by a variety of track circuits as detailed in the section below.

2.5.4.1 Track Circuits

The TMM shall take note of guidance GK/GN0628 Guidance on Infrastructure Based Train Detection Interface Requirements and the Unit shall operate track circuits without requiring the use of track circuit actuators.
TIIS-1638

The Unit shall operate on infrastructure equipped with train detection systems in accordance with the Network Rail Standard RT/E/S/11752 Train Detection including:

- RT/E/PS/11755 DC Track Circuits
- RT/E/PS/11756 HVI Track Circuits
- RT/E/PS/11757 AC Phase-Sensitive Track Circuits
- RT/E/PS/11764 Track Circuit Interrupters
- Ti21 Track Circuits (refer to section 2.7 Electro Magnetic Compatibility)
- REED Track Circuits (refer to section 2.7 Electro Magnetic Compatibility)
- RT/E/PS/11762 Track Circuits Assister Interference Detectors

TIIS-1640

2.5.4.2 Train Location Determined Onboard the Unit

Over the lifetime of the Unit, it is anticipated that Advanced Positioning (AP) (possibly via GNSS, inertial measurement and track mapping) may be rolled out across the Thameslink routes.

The TMM shall work with Network Rail to provide such an Advanced Positioning system during the lifetime of the Unit.
TIIS-1787

Provision of space for future installation of an Advanced Positioning system shall be made at the outset.
TIIS-1922

2.5.5 Automatic Warning System (AWS)

Network Rail infrastructure is equipped with AWS complying with the system requirements of the Railway Group Standard GE/RT8035 Automatic Warning System (AWS).

The Unit shall be capable of operating over routes equipped with both standard strength AWS track equipment and extra strength AWS track equipment.
TIIS-326

AWS functionality shall be implemented as a Specific Transmission Module (STM) of the ETCS.
TIIS-1653

The Unit shall use the ETCS Driver Machine Interface (DMI) for the interface with the driver.
TIIS-1942

2.5.6 Train Protection and Warning System (TPWS)

Network Rail infrastructure is equipped with TPWS complying with the system requirements of Railway Group Standard GE/RT8030 Train Protection and Warning System (TPWS).

TPWS functionality shall be implemented by a Specific Transmission Module (STM) of the ETCS.
TIIS-1655

The Unit shall use the ETCS Driver Machine Interface (DMI) for the TPWS interface with the driver.
TIIS-1656

2.5.7 Automatic Train Operation (ATO)

The Unit shall be fitted with an ATO system that is integrated with ETCS as specified in the Thameslink Train Control System Requirements (Annex J to this TIIS).
TIIS-1194

While the target is to deliver fully operational Units, ATO functionality integrated with ETCS has not previously been delivered in the heavy rail market. Therefore in order to de-risk programme delivery of the new Units, the on-board train control system architecture is to allow for the Units to be operated in service in manual mode without the ATO system functional.

The ATO system architectural concept shall support delivery of the Units initially without the ATO system functional, allowing this functionality to be enabled at a later date.
TIIS-1924

2.5.7.1 Stopping Accuracy

The ATO system shall stop the Unit in station platforms and at stopping points in the Core Area with an accuracy of +/- 0.5 metres.
TIIS-1894

2.5.7.2 Emergency Cut Out

The Unit driver shall have a manual emergency cut-out facility in the driver's cab that when operated disconnects the ATO system by removing any traction demand.
TIIS-1662

When the Unit's emergency cut-out facility is operated, it shall apply the full service brake until the Unit has come to a stand.
TIIS-1912

2.5.7.3 Engaging and Releasing ATO

The Unit ATO system shall only be available when the OBU is in ETCS FS mode.
TIIS-1972

The Unit ATO system availability shall be indicated to the driver whenever ATO self-test and communication systems testing indicates that the ATO system is functional and ready to engage.
TIIS-1664

The Unit ATO engagement shall be possible when the train is stationary or moving and the driver selects this option.
TIIS-1665

When the driver of the Unit selects ATO engagement, there shall be immediate (within 100msecs) feedback of this action in the form of an indication to confirm the driver's action.
TIIS-1926

The Unit ATO system engagement shall occur within 3 seconds of the driver's selection, so as not to introduce unnecessary delay to the train.
TIIS-1927

The ATO engagement sequence shall occur without being perceptible to the passengers.
TIIS-1973

The Unit ATO release shall be possible when the Unit is stationary or moving.
TIIS-1666

The Unit ATO shall provide an indication to the driver accompanied by an audible alert that ATO is to be released.
TIIS-1974

The ATO shall automatically disengage if an internal fault occurs or if the ETCS leaves FS mode.
TIIS-1975

The Unit ATO shall be capable of being re-engaged following an emergency cut-out provided that the Unit has come to a stand and the system is available and operational.
TIIS-1667

2.5.7.4 Data Communication Systems for ATO

The ATO system shall be designed to respond to changes in stop pattern and regulation instructions received using the Packet 44 National Packet mechanism of ETCS.
TIIS-1669

The TMM shall work with Network Rail to submit proposals in accordance with the requirements of Railway Group Standard GE/RT/8064 "ETCS - The Management of Packet 44", to register an ATO message protocol within ETCS that will become the national standard for mainline ATO systems in Great Britain.
TIIS-1896

Network Rail will separately procure Traffic Management, Interlocking (I/L) and Radio Block Centre (RBC) Systems for the Thameslink Network that will deliver and respond to ETCS messages including those developed under the MSA for Thameslink Units.

Passive ETCS Balises may be used for communicating fixed information via the Packet 44 mechanism, while the ETCS Radio Block Centre communication stream shall be used to send variable (and possibly also fixed) ATO information such as change of driving style instructions from the trackside to the Unit also using the Packet 44 construct.
TIIS-1670

The ATO shall not require any additional infrastructure registration beacons - other than passive (fixed) ETCS balises - in order to achieve the specified stopping accuracy.
TIIS-1671

The TMM shall identify the infrastructure assumptions upon which ATO operation is predicated - for example, if the stopping accuracy requires a number of additional ETCS balises to be fitted at specific intervals in the approach to station areas.
TIIS-1672

2.5.7.5 Performance and Response Times

The ATO system shall be capable of driving the Unit to just within the First Line of Intervention Curve calculated within the ETCS, when demanded by the regulation instructions received (see TIIS_1669 & TIIS_1896).
TIIS-1675

The Unit on-board ATO system shall be capable of utilising the maximum available Unit acceleration and safe speed available under the ETCS Movement Authority during recovery from perturbation.
TIIS-1676

2.5.7.6 Station Stops

The Unit on-board ATO system shall match its Unit length to the correct stopping position for that length of train at each station. For example, it is currently envisaged that the FLUs and the RLUs will be stopped at different positions in Thameslink Core Area stations so that they are positioned symmetrically around the centre of the platform.
TIIS-1679

2.5.7.7 Train Control Systems Self-test and Upgrades

The Unit shall include sufficient trainborne self-test facilities to demonstrate successful system operation.
TIIS-1681

The Unit self-test system shall include extended tests required following system upgrades, possibly involving the application of specialist portable test harnesses - i.e. it would be desirable to carry out specified types of system upgrades at remote stabling sidings rather than always requiring depot facilities.
TIIS-1682

Routine system start-up tests shall take no longer than 1 minute to complete from cab power-up, from the Unit's normal standby state with battery supplies switched on.
TIIS-1683

Start-up tests following system upgrade may take longer, and the TMM shall indicate likely scenarios and time required.
TIIS-1684

2.5.8 European Train Control System (ETCS)

The Unit shall be delivered with operational ETCS on-board systems compatible with ETCS V2.3.0d infrastructure, including a national Specific Transmission Module (STM) for delivery of AWS and TPWS compatibility.
TIIS-1469

The Unit operational ETCS on-board systems shall be upgraded to comply with ETCS Baseline 3 specification when released.
TIIS-1976

The driver shall use the ETCS DMI for control of the Unit from the outset, even though the initial operation will be over infrastructure that is equipped only with conventional AWS and TPWS train protection systems, and therefore the ETCS will run in national mode.
TIIS-1685

2.5.8.1 Staged Commissioning

The ETCS on-board European Vital Computer (EVC) system shall be capable of capturing and storing ETCS system data in the background while interfacing to the driver in national train protection mode. This will facilitate staged ETCS system implementation for example by monitoring test transmissions from the RBC and recording messages from balises for analysis by system test engineers prior to ETCS infrastructure stage commissioning.
TIIS-1687

2.5.8.2 Advisory Speed

The ETCS shall provide regulation information to indicate the status of the route ahead to be used either by the ATO system or by a driver advisory speed system.
TIIS-1689

2.5.9 European Rail Traffic Management System (ERTMS)

Much of the UK infrastructure will be fitted with ERTMS Level 2 compliant to the Control Command and Signalling TSI. The Level 2 ETCS proposed in the Thameslink Performance Core will be implemented in addition to full lineside signalling. A high-density four aspect conventional signalling system with a Proceed on Sight Aspect (PoSA) at each signal position for fallback will be implemented through the Core Area.

2.5.9.1 Operation with Dual Fitted Infrastructure

The conventional signalling system will remain as a mechanism to aid migration of rolling stock, and service provision with a mixture of fitted and unfitted vehicles. Drivers of ETCS fitted vehicles will be trained to use their DMI cab display as the primary signalling system, while observing the lineside signals (which will still be illuminated) as secondary information. Small deviations in timing between the lineside signalling and the cab display will be observed by the drivers, who will be trained to recognise this feature.

2.5.9.2 ATP Aspect

The infrastructure implementation of ETCS includes the provision of additional “sub-blocks” of train detection within the conventional signalling system. These sub-blocks will be used to provide incremental movement authorities through ETCS allowing a following train in the Performance Core to approach more closely the train currently in the platform, thus minimising platform re-occupation times. In these circumstances it is proposed a Single Yellow Aspect will be displayed on the protecting signal which would otherwise display a Red Aspect. This overriding signal aspect will only be displayed when the RBC has confirmation that the ETCS on-board systems of the approaching train are 'communicating' and operating in FS mode.

2.5.9.3 ERTMS Specifications

The Unit shall comply with the Thameslink Train Control System Requirements (Annex J to this TIIS).
TIIS-343

The TMM shall cooperate with Network Rail and the Operator in developing the ETCS, ATO and DAS detailed design, reflecting agreement of the detailed functional split between the onboard and infrastructure subsystems and allowing finalisation of an ETCS/ATO operational concept.
TIIS-1981

2.5.9.4 Train Complete

The Unit shall include provision for a ‘Train Complete’ detection system allowing the on-board system to be certain that no part of the train has become separated from the rest.
TIIS-1697

The provision for a 'Train Complete' detection system shall be a vital input to the EVC.
TIIS-1913

During the lifetime of the Unit it is anticipated that Advanced Positioning (AP) systems may be implemented in Great Britain, and are likely to use the planned ETCS Level 3 functionality (see section 2.5.4.2 above). While this functionality does not exist currently, the provision of a Train Complete detection circuit or system from the outset will facilitate the gradual upgrade of the on-board systems to integrate with an Advanced Positioning system over the life of the Unit.

2.5.10 GSM-R Radio

The GSM-R radio system will be introduced on to Thameslink routes.

The Unit shall be provided with a GSM-R radio system compliant to the requirements stated in the applicable Railway Group Standards and Guidance Notes.
TIIS-1493

From the outset of operation of the Units the GSM-R voice systems shall be the primary means of communication between driver and signaller.

2.5.11 Automatic Selective Door Operation (ASDO)

The Unit shall be fitted with an Automatic Selective Door Operation (ASDO) system to enable the Unit to call at stations with platforms shorter than the length of the Unit.
TIIS-358

The Unit selective door operation system shall be designed to make maximum use of the available platform length at certain stations by inhibiting door release on the rearmost set of doors only. At other stations the selective door operation system shall select or inhibit the doors on each Vehicle.
TIIS-1943

The Unit selective door operation system shall take account of Railway Group Guidance Note GE/GN8577 'Guidance on the Application of Selective Door Operation Systems'.
TIIS-1498

The Unit ASDO system architecture shall be similar to that described for ASDO using RFID Tags.
TIIS-1733

The Unit ASDO system shall operate usually from GNSS-derived positioning information.
TIIS-1899

The Unit ASDO system shall operate using Eurobalise, not RFID Tags for the positioning infill where satellites are not visible (e.g. in tunnels) or where discrimination between adjacent running lines is not possible using GNSS and route maps.
TIIS-1900

The Unit ASDO system shall operate as FASDO when used in association with ATO.
TIIS-1788

2.6 Infrastructure Monitoring

2.6.1 Forward Facing and Rear Facing (FFRF) CCTV

All Units shall be fitted with a Forward Facing & Rear Facing (FFRF) Closed Circuit Television (CCTV) system for the purposes of infrastructure monitoring and incident management.
TIIS-497

The Unit FFRF CCTV system shall consist of two cameras, one installed in each driving cab (front and rear).
TIIS-1847

The Unit FFRF CCTV system shall consist of one Digital Video Recorder (DVR) that is fitted with a removable data storage device, installed in each driving vehicle (front and rear).
TIIS-1901

The Unit FFRF CCTV cameras shall be capable of recording images of track, signals, overhead catenary, and the lineside as seen by the driver (but positioned so as not to obstruct the driver's view).
TIIS-1848

The Unit FFRF CCTV cameras shall be capable of recording images that are continuous and in focus within the swept area of the windscreen wiper.
TIIS-1849

The Unit FFRF CCTV cameras shall be positioned so that the driver cannot block the camera’s field of vision.
TIIS-1823

The Unit FFRF CCTV camera's field of vision (pan and tilt) shall only be adjustable by the use of special tools.
TIIS-1850

Each Unit FFRF CCTV camera shall be capable of capturing colour images of a quality that are at least 1600 x 1200 pixels at the maximum operating speed of the Unit (100 mph) at a recording rate of at least 12 frames per second (fps).
TIIS-1505

The Unit FFRF CCTV cameras shall be capable of capturing images to a minimum lighting level of 1 lux.
TIIS-1506

The Unit FFRF CCTV cameras shall be capable of capturing images that are, as far as reasonably practicable, continuously in focus when there is a sudden change in lighting levels, i.e. when entering and exiting a tunnel.
TIIS-1828

The images recorded by the Unit FFRF CCTV camera system shall clearly display Unit position, date and time references taken from the train positioning system (GPS and balise).
TIIS-1530

The images recorded by the Unit FFRF CCTV system shall synchronise to the GPS clock so that it automatically adjusts to daylight saving hours i.e. Greenwich Mean Time (GMT) and British Summer Time (BST).
TIIS-1851

The recorded data from each the Unit FFRF CCTV removable data storage device within the DVR shall have a minimum recording capacity of 72 hours before any data is overwritten.
TIIS-1824

The Unit FFRF CCTV removable DVR data storage device shall be located within a secure housing, controlled by a unique “safelock” type key with a common security code that is unique to the Fleet.
TIIS-1825

The Unit FFRF CCTV removable DVR data storage device security keys shall only be issued to authorised Operator and Network Rail staff.
TIIS-1853

It shall be possible to download and replay the FFRF CCTV recorded files from the Unit using a laptop PC using software provided by the TMM to authorised staff as a 'Special Tool'.
TIIS-1822

The FFRF CCTV system shall be configured so that recording takes place automatically from both the forward facing camera and rear facing camera whenever a cab is 'in service'.
TIIS-1826

The FFRF CCTV system and its outputs shall comply with the CCTV Operational Requirements Manual Publication 55/06 produced by the Home Office Scientific Development Branch.
TIIS-1531

The output produced by the Unit FFRF CCTV system shall be capable of being admissible in any UK court of law.
TIIS-1932

The Unit FFRF CCTV system shall be provided with a means to automatically flag features for further investigation of recorded images immediately preceding and immediately after an incident, e.g. when an emergency brake application has been made, without affecting the integrity of the data.
TIIS-506

The Unit FFRF CCTV system shall be provided with a means to automatically report to the Service Delivery Centre when a driver records an incident on the TMS HMI.
TIIS-1949

2.6.2 Off Train Equipment

Off Train Equipment shall be provided to review information electronically recorded by the Unit's FFRF CCTV system.
TIIS-512

It shall be possible to replay the downloaded FFRF CCTV recorded files from the Unit without the need for re-indexing or verification checks.
TIIS-1950

The Off Train Equipment shall comprise of an off train playback station to be used to review information electronically recorded by the Unit's FFRF CCTV system.
TIIS-1888

The Off Train Equipment shall be capable of converting data electronically recorded by the Unit's FFRF CCTV system to other storage media (DVD, CD, USB and other PC's).
TIIS-1890

This Off Train Equipment playback station shall be provided with software to allow the investigator to able to search the data electronically recorded by the Unit's FFRF CCTV system.
TIIS-1887

The Off Train Equipment playback station software shall be capable of searching and ordering information by time, date and Unit location.
TIIS-1889

The FFRF CCTV removable data storage device shall also be connectable to a standard PC desktop or laptop via conventional ports for the purposes of reviewing, system maintenance, programming and system configuration.
TIIS-513

Once processed by the video analysis software special tool the images recorded on the DVR data storage device shall be stored in a software format that is compatible with standard media players (e.g. Microsoft Windows Media Player).
TIIS-514

Data recorded on the DVR data storage devices by the Unit's FFRF CCTV system shall be password protected so as to prevent unauthorised access.
TIIS-1891

2.6.3 Automatic Vehicle Identification (AVI)

The Automatic Vehicle Identification (AVI) system which utilises an AVI tag fitted to a Vehicle will enable Network Rail and the Operator to identify a Vehicle or Unit precisely following the activation of any vehicle monitoring device that is fitted to the infrastructure. The AVI system tags will be based on RFID technology and will be passive.

The Unit shall have provision for the fitting of AVI tags that consist of two tags per Unit fitted on the opposite sides of each driving Vehicle.
TIIS-545

The Unit shall have provision for the fitting of AVI tags that will have a maximum dimension of 300mm long x 100mm wide x 50mm deep.
TIIS-1516

The Unit shall have provision for the fitting of AVI tags that are located so they are not shielded or obstructed by any bodyside fittings, vinyl livery film or bodyside sacrificial coatings.
TIIS-1519

The Unit shall have provision for the fitting of AVI tags that will weigh a maximum 100g per AVI tag.
TIIS-1522

2.7 Electro Magnetic Compatibility (EMC)

Network Rail infrastructure does not comply with the TSIs for Command, Control and Signalling of the High Speed Rail and Conventional Rail Systems.

Specific requirements for the Unit are as follows:

A declaration of conformity with EMC Directives for the Unit shall be accepted as part of the Process for Assessment of Compatibility of Rolling Stock and Infrastructure.
TIIS-553

The EMC compatibility case for the Unit shall consider all coupling from DC to 2.5 GHz as required by Railway Group Standard GE/RT8015, British Standard BS EN50121:2006 and British Standard BS EN50388:2005.
TIIS-554

Compatibility of the Unit under normal conditions shall be evaluated as a pass / fail criteria against the limits from appropriate EN standards and Network Rail EMC specifications.
TIIS-555

Electromagnetic emissions from the Unit, in normal or degraded modes of operations, shall be demonstrated to be compatible with the systems described in the Network Rail EMC specifications listed in TIIS_561.
TIIS-556

If EMC between the Unit and the signalling systems is achieved by the deployment of purpose built Interference Current Monitoring Units (ICMU), then the safety integrity of these units shall be sufficient to ensure compatibility with the corresponding signalling system(s) it is protecting. The safety argument shall be recorded as part of the established Safety Management System (SMS).
TIIS-559

The Unit shall comply with the requirements stated in the following standards:
NR/SP/SIG/50002 Methodology for the demonstration of compatibility with single rail Reed Track Circuits on the AC railway
NR/GN/SIG/50003 Methodology for the demonstration of compatibility with Reed Track Circuits on the DC railway
NR/SP/SIG/50004 Methodology for the demonstration of electrical compatibility with DC (AC-immune) Track Circuits
NR/SP/SIG/50005 Methodology for the demonstration of compatibility with 50 Hz Single Rail Track Circuits
NR/SP/SIG/50006 Methodology for the demonstration of compatibility with 50 Hz Double Rail Track Circuits
NR/SP/SIG/50007 Methodology for the demonstration of compatibility with HVI Track Circuits
NR/SP/SIG/50008 Methodology for the demonstration of compatibility with TI21 Track Circuits
NR/SP/SIG/50009 Methodology for the demonstration of compatibility with FS2600 Track Circuits
NR/SP/SIG/50011 Methodology for the demonstration of compatibility with Axle Counters
NR/SP/SIG/50012 Methodology for the demonstration of compatibility with TPWS trackside equipment
NR/SP/SIG /50013 Methodology for the demonstration of compatibility with Interlockings
NR/GN/SIG/50014 Methodology for the demonstration of compatibility with Lineside Equipment on AC and DC Railways
NR/SP/SIG/50015 Methodology for the demonstration of compatibility with Reed FDM Systems
NR/SP/TEL/50016 Methodology for the demonstration of compatibility with Telecoms Systems
NR/SP/SIG/50018 Methodology for the determination of interaction with Neighbouring Railways
TIIS-561

2.7.1 Harmonics

Harmonics are present in the 25kV supply due to traction rectifiers and thyristors on trains.

The Unit shall not exceed the maximum levels defined in Network Rail Company Standard NR/GN/ELP/27233.
TIIS-1527

The wave-form of the line voltage may be severely distorted, such that there are more than two zero crossings per cycle. This distortion may also result in the crest value of the voltage rising to 110% of the crest value of the undistorted no-load voltage.

3 Operational Interfaces

3.1 Train Dispatch

The Unit shall be compatible with the following current train dispatch arrangements provided on Network Rail infrastructure, as well as the new arrangements utilising ATO:
- DOO, CCTV from train mounted cameras,
- DOO, CD/RA,
- DOO, Platform Dispatch,
- DGO, dispatch by conductor/guard,
- DGO, dispatch with station dispatch staff.

TIIS-624

The Unit shall be provided with a manual ‘Close Doors’ (CD) control in the driver's cab to initiate door closure.
TIIS-627

The Unit shall be provided with a ‘Doors Closed’ detection indication in each driver's cab.
TIIS-1769

The Unit shall be provided with a system to detect if any Unit doors fail to close.
TIIS-1770

The Unit doors shall be capable of being manually locked shut and isolated if they fail to close.
TIIS-1771

3.2 Driver Monitoring of Doors for DOO

The requirements for driver monitoring of passenger doors, including the requirement for the Units to be equipped with in-cab monitors, are specified in the Train Technical Specification (TTS).

The trainborne CCTV cameras fitted to the Unit shall provide colour images of sufficient quality to support DOO dispatch with clear definition and sharp contrast under the full range of weather conditions to be expected on Thameslink routes with both natural light, including bright sunshine on open platforms and deep shade under canopies, and artificial light or a combination of such conditions.
TIIS-1240

The trainborne CCTV cameras fitted to the Unit shall provide images of sufficient quality to support DOO dispatch under the full range of platform lighting conditions compliant with the requirements stated in Section 10.2 and 10.3 of the Railway Group Standard GI/RT7016.
TIIS-1241

The trainborne CCTV cameras fitted to the Unit shall provide images of sufficient quality to support DOO dispatch where the minimum horizontal illuminance is 10 lux over the useable platform edge area with a horizontal uniformity greater than or equal to 0.4, diversity greater than or equal to 0.1, and the minimum vertical plane illuminance is 2 lux measured 1.0m above the platform and 0.3m back from the platform edge with a diversity equal to 0.125.
TIIS-1726

The trainborne CCTV cameras fitted to the Unit shall provide images of sufficient quality to support DOO dispatch when the minimum illuminance is achieved either with metal halide luminaires, with high pressure sodium luminaires, with fluorescent lighting (at different colour temperatures) or a combination of each on the same platform.
TIIS-1727

In addition to the requirements above, the trainborne DOO CCTV system shall include functionality to compensate, as far as reasonably practicable, for variable lighting levels along the length of the Unit due to limitations or failure of the platform infrastructure.
TIIS-1954

3.3 Customer Information Systems

The planned 24 trains per hour (tph) through the Core Area requires a platform dwell time of 45 seconds and allowing for door opening/closing cycles, etc, the time available for passengers to leave and board the Unit is limited. During the peak period this increased service along with the forecast passenger figures implies that passenger flow and platform management will be a key factor in effective train service operation. To minimise passenger boarding times and hence station dwell time, Station Information & Surveillance Systems (SISS) have a vital role in both supplying passengers and empowering TOC staff with timely and accurate information. It is envisaged that the platform Customer Information System be a component part of a much wider system; covering all levels of operations; it will effectively disseminate the required information across the Thameslink Network and associated trains.

It is anticipated the data flows between the Unit and a central Service Delivery Centre will need to include, but not limited to, the status of individual Vehicle loading (i.e. which parts of the Unit are already full and which parts still have space), door system status (i.e. location of any isolated doors so that passengers can be directed to other doors), status of other 'amenities (location of First Class, defective toilets, etc). Similarly, data flows from the Service Delivery Centre to Units will need to include, but not be limited to, information on service disruption including anticipated delays, changes to destination or stopping pattern in response to service perturbation, status of connecting services including other operators (e.g. LUL and Crossrail), information on station disruption and zoned guidance on exit routes from the platform.

The data transmission between the Unit and the Service Delivery Centre shall be based on data packets transmitted by public GPRS link between the Units and ground base stations for 'essential' real-time information.
TIIS-663

The data transmission between the Unit and the Service Delivery Centre shall be based on a higher bandwidth public communication radio system (e.g. WiFi, GPRS) between the Units and ground base stations for non-essential data rich information/applications.
TIIS-1789

3.4 Persons with Reduced Mobility Requirements (PRM)

It is a key objective of the Thameslink programme to operate 24 trains per hour (tph) at peak periods throughout the 'Core Area'. Therefore to assist in facilitating this key requirement a method of assisting PRM passengers has been proposed to assist in achieving the 45 second dwell time objective that has been set for the Units at stations within the 'Core Area'. It is anticipated that at 'Core Area' stations only a raised platform installation may be constructed at a selected point on the station platform to enable compliance with the PRM TSI without the need for the use of portable Unit/platform bridging devices.
A PRM TSI compliant solution has been proposed that:
reduces the impact on the ability of the service to meet the required 45 second dwell time during peak periods of operation at 'Core Area' stations
does not operationally constrain the Unit in anyway, but requires accurate stopping
does not require platform staff intervention to enable the PRM solution to be utilised at 'Core Area' stations only
does not make the Unit incompatible with station platform infrastructure across the defined Thameslink routes outside of the 'Core Area' where a manually deployed method of assisting PRM maybe considered necessary
is limited to designated PRM Vehicles only.

As it is likely that the PRM solution or combination of PRM solutions will be the first of its kind to be applied in a heavy-rail suburban environment in the UK, the TMM shall work with Network Rail to enable acceptance of the defined PRM solution from the appropriate approvals bodies to be gained.
TIIS-1791

The TMM shall provide an interface at the door entrance at Unit floor height that will not damage, as far as reasonably practicable, platform mounted rubber edged platform gap fillers.
TIIS-1880

At platforms without a raised platform installation it will be necessary to deploy an access ramp for PRM. The Unit design shall minimise the time taken to attach/detach the access ramp.
TIIS-1933

3.5 Noise

The Network Rail Thameslink infrastructure programme has a number TWA Order commitments concerned with minimising noise nuisance to neighbours. A number of the noise reduction measures identified in mitigation impose requirements on the Units.

The Unit design shall include measures to reduce the initiation or sustained generation of flange squeal or wheel ringing due to flange contact on small radius curves. Such measures may include flange lubrication or suitable proven wheel damping solutions.
TIIS-1760

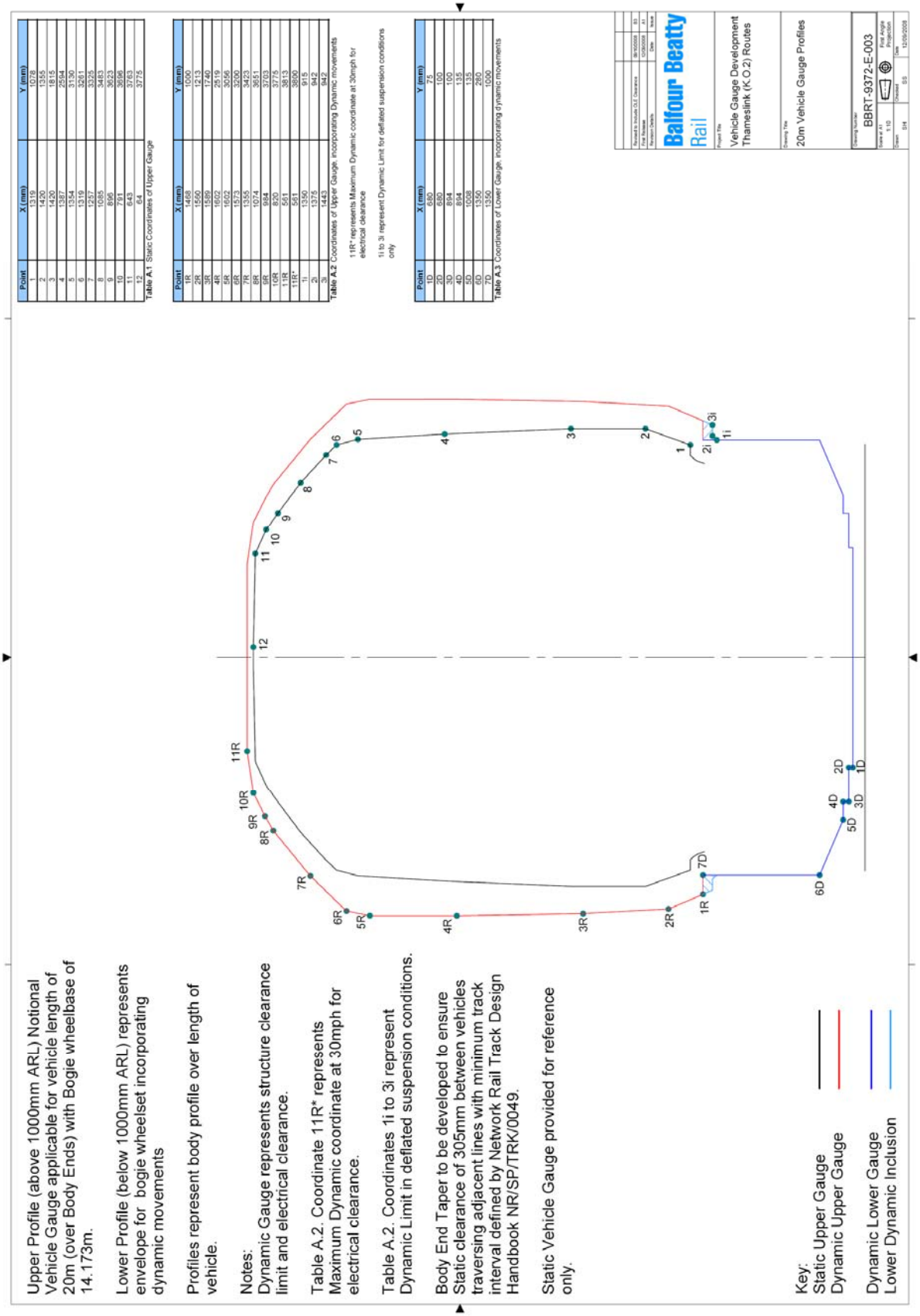
The Unit design shall include measures to ensure the running surface of the wheels are maintained in good condition as far as reasonable practicable. Such measures may include a method of conditioning the wheel tread.
TIIS-1761

3.6 Emergency Egress

There is a single bore tunnel section where side access is restricted and a Unit may have to be stopped for operational reasons. This section is referred to as the Snow Hill tunnel located in the 'Core Area'.

The Unit shall include the capability to detrain passengers located in any part of the Unit to track level through side doors where side access to the Unit may be restricted due to the proximity of tunnel sidewalls (down to 1.5m from the running rail) or other infrastructure features.
TIIS-1958

ANNEX A - GAUGE PROFILE



ANNEX B - LIST OF ROUTES

The description of the routes includes all running lines in signalled direction, including Fast/Main, Slow/Relief and loops, all crossovers and connections between them and all tracks serving all platform faces (including bay platforms). The routes exclude sidings, depots and crossovers/connections between the running lines and those sidings and depots.

List of Routes for Key Output 2 (KO2)

				Start		End				
	Route / Sub-Route		**Engineers Line Reference (ELR)**	**Miles**	**Yards**	**Miles**	**Yards**	**Approx Decimal Miles**	**Route Type (Simplified)**	**Notes**
Midland Main Line										
	Kings Cross Tunnel North Portal to Bedford									
		Kings Cross Tunnel North Portal to Carlton Road Jn	MCL	2	1232	4	132	1.4	Main route	
		Carlton Road Jn to Belsize Tunnel North Portal	SPC	2	286	3	748	1.3	Main route	
		Belsize Tunnel North Portal to Bedford	SPC	3	748	49	1430	46.4	Main route	
		Bedford Cauldwell Depot	SPC						Depot route	
	Kings Cross Tunnel North Portal to Cricklewood									
		Kings Cross Tunnel North Portal to Carlton Road Jn	MCL	2	1232	4	132	1.4	Depot route	
		Carlton Road Jn to Belsize Tunnel North Portal	SPC	2	286	3	748	1.3	Depot route	
		Belsize Tunnel North Portal to Cricklewood Depot	SPC	3	748	5	1386	2.4	Depot route	
		Carlton Road Jnc to Junction Road Junction	JRT1 JRT2	0 2	66 0	0 2	396 924	0.7	Depot route	Non-electrified route
		Junction Road Junction to Harringay Park Junction	TAH1	2	924	4	330	1.7	Depot route	Non-electrified route
		Harringay Park Junction to Harringay Junction	HPW	0	66	0	550	0.3	Depot route	Non-electrified route
		Harringay Junction to Ferme Park EMU Sidings	ECM1	3	638	3	1628	0.5	Depot route	
		Ferme Park North Junction to Down Slow 2	ECM1	3	1628	4	88	0.1	Depot route	
		Down Slow 2 to Harringay Reversing Siding	ECM1	4	88	3	440	0.8	Depot route	
		Harringay Reversing Siding to Hornsey Depot	ECM1	3	440	4	550	1.1	Depot route	

List of Routes for Key Output 2 (KO2)

Route / Sub-Route	Engineers Line Reference (ELR)	Start Miles	Start Yards	End Miles	End Yards	Approx Decimal Miles	Route Type (Simplified)	Notes
Bedford to Bedford St Johns (include Jowett Sidings)	BBM	16	1100	16	176	0.5	Depot route	Access to stabling sidings
East Coast Main Line								
Belle Isle Junction to Cambridge								
Belle Isle Junction to Hitchin	ECM1	0	1166	32	242	31.5	Main route	
Hitchin to Shepreth Branch Junction	SBR	32	242	55	572	23.2	Main route	
Shepreth Branch Junction to Cambridge	BGK	53	66	55	1144	2.6	Main route	
Cambridge to Kings Lynn								
Cambridge to Kings Lynn	BGK	55	1144	96	1650	41.3	Feasibility route	
Belle Isle Junction to Peterborough								
Belle Isle Junction to Hitchin	ECM1	0	1166	32	242	31.5	Main route	
Hitchin to Peterborough	ECM1	32	242	76	814	44.3	Main route	
Belle Isle Junction to Bounds Green								
Belle Isle Junction to Bounds Green	ECM1	0	1166	5	220	4.5	Depot route	
Wood Green North Junction to Bowes Park reversing siding	HDB	5	154	5	1716	0.9	Depot route	
Belle Isle Junction to Hornsey								
Belle Isle Junction to Hornsey	ECM1	0	1166	4	550	3.7	Depot route	
Belle Isle Junction to Hornsey Up Carriage Sidings								
Belle Isle Junction to Hornsey Up Carriage Sidings	ECM1	0	1166	4	880	3.8	Depot route	
(incl Coronation Sidings)								
Harringay Viaduct and reversing sidings	ECM1	3	440	4	88	0.8	Depot route	
Belle Isle Junction to Ferme Park Sidings								
Belle Isle Junction to Ferme Park Sidings	ECM1	0	1166	3	1254	3.1	Depot route	
Peterborough to Werrington Junction	ECM1	76	638	79	748	3.1	Depot route	Access for stabling in New England yard
Peterborough Nene Sidings	ECM1						Depot route	
Letchworth Stabling	SBR						Depot route	

List of Routes for Key Output 2 (KO2)

Route / Sub-Route	Engineers Line Reference (ELR)	Start Miles	Start Yards	End Miles	End Yards	Approx Decimal Miles	Route Type (Simplified)	Notes
Sidings								
Cambridge Depot	BGK						Depot route	
Welwyn Garden City Sidings	ECM1						Depot route	
Belle Isle Junction to St Pancras (Midland Road Junction)								
Belle Isle Junction to St Pancras (Canal Tunnels Junction)	tbd	???	???	???	???		Main route	New Canal Tunnels
Diversionary Routes								
St Pancras (MML Platforms) to Carlton Road Jnc	SPC	0	0	2	286	2.2	Diversion route	
Kings Cross - Belle Isle Jnc	ECM1	0	0	0	1166	0.8	Diversion route	Access required to both suburban and main line platforms
Alexandra Palace – Hertford North	HDB	4	1716	19	1056	14.6	Diversion route	
Hertford North – Langley Jn (Stevenage)	HDB	19	1056	28	330	8.6	Diversion route	ETCS/ATO Integration Facility
Core Area								
Kings Cross Tunnel North Portal to Blackfriars								
Kings Cross Tunnel North Portal to Farringdon	MCL	2	1232	0	1276	2.0	Main route	
Farringdon to City Thameslink South Portal	FTL	0	0	0	858	0.5	Main route	inc. Smithfield Sidings
City Thameslink South Portal to Blackfriars	HHH	0	462	0	770	0.2	Main route	
Brighton Line								
Blackfriars to Brighton (via Brighton Main line)								
Blackfriars to Metropolitan Junction (B)	HHH BMJ	0 0	770 1386	0 1	1386 308	0.4 0.4	Main route	
Metropolitan Junction (B) to Blue Anchor Junction	XTD	1	682	3	704	2.0	Main route	
Blue Anchor Junction to Windmill Bridge Junction	LBW	1	990	9	1518	8.3	Main route	
Windmill Bridge Junction to Purley (Slow Lines)	VTB2	9	1518	13	638	3.5	Main route	
Purley to Earlswood North Junction (Redhill Line)	RED1 RED2	13 16	638 1452	15 23	44 0	1.7 6.2	Main route	
Windmill Bridge Junction to Earlswood North Junction (Fasts/Quarry Line)	VTB2	9	1518	21	462	11.4	Main route	

List of Routes for Key Output 2 (KO2)

Route / Sub-Route	Engineers Line Reference (ELR)	Start Miles	Start Yards	End Miles	End Yards	Approx Decimal Miles	Route Type (Simplified)	Notes
Earlswood North Junction to Brighton	VTB3	21	330	50	1078	29.4	Main route	
Blackfriars to East/West Croydon								
Blackfriars to Metropolitan Junction (B)	HHH	0	770	0	1386	0.4	Main route	
	BMJ	0	1386	1	308	0.4		
Metropolitan Junction (B) to Blue Anchor Junction	XTD	1	682	3	704	2.0	Main route	
Blue Anchor Junction to Windmill Bridge Junction	LBW	1	990	9	1518	8.3	Main route	
Windmill Bridge Junction to East Croydon (Slow Lines)	VTB2	9	1518	10	616	0.5	Main route	
Blue Anchor Junction to Norwood Fork Junction	LBW	1	990	9	726	7.9	Main route	
Norwood Fork Junction to West Croydon	NFE	9	726	10	814	1.1	Diversion route	
Blackfriars to East Croydon (via Tulse Hill & Streatham)								
Blackfriars to Loughborough Junction	HHH	0	770	3	748	3.0	Main route	
Loughborough Junction to Herne Hill	HHH	3	748	4	814	1.0	Main route	
Herne Hill to Tulse Hill South Junctioin	HHT	3	1672	5	330	1.2	Main route	
Tulse Hill South Junction to Streatham Junction	BTH1	6	440	7	1254	1.5	Main route	
Streatham Junction to Streatham Common North Junction	SSC	7	1254	8	220	0.4	Main route	
Streatham Common North Junction to Selhurst Junction	VTB1	6	924	9	814	2.9	Main route	
Selhurst Junction to Windmill Bridge Junction	VTB1	9	814	10	66	0.6	Main route	
Blackfriars to East Croydon (via Tulse Hill & Crystal Palace)								
Blackfriars to Loughborough Junction	HHH	0	770	3	748	3.0	Main route	
Loughborough Junction to Herne Hill	HHH	3	748	4	814	1.0	Main route	
Herne Hill to Tulse Hill South Junction	HHT	3	1672	5	330	1.2	Main route	
Tulse Hill South Junction to West Norwood Jnc	WTH	6	330	6	902	0.3	Main route	
West Norwood Junction to Crystal Palace Tunnel Junction	BBJ	6	1276	8	1034	1.9	Main route	
Crystal Palace Tunnel Junction to Norwood North Junction	BJN1 / BJN2	8	1034	9	1650	1.4	Main route	

List of Routes for Key Output 2 (KO2)

Route / Sub-Route	Engineers Line Reference (ELR)	Start Miles	Start Yards	End Miles	End Yards	Approx Decimal Miles	Route Type (Simplified)	Notes
Norwood North Junction to East Croydon	LBW	8	682	9	1518	1.5	Main route	
	VTB2	9	1518	10	616	0.5		
East Grinstead Service								
Blackfriars to East Grinstead (via East Croydon and Brighton Main line)								
Blackfriars to Metropolitan Junction (B)	HHH	0	770	0	1386	0.4	Main route	
	BMJ	0	1386	1	308	0.4		
Metropolitan Junction (B) to Blue Anchor Junction	XTD	1	682	3	704	2.0	Main route	
Blue Anchor Junction to Windmill Bridge Junction	LBW	1	990	9	1518	8.3	Main route	
Windmill Bridge Junction to South Croydon Junction	VTB2	9	1518	11	638	1.5	Main route	
South Croydon Junction to Hurst Green Junction	SCU	11	638	21	770	10.1	Main route	
Hurst Green Junction to East Grinstead	HGG	21	770	30	220	8.7	Main route	
Caterham & Tattenham Corner Services								
Blackfriars to Metropolitan Junction (B)	HHH	0	770	0	1386	0.4	Main route	
	BMJ	0	1386	1	308	0.4		
Metropolitan Junction (B) to Blue Anchor Junction	XTD	1	682	3	704	2.0	Main route	
Blue Anchor Junction to Windmill Bridge Junction	LBW	1	990	9	1518	8.3	Main route	
Windmill Bridge Junction to Purley	VTB2	9	1518	13	638	3.3	Main route	
Purley to Caterham	PAT	15	286	19	1540	4.7	Main route	
Purley to Tattenham Corner	TAT	15	286	23	814	8.3	Deployment route	
Horsham Service								
Blackfriars to Horsham (via Three Bridges and Brighton Main line)								
Blackfriars to Metropolitan Junction (B)	HHH	0	770	0	1386	0.4	Main route	
	BMJ	0	1386	1	308	0.4		
Metropolitan Junction (B) to Blue Anchor Junction	XTD	1	682	3	704	2.0	Main route	
Blue Anchor Junction to Windmill Bridge Junction	LBW	1	990	9	1518	8.3	Main route	
Windmill Bridge Junction to Purley (Slow Lines)	VTB2	9	1518	13	638	3.5	Main route	
Purley to Earlswood	RED1	13	638	15	44	1.7	Main route	

List of Routes for Key Output 2 (KO2)

Route / Sub-Route	Engineers Line Reference (ELR)	Start Miles	Start Yards	End Miles	End Yards	Approx Decimal Miles	Route Type (Simplified)	Notes
North Junction (Redhill Line)	RED2	16	1452	23	0	6.2		
Windmill Bridge Junction to Earlswood North Junction (Fasts/Quarry Line)	VTB2	9	1518	21	462	11.4	Main route	
Earlswood North Junction to Three Bridges	VTB3	21	330	29	594	8.2	Main route	
Three Bridges to Horsham	TBH	29	594	37	1232	8.4	Main route	
Tunbridge Wells/Paddock Wood Services								
Blackfriars to Tonbridge, Tunbridge Wells Paddock Wood and Ashford via Hither Green (via Kent Main line)								
Blackfriars to Metropolitan Junction (B)	HHH BMJ	0 0	770 1386	0 1	1386 308	0.4 0.4	Main route	
Metropolitan Junction (B) to London Bridge	XTD	1	682	1	1540	0.5	Main route	
London Bridge to North Kent East Junction	XTD	1	1540	4	506	2.4	Main route	
North Kent East Junction to Tonbridge	XTD	4	506	29	924	25.2	Main route	
St Johns Junction to Lewisham Crossover Junction (D)	BEX	5	1188	5	1716	0.3	Main route	
Tanners Hill Junction to Lewisham Vale Junction	LVT	5	638	5	1254	0.4	Main route	
Lewisham Vale Junction to Lewisham Crossover Junction (D)	NTL	7	814	7	1276	0.3	Main route	
Lewisham Crossover Junction (D) to Courthill Loop South Junction	NCS	5	1716	6	946	0.6	Main route	
Tonbridge to Tunbridge Wells	TTH	29	924	34	704	4.9	Main route	
Tonbridge to Paddock Wood	XTD	29	924	34	1474	5.3	Main route	
Paddock Wood to Ashford	XTD	34	1474	56	264	21.3	Main route	
Blackfriars to Tonbridge, Tunbridge Wells, Paddock Wood and Ashford via Catford Loop								
Blackfriars to Loughborough Junction	HHH	0	770	3	748	3.0	Main route	
Loughborough Junction to Cambria Junction	LTC	3	748	3	1364	0.4	Main route	
Cambria Junction to Nunhead Junction	CAT	3	1496	6	220	2.3	Main route	
Nunhead Junction to Shortlands Junction	CAT	6	220	10	1606	4.8	Main route	
Ravensbourne Junction to Shortlands Junction	RVC	0	0	0	1056	0.6	Main route	
Shortlands Junction to Bickley Junction	VIR	9	1254	12	880	2.8	Main route	
Bickley Junctions to Petts Wood Junctions	TLP1 TLP2	12 12	836 880	13 13	638 770	0.9 0.9	Main route	

List of Routes for Key Output 2 (KO2)

Route / Sub-Route	Engineers Line Reference (ELR)	Start Miles	Start Yards	End Miles	End Yards	Approx Decimal Miles	Route Type (Simplified)	Notes
Petts Wood Junction to Tonbridge	XTD	12	528	29	924	17.2	Main route	
Tonbridge to Tunbridge Wells	TTH	29	924	34	704	4.9	Main route	
Tonbridge to Paddock Wood	XTD	29	924	34	1474	5.3	Main route	
Paddock Wood to Ashford	XTD	34	1474	56	264	21.3	Main route	
Dartford Services								
Blackfriars to Dartford (via Bexleyheath)								
Blackfriars to Metropolitan Junction (B)	HHH	0	770	0	1386	0.4	Main route	
	BMJ	0	1386	1	308	0.4		
Metropolitan Junction (B) to Blue Anchor Junction	XTD	1	682	3	704	2.0	Main route	
Blue Anchor Junction to St Johns	XTD	3	704	5	1188	2.3	Main route	
St Johns to Crayford Creek Junction	BEX	5	1188	15	792	9.8	Feasibility route	
Crayford Creek Junction Junction to Dartford Junction	NKL	15	1452	16	1672	1.1	Feasibility route	
Dartford Junction to Dartford	HDR	16	1210	17	264	0.5	Feasibility route	
Blackfriars to Dartford (via Sidcup)								
Blackfriars to Metropolitan Junction (B)	HHH	0	770	0	1386	0.4	Main route	
	BMJ	0	1386	1	308	0.4		
Metropolitan Junction (B) to Blue Anchor Junction	XTD	1	682	3	704	2.0	Main route	
Blue Anchor Junction to North Kent Junction	XTD	3	704	4	506	0.9	Main route	
North Kent Junction to St Johns Junction	XTD	4	506	5	1188	1.4	Main route	
St Johns Junction to Lewisham Crossover Junction (D)	BEX	5	1188	5	1716	0.4	Main route	
Tanners Hill Junction to Lewisham Vale Junction	LVT	5	638	5	1254	0.4	Main route	
Lewisham Vale Junction to Lewisham Crossover Junction (D)	NTL	7	814	7	1276	0.3	Main route	
Lewisham Crossover Junction to Courthill Loop South Junction	NCS	5	1716	6	946	0.6	Main route	
Courthill Loop Sth Jnc to Hither Green	XTD	6	792	7	88	0.6	Main route	
Hither Green to Dartford Junction	HDR	7	88	16	1210	9.6	Feasibility route	
Dartford Junction to Dartford	HDR	16	1210	17	264	0.5	Feasibility route	
Wimbledon Loop								

List of Routes for Key Output 2 (KO2)

Route / Sub-Route	Engineers Line Reference (ELR)	Start Miles	Start Yards	End Miles	End Yards	Approx Decimal Miles	Route Type (Simplified)	Notes
Blackfriars and Wimbledon Loop								
Blackfriars to Loughborough Junction	HHH	0	770	3	748	3.0	Main route	
Loughborough Junction to Herne Hill	HHH	3	748	4	814	1.0	Main route	
Herne Hill to Tulse Hill South Junction	HHT	3	1672	5	330	1.2	Main route	
Tulse Hill South Junction to Sutton East Junction (via Mitcham Junction)	BTH1	6	440	13	990	7.3	Deployment route	
Sutton East Junction to Sutton West Junction	BTH2	14	1452	15	44	0.2	Deployment route	
Sutton West Junction to Wimbledon	SMS2	12	946	7	418	5.3	Deployment route	
Wimbledon to Streatham South Junction	SMS1	3	110	0	0	3.1	Deployment route	
Guildford Service								
Blackfriars to Guildford								
Blackfriars to Metropolitan Junction (B)	HHH BMJ	0 0	770 1386	0 1	1386 308	0.4 0.4	Main route	
Metropolitan Junction (B) to Blue Anchor Junction	XTD	1	682	3	704	2.0	Main route	
Blue Anchor Junction to Norwood Fork Junction	LBW	1	990	9	726	7.9	Main route	
Norwood Fork Junction to West Croydon	NFE	9	726	10	814	1.1	Diversion route	
West Croydon to Sutton East Junction	NFE	10	814	14	1452	4.4	Diversion route	
Sutton East Junction to Epsom	BTH2	14	1452	19	66	4.2	Diversion route	
Epsom to Leatherhead Junction	BTH3	14	594	18	220	3.8	Diversion route	
Leatherhead Junction to Effingham Junction	LEJ	18	220	22	330	4.1	Feasibility route	
Effingham Junction to Guildford	NGL	21	88	29	1540	8.8	Feasibility route	
Littlehampton Service								
Blackfriars to Littlehampton (via Brighton Main line)								
Blackfriars to Metropolitan Junction (B)	HHH BMJ	0 0	770 1386	0 1	1386 308	0.4 0.4	Main route	
Metropolitan Junction (B) to Blue Anchor Junction	XTD	1	682	3	704	2.0	Main route	
Blue Anchor Junction to Windmill Bridge Junction	LBW	1	990	9	1518	8.3	Main route	
Windmill Bridge Junction to Purley	VTB2	9	1518	13	638	3.5	Main route	
Purley to Earlswood North Junction	RED1 RED2	13 16	638 1452	15 23	44 0	1.7 6.2	Main route	

List of Routes for Key Output 2 (KO2)

Route / Sub-Route	Engineers Line Reference (ELR)	Start Miles	Start Yards	End Miles	End Yards	Approx Decimal Miles	Route Type (Simplified)	Notes
Earlswood North Junction to Preston Park Junction	VTB3	21	330	49	946	28.4	Main route	
Preston Park Junction to Hove	PPH	49	946	50	1232	1.2	Diversion route	
Hove to Arundel Junction South	BLI1	1	770	19	44	17.6	Diversion route	
Arundel Junction South to Littlehampton Junction	BLI2	19	44	19	550	0.3	Diversion route	
Littlehampton Junction to Littlehampton	BLI2	60	1254	62	66	1.3	Diversion route	
Eastbourne Service								
Blackfriars to Eastbourne (via Brighton Main line)								
Blackfriars to Metropolitan Junction (B)	HHH	0	770	0	1386	0.4	Main route	
	BMJ	0	1386	1	308	0.4		
Metropolitan Junction (B) to Blue Anchor Junction	XTD	1	682	3	704	2.0	Main route	
Blue Anchor Junction to Windmill Bridge Junction	LBW	1	990	9	1518	8.3	Main route	
Windmill Bridge Junction to Purley	VTB2	9	1518	13	638	3.5	Main route	
Purley to Earlswood North Junction	RED1	13	638	15	44	1.7	Main route	
	RED2	16	1452	23	0	6.2		
Earlswood North Junction to Keymer Junction	VTB3	21	330	40	1518	19.7	Main route	
Keymer Junction to Lewes Short Mile (East Junction)	KJE1	40	1518	50	638	9.5	Diversion route	
Lewes Short Mile (East Junction) to Southerham Junction	KJE2	50	880	51	242	0.6	Feasibility route	
Southerham Junction to Eastbourne	KJE3	9	242	23	1606	14.8	Feasibility route	
Sevenoaks/Orpington Service								
Blackfriars to Sevenoaks (via Catford Loop)								
Blackfriars to Loughborough Junction	HHH	0	770	3	748	3.0	Main route	
Loughborough Junction to Cambria Junction	LTC	3	748	3	1364	0.4	Main route	
Cambria Junction to Nunhead Junction	CAT	3	1496	6	220	2.3	Main route	
Nunhead Junction to Shortlands Junction	CAT	6	220	10	1606	4.8	Main route	
Ravensbourne Junction to Shortlands Junction	RVC	0	0	0	1056	0.6	Main route	
Shortlands Junction to Bickley Junction	VIR	9	1254	12	880	2.8	Main route	
Bickley Junction to Swanley Junction	VIR	12	880	17	1012	5.1	Main route	
Swanley Junction to Otford Junction	SBJ	17	1012	24	1188	7.1	Main route	

List of Routes for Key Output 2 (KO2)

	Route / Sub-Route		Engineers Line Reference (ELR)	Start Miles	Start Yards	End Miles	End Yards	Approx Decimal Miles	Route Type (Simplified)	Notes
		Otford Junction to Sevenoaks	OJS	24	1188	26	1430	2.2	Main route	
		Bickley Junctions to Petts Wood Junctions	TLP1	12	836	13	638	0.9	Main route	
			TLP2	12	880	13	770	0.9		
		Petts Wood Junction to Orpington	XTD	12	528	13	1430	1.5	Main route	
Rochester Service										
	Blackfriars to Rochester (via Catford Loop)									
		Blackfriars to Loughborough Junction	HHH	0	770	3	748	3.0	Main route	
		Loughborough Junction to Cambria Junction	LTC	3	748	3	1364	0.4	Main route	
		Cambria Junction to Nunhead Junction	CAT	3	1496	6	220	2.3	Main route	
		Nunhead Junction to Shortlands Junction	CAT	6	220	10	1606	4.8	Main route	
		Ravensbourne Junction to Shortlands Junction	RVC	0	0	0	1056	0.6	Main route	
		Shortlands Junction to Bickley Junction	VIR	9	1254	12	880	2.8	Main route	
		Bickley Junction to Swanley Junction	VIR	12	880	17	1012	5.1	Main route	
		Swanley Junction to Rochester	VIR	17	1012	33	1342	16.2	Deployment route	
South London Depot Routes										
	Blackfriars to Selhurst									
		Blackfriars to Loughborough Junction	HHH	0	770	3	748	3.0	Main route	
		Loughborough Junction to Herne Hill	HHH	3	748	4	814	1.0	Main route	
		Herne Hill to Tulse Hill South Junction	HHT	3	1672	5	330	1.2	Main route	
		Tulse Hill South Junction to Streatham Junction	BTH1	6	440	7	1254	1.5	Main route	
		Streatham Junction to Streatham Common North Junction	SSC	7	1254	8	220	0.4	Main route	
		Streatham Common North Junction to Selhurst Junction	VTB1	6	924	9	814	2.9	Main route	
		Selhurst Junction to Selhurst Depot	NYD	9	1012	8	1738	0.6	Depot route	
		Norwood Junction to Selhurst Depot	LBW	8	1210	8	1738	0.3	Depot route	
	Three Bridges									
		Three Bridges to Three Bridges Depot	TBH	29	594	29	910	0.2	Depot route	

List of Routes for Key Output 2 (KO2)

Route / Sub-Route	Engineers Line Reference (ELR)	Start Miles	Start Yards	End Miles	End Yards	Approx Decimal Miles	Route Type (Simplified)	Notes
Deployment and Diversionary Routes								
Charing Cross to Metropolitan Junction	XTD	0	0	1	682	1.4	Deployment route	
Cannon Street to Borough Market Jn	CBM	0	0	0	836	0.5	Deployment route	
Cannon Street to Metropolitan Jn	CSW	1	770	1	1320	0.3	Depot route	
London Bridge LL to Bricklayers Arms Junction (via Spa Rd Jn)	LBW	0	0	2	264	2.2	Deployment route	
London Bridge LL to Bricklayers Arms Junction (via South Bermondsey Jn)	LBC	0	0	2	264	2.2	Deployment route	
Victoria (Central side) to Windmill Bridge Junction	VTB1	0	0	10	66	10.0	Deployment route	Fast & Slow lines
Victoria (Eastern side) - Herne Hill	VIR	0	0	4	0	4.0	Deployment route	
Victoria (Eastern side) - Peckham Rye Junction	BSF	0	0	1	1650	1.9	Diversion route	
	ATL	6	1276	3	1034	3.1		
Nunhead Junction to Lewisham Crossover Junctions	NTL	6	220	7	1276	1.6	Diversion route	
Chislehurst Junction to St Mary Cray Junctions	CSM1	11	726	11	1562	0.5	Diversion route	
	CSM3	11	1144	12	660	0.7		
Redhill to Reigate	RSJ	22	1012	24	594	1.8	Feasibility route	
Blackfriars to Maidstone East and Ashford								
Blackfriars to Loughborough Junction	HHH	0	770	3	748	3.0	Main route	
Loughborough Junction to Herne Hill	HHH	3	748	4	814	1.0	Main route	
Herne Hill to Shortlands Junction	VIR	3	1672	9	1650	6.0	Deployment route	
Shortlands Junction to Swanley Junction	VIR	9	1650	17	1012	7.6	Main route	
Swanley Junction to Otford Junction	SJB	17	1012	24	1188	7.1	Main route	
Otford Junction to Maidstone East	SBJ	24	1188	39	1672	15.3	Main route	
Maidstone East to Ashford	SBJ / XTD	39	1672	58	1342	18.8	Deployment route	
Arun Valley Route Horsham to Littlehampton								
Horsham to Arundel Junction North	TBH1	37	1232	59	1650	22.2	Diversion route	
Arundel Junction North to Littlehampton Junction	BLI2	19	22	19	550	0.3	Diversion route	
Littlehampton Junction to Littlehampton	BLI2	60	1254	62	66	1.3	Diversion route	
Blackfriars to East Croydon via South London Line (1)								

List of Routes for Key Output 2 (KO2)

Route / Sub-Route	Engineers Line Reference (ELR)	Start Miles	Start Yards	End Miles	End Yards	Approx Decimal Miles	Route Type (Simplified)	Notes
Blackfriars to Metropolitan Junction (B)	HHH	0	770	0	1386	0.4	Main route	
	BMJ	0	1386	1	308	0.4		
Metropolitan Junction (B) to South Bermondsey Junction	XTD	1	682	2	1540	1.5	Main route	New connection provided as part of TLP scheme
	LBC	1	22	1	1078	0.6		
South Bermondsey Junction to Peckham Rye Junction	BTH1	1	1078	3	1034	2.0	Diversion route	
Peckham Rye Junction to Tulse Hill South Junction	BTH1	3	1034	6	330	2.6	Diversion route	
Tulse Hill South Junction to West Norwood Jnc	WTH	6	330	6	902	0.3	Main route	
West Norwood Junction to Crystal Palace Tunnel Junction	BBJ	6	1276	8	1034	1.9	Main route	
Crystal Palace Tunnel Junction to Norwood North Junction	BJN1 / BJN2	8	1034	9	1650	1.4	Main route	
Norwood North Junction to East Croydon	LBW / VTB2	8	682	10	616	2.0	Main route	
Blackfriars to East Croydon via South London Line (2)								
Blackfriars to Metropolitan Junction (B)	HHH	0	770	0	1386	0.4	Main route	
	BMJ	0	1386	1	308	0.4		
Metropolitan Junction (B) to South Bermondsey Junction	XTD	1	682	2	1540	1.5	Main route	New connection provided as part of TLP scheme
	LBC	1	22	1	1078	0.6		
South Bermondsey Junction to Peckham Rye Junction	BTH1	1	1078	3	1034	2.0	Diversion route	
Peckham Rye Junction to Tulse Hill South Junction	BTH1	3	1034	6	330	2.6	Diversion route	
Tulse Hill South Junction to Streatham Junction	BTH	6	330	7	1254	1.5	Main route	
Streatham Junction to Streatham Common Junction	SSC	7	1254	8	220	0.4	Main route	
Streatham Common Junction to Selhurst Junction	VTB1	6	924	9	814	2.9	Main route	
Selhurst Junction to Windmill Bridge Junction	VTB1	9	814	10	66	0.6	Main route	
Windmill Bridge Junction to East Croydon	VTB2	9	1518	10	616	0.5	Main route	
Blackfriars to Dartford (via Greenwich)								
Blackfriars to Metropolitan Junction (B)	HHH	0	770	0	1386	0.4	Main route	
	BMJ	0	1386	1	308	0.4		
Metropolitan Junction (B) to Blue Anchor Junction	XTD	1	682	3	704	2.0	Main route	

List of Routes for Key Output 2 (KO2)

Route / Sub-Route	Engineers Line Reference (ELR)	Start Miles	Start Yards	End Miles	End Yards	Approx Decimal Miles	Route Type (Simplified)	Notes
Blue Anchor Junction to North Kent East Junction	XTD	3	704	4	506	0.9	Main route	
North Kent East Junction to Dartford Junction	NKL	4	506	16	1672	12.7	Feasibility route	
Dartford Junction to Dartford	HDR	16	1210	17	264	0.5	Feasibility route	
Blackheath Junction to Charlton Junction	BTC	7	286	8	1386	1.6	Feasibility route	
Erith Loop	PSF	15	682	15	154	0.3	Feasibility route	
Crayford Spur	CRA	16	902	16	242	0.4	Feasibility route	
Blackfriars to Hayes								
Blackfriars to Metropolitan Junction (B)	HHH BMJ	0 0	770 1386	0 1	1386 308	0.4 0.4	Main route	
Metropolitan Junction (B) to Blue Anchor Junction	XTD	1	682	3	704	2.0	Main route	
Blue Anchor Junction to North Kent Junction	XTD	3	704	4	506	0.9	Main route	
North Kent Junction to St Johns Junction	XTD	4	506	5	1188	1.4	Main route	
St Johns Junction to Lewisham Crossover Junction (D)	BEX	5	1188	5	1716	0.3	Main route	
Lewisham Crossover Junction (D) to Courthill Junction	LCH	5	1716	6	462	0.3	Main route	
Courthill Junction to New Beckenham Junction	LCH	6	462	9	1122	3.4	Feasibility route	
New Beckenham Junction to Hayes	LCH	9	1122	14	748	4.8	Feasibility route	
Ladywell Loop (Parks bridge Jn to Ladywell Jn)	LLL	6	286	6	638	0.2	Diversion route	
West Croydon to Horsham								
West Croydon to Sutton East Junction	NFE	10	814	14	1452	4.4	Diversion route	
Sutton East Junction to Epsom	BTH2	14	1452	19	66	4.2	Diversion route	
Epsom to Leatherhead Junction	BTH3	14	594	18	220	3.8	Diversion route	
Leatherhead Junction to Horsham Junction	BTH3	18	220	37	770	19.3	Diversion route	
Brighton to Hove								
Brighton to Hove	BL1	0	0	1	770	1.4	Diversion route	
Brighton to Lewes								
Brighton to Lewes Junction	BTL	0	0	8	66	8.0	Diversion route	

List of Routes for Key Output 2 (KO2)

Route / Sub-Route	Engineers Line Reference (ELR)	Start Miles	Start Yards	End Miles	End Yards	Approx Decimal Miles	Route Type (Simplified)	Notes
Miscellaneous Depot/Stabling Routes								
Redhill Tonbridge Line Junction to Tonbridge	RTT	22	1122	42	352	19.6	Depot route	
Maidstone East to Ashford Depot/Down Yard C S	SBJ XTD / ACR	39 56	1672 44	58 57	1342 0	18.8 1.0	Depot route	
Balham Jnc - West Norwood Jnc incl Streatham Hill Depot	BBJ	4	1518	6	1276	1.9	Depot route	
Brixton Junction - Cambria Junction	CAT	3	176	3	1496	0.8	Depot route	
Canterbury Road Junction - Loughborough Junction	LOC	3	858	3	1738	0.5	Depot route	
Leigham Spurs	LTH	6	440	6	880	0.3	Depot route	
Crystal Palace Tunnel Junction to Sydenham	SCP	6	902	7	1342	1.3	Depot route	
Bromley Junction (Crystal Palace) to Beckenham Junction	BBJ	9	792	11	1364	2.3	Depot route	
Courthill Junction to New Beckenham Junction	LCH	6	462	9	1122	3.4	Depot route	
New Beckenham Junction to Beckenham Junction	NBB	9	1122	10	88	0.4	Depot route	
Ladywell Loop (Parks bridge Jn to Ladywell Jn)	LLL	6	286	6	638	0.2	Depot route	
Dartford to Rochester Bridge Junction	HDR	17	264	31	748	14.3	Depot route	
Factory Junction to Longhedge Junction	FLL	0	0	0	902	0.5	Depot route	
Battersea Pier Junction to Longhedge Junction	BSP	0	1716	1	1276	0.8	Depot route	
Longhedge Junction to Pouparts Junction	BSP	1	1386	2	440	0.5	Depot route	
Longhedge Junction to Latchmere No1 Junction	CKL	1	1386	2	1122	0.9	Depot route	
Falcon Junction to Latchmere No1 Junction	WLL	0	0	0	1386	0.8	Depot route	
Latchmere No1 Junction to Mitre Bridge Junction	WLL	0	1386	5	1452	5.0	Depot route	
Mitre Bridge Junction to West London Junction	WLL	5	1452	6	418	0.4	Depot route	
West London Junction to Willesden Junction	LLG	0	264	0	1562	0.7	Depot route	
West London Junction to Camden Junction	LEC1	5	506	1	1122	3.7	Depot route	
Camden Junction to Camden Road West Jn	CRC2	5	1650	5	220	0.8	Depot route	
Mitre Bridge Junction to Willesden High Level Junction	WMB	0	0	0	946	0.5	Depot route	
Willesden High Level Junction to Camden Road West Junction	BOK	0	0	5	1056	5.6	Depot route	
Camden Road West Junction to Camden Road Central Junction	BOK	4	1408	5	220	0.3	Depot route	

List of Routes for Key Output 2 (KO2)

	Route / Sub-Route		Engineers Line Reference (ELR)	Start Miles	Start Yards	End Miles	End Yards	Approx Decimal Miles	Route Type (Simplified)	Notes
		North London Incline (Camden Rd C Jn to Copenhagen Jn)	CRF	0	0	0	1122	0.6	Depot route	
		Camden Road Central Junction to Navarino Road Junction	BOK	1	1144	4	1408	3.2	Depot route	
		Navarino Road Junction to Hackney Wick	DWW	1	242	3	0	1.9	Depot route	
		Canonbury West Junction to Finsbury Park	CFP	3	264	4	726	1.3	Depot route	
									Key:	
									Main route	Routes for KO2 Train Service Specification
									Deployment route	Routes for pre-KO2 initial service deployment
									Diversion route	Diversionary routes for KO2 TSS or initial service deployment
									Depot routes	Routes for empty stock working to depots and stabling locations
									Feasibility route	Other potential routes not required to support KO2 TSS or initial service deployment

ANNEX C - TECHNICAL DESCRIPTION REQUIREMENTS - TECHNICAL INFORMATION

Unit and Vehicle data to be included within the Train Technical Description by the TMM is detailed below:

- General arrangement drawings for Unit and for each Vehicle showing key dimensions
TIIS-878

- Shoegear locations for the Units
TIIS-1878

- Vehicle Length (over couplers and over bodyend), Width, Door position (passenger and crew), footstep locations, pantograph positions, bogie centres, wheel centres, nose overhang.
TIIS-879

- Vehicle weight - Tare, all seats occupied, crush laden
TIIS-880

- Axle load - Tare, all seats occupied, crush laden
TIIS-881

- Unsprung mass (for both powered and non-powered wheelsets)
TIIS-882

- Route Availability (RA)
TIIS-883

- Wheel Profile
TIIS-884

- Wheel diameter
TIIS-885

- T-gamma ($T\gamma$) curves (powered and non-powered bogies)
TIIS-886

- Characteristics including Tractive Effort, Braking Effort (if Regenerative Braking operation is available) and Line Current against Speed, for the FLU and RLU, for AC and DC operation, in each case for each line current limit and for the range of line voltages, presented in the spreadsheet format given in Annex I.
TIIS-1904

- Power factor
TIIS-1905

- Efficiency for Traction Load as well as for Auxiliary Load
TIIS-1906

- Maximum Auxiliary Load
TIIS-1907

- Maximum Tractive Effort
TIIS-1908

- Maximum Speed
TIIS-1909

- Maximum Rail Power while driving as well as braking
TIIS-1910

- The Kinematic Envelope for the Unit shall be provided in electronic format, i.e. as a 'Vampire' KE or equivalent, in ClearRoute™ format in addition to drawings
TIIS-888

- The stages of Kinematic Envelope development for the Unit
TIIS-1871

- Details of how the design of the Unit complies with the requirements stated in GM/RT2149 using the platform data contained within the National Gauging Database.
TIIS-1872

- Provide details of the defining features of the bogie and Vehicle design, in respect of their interaction with the track geometry.
TIIS-1873

- Supply the results of vehicle dynamics simulations on each of the VTT track geometry files.
TIIS-1874

- Minimum curve radii
TIIS-1875

- EMC compatibility with infrastructure
TIIS-889

- Coupling compatibility with existing train types (Type & Height)
TIIS-890

- Rescue arrangements
TIIS-891

- Braking curve (Full Service and Emergency Applications)
TIIS-892

- Acceleration Curve (with supporting values in Microsoft Excel format)
TIIS-893

- Visibility from drivers seat (sight lines)
TIIS-894

- Radio communication system details
TIIS-896

- List of start-up tests following system upgrade and time required for start-up tests
TIIS-1879

- Interface with CET emptying facilities - connection details and locations
TIIS-898

- Shore Supply requirements - electrical and water
TIIS-899

- Dwell Time breakdown (inc. door cycle times)
TIIS-900

ANNEX D - NOT USED

ANNEX E - NOT USED

ANNEX F - ABBREVIATIONS & DEFINITIONS

Term	Meaning / Definition
AC	Alternating Current
ADD	Auto Drop Device (pantograph)
AP	Advanced Positioning
APC	Automatic Power Control
ARL	Above Rail Level
ASDO	Automatic Selective Door Operation
ATO	Automatic Train Operation
ATO Area	The area within the ETCS Level 2 Area where Units are able to operate in ATO mode.
ATP	Automatic Train Protection
ATS	Automatic Train Supervision
AVI	Automatic Vehicle Identification
AWS	Automatic Warning System
BR	British Rail
BST	British Summer Time
CAD	Computer Aided Design
CCS	Control Command & Signalling
CCTV	Closed Circuit TeleVision
CD	Compact Disc
CD/RA	Close Doors / Right Away
CET	Controlled Emission Toilet
Core Area	The section of the Thameslink Network between the new Canal Tunnels Junction and Blackfriars Junction including St Pancras International, Farringdon, City Thameslink and Blackfriars stations
CSDE	Correct Side Door Enable
CSM	Ceiling Speed Monitoring
DAS	Driver Advisory System
DC	Direct Current
DfT	Department for Transport
DGO	Driver & Guard Operation
DMI	Driver Machine Interface
DOO	Driver Only Operation
DOORS	Dynamic Object Orientated Requirements Software
DVD	Digital Versatile Disc
DVR	Digital Video Recorder
EDOR	ETCS Data Only Radio
ELR	Engineers Line Reference
EMC	Electro-Magnetic Compatibility
EMI	Electro-Magnetic Interference
EMU	Electric Multiple Unit
EN	Euro Norm
ERA	European Railway Agency
ERTMS	European Railway Traffic Management System
ETCS	European Train Control System
ETCS (V2.3.0d)	As defined in SUBSET-026 v2.3.0 as amended by SUBSET-108 v1.2.0 and the list of mandatory specifications given in Annex A of the CCS TSI.
ETCS Level 2 Area	The section(s) of the Thameslink Network to be equipped with ETCS Level

Term	Meaning / Definition
	2 infrastructure and Units will normally operate in ETCS Level 2. (Initially the Core Area and the section of the Thameslink Network from Blackfriars Junction through London Bridge Station (Platforms 3, 4, 5 and 6) to a location to the west of the new Corbett's Lane Junction).
EVC	European Vital Computer
FASDO	Fully Automatic Selective Door Opening
FDM	Frequency Division Multiplex
FFFIS	Form, Fit, Function & Interface Specification
FFRF	Forward Facing and Rearward Facing
FLU	Full Length Unit
fps	frames per second
FS	ETCS Full Supervision Mode
GMT	Greenwich Mean Time
GNSS	Global Navigation Satellite System
GPRS	General Packet Radio System
GPS	Global Positioning System
GRIP	Governance of Railway Investment Projects
GSM	Global System for Mobile Communications
GSM-R	Global System for Mobile Communications - Railways
HNIF	Hertford National Integration Facility
HVI	High Voltage Impulse
ICMU	Interference Current Monitoring Unit
ID	Identification
I/L	(Signalling) Interlocking
ILTE	(System) Integration Lab Train Equipment (as defined in the MSA)
IS	ETCS Isolate Mode
KE	Kinematic Envelope
kph	kilometres per hour
KO2	Key Output 2
L2	ETCS Level 2
LED	Light Emitting Diode
LUL	London Underground Limited
mph	miles per hour
MSA	Manufacture & Supply Agreement
NGD	National Gauging Database
NR	Network Rail
NRN	National Radio Network
OBU	On Board Unit
OLE	Overhead Line Equipment (Electrical Traction Supply)
Operations Control	The Network Rail Route operations control centre.
ORR	Office of the Railway Regulator
PC	Personal Computer
Performance Core	The sections of the Thameslink Network that fall within the area bounded by the Performance Core Boundary Recording Points.
Performance Core Boundary Recording Points	The Recording Points which monitor the timing of trains, located at or most proximate to West Hampstead station, Finsbury Park station, Elephant and Castle station and the new Corbett's Lane Junction, approximately 2.5 kilometres east of London Bridge station
PoSA	Proceed on Sight Aspect
PRM	Persons with Reduced Mobility

Term	Meaning / Definition
PTI	Platform Train Interface
RA	Route Availability
RBC	Radio Block Centre
RCF	Rolling Contact Fatigue
RFId	Radio Frequency Identification
RGS	Railway Group Standards
RLU	Reduced Length Unit
RSM	Release Speed Monitoring
RSSB	Rail Safety Standards Board
Service Delivery Centre	The Operator's train service delivery control centre.
SDO	Selective Door Operation
SF	ETCS System Failure Mode
SISS	Station Information & Surveillance Systems
SMS	Safety Management System
SN	ETCS National STM Mode
STM	Specific Transmission Module
TIIS	Train Infrastructure Interface Specification
TL KO2 Stock	New Thameslink Rolling Stock
TMM	Train Manufacturer and Maintainer
TMS	Train Management System
TOC	Train Operating Company
tph	Trains Per Hour
TPWS	Train Protection and Warning System
TRN	Train Running Number
TRSP	Thameslink Rolling Stock Project
TSI	Technical Specification for Interoperability
TSM	Target Speed Monitoring
TTCS	Thameslink Train Control Specification
TTD	Train Technical Description
TTS	Train Technical Specification
TWA	Transport and Works Act
UIC	Union Internationale des Chemins de fer (International Union of Railways)
UK	United Kingdom
UMTS2100	Universal Mobile Telecommunications System 2100 MHz
UPS	Uninterruptible Power Supply
USB	Universal Serial Bus
UTC	Coordinated Universal Time
VTISM	Vehicle Track Interaction Strategic Model
VTT	Virtual Test Track
WiFi	Wireless communication based on the IEEE 802.11 standards

ANNEX G - REQUIREMENT IDENTIFIER INDEX

ANNEX H - Tγ CURVE DEFINITION

Curve Radius (m)	Cant Deficiency (mm)	
	0	120
150	510.2	500.9
200	334.9	309.0
250	240.1	216.9
300	191.1	169.3
350	166.1	154.6
450	118.0	111.5
500	92.6	83.9
550	67.4	53.5
650	58.7	43.7
750	56.9	31.5
800	49.5	26.8
850	44.7	23.0
900	40.7	19.7
950	37.2	16.9
1000	32.4	14.2
1400	16.3	4.7
1800	10.3	2.5
2500	6.0	0.8
5000	1.2	0

The train characteristics data in the spreadsheet format below may be provided as a separate document to the Train Technical Description.

ANNEX I - TRAIN CHARACTERISTICS DATA TEMPLATE

The train characteristics data in the spreadsheet format below may be provided as a separate document to the Train Technical Description.

TRSP Train Characteristics Template

This spreadsheet contains tractive effort values during traction and braking	
RLU FLU Full	Reduced Length Unit - 8 car train Full Length Unit - 12 car train Full loading condition as defined within TTS
AC Base AC Inter AC High DC Base DC Inter DC High	Base Current Limit on the 25kV AC network (RLU = 140A; FLU = 200A) Intermediate Current limit on 25kV AC network (RLU = 170A; FLU = 250A) High Current Limit on the 25kV AC network (RLU = 200A; FLU = 300A) Base Current Limit on the 750V DC network (RLU = 3000A; FLU = 4000A) Intermediate Current limit on 750V DC network (RLU = 3750A; FLU = 5000A) High Current Limit on the 750V DC network (RLU = 4500A; FLU = 6800A)
FLU/RLU Gen1 FLU/RLU Gen2 FLU/RLU Gen3	Train Length, Train Mass, and Braking Rate information. Train Resistance coefficients Reference Line Voltages and Line Current Limits

Introduction

TRSP Train Characteristics Template

GENERAL INFORMATION

Class		Number of cars		AC/DC/Dual		Maximum Power Draw	

EMU/DMU/Loco		Family Name	
Manufacturer		Year of Introduction	
Max Acceleration Rate (m/s/s)		Service Braking rate (m/s/s)	
Maximum Speed (km/h)		Rotating mass (%)	

Car Details	Unit Length	Unit Width	Unit Height	AW0	AW1	AW2	AW3	AW4
TOTAL	0.00			0	0	0	0	0

Car Details	Total No Of Motors	No Of Axles	No Of Motored Axles	No Of Seats	Standing Space (Square metres)
TOTAL	0	0	0	0	0

Typical Formation	

e.g. DMS+TS+PTS+DMS

AW0 Empty weight of car (kg)

AW1 Weight of the car with fully seated load and driver (kg)

AW2 Weight of the car with fully seated load and driver plus 4 passengers standing per square metre (kg)

AW3 Weight of the car with fully seated load and driver plus 6 passengers standing per square metre (kg)

AW4 Weight of the car with fully seated load and driver plus 8 passengers standing per square metre (kg)

FLU / RLU - General 1

TRSP Train Characteritics Template

TECHNICAL CHARACTERISTICS

Class		Number of cars		AC/DC/Dual		Maximum Power Draw	

AC Characteristics

Maximum power including auxiliary loads (kW)	
Maximum current including auxiliary loads (A)	
Minimum operating voltage (V)	

Auxiliary loads	Current (A)	Power (kW)
Spring		
Summer		
Autumn		
Winter		

Regen braking capable?	
Regen braking enabled?	

DC Characteristics

Maximum power including auxiliary loads (kW)	
Maximum current including auxiliary loads (A)	
Minimum operating voltage (V)	

Auxiliary loads	Current (A)	Power (kW)
Spring		
Summer		
Autumn		
Winter		

Regen braking capable?	
Regen braking enabled?	

Resistance to Motion

Formula used (in Newtons)	$A*m_{train}/t + B*v/(km/h) + C*(v/(km/h))^2$

Coefficients used

	Open Air		Tunnel
A		A	
B		B	
B2 (if used)		B2 (if used)	
C		C	

Power limitations used? (Y/N)	
Maximum power including auxiliary loads without power limitations(kW)	
Maximum current including auxiliary loads without power limitations(A)	

FLU / RLU - General 2

TRSP Train Characteristics Template

TECHNICAL CHARACTERISTICS

Class		Number of cars		AC/DC/Dual		Maximum Power Draw	

For each line current limit: tractive effort and braking effort characteristics shall be provided for the following reference voltages:

AC	DC
12,500V	400V
14,500V	450V
17,000V	500V
19,000V	550V
21,000V	600V
22,500V	650V
24,000V	700V
25,000V	750V
27,500V	800V
29,000V	850V

If the upper and lower Voltage limits of the train do not match those listed above, please use those as the limits for tractive effort and braking effort characteristics and specify:

	AC	DC
Upper limit		
Lower limit		

Line Current limits:		AC	DC
Base Level:	FLU	200A	4000A
	RLU	140A	3000A
Intermediate Level:	FLU	250A	5000A
	RLU	170A	3750A
High Level:	FLU	300A	6800A
	RLU	200A	4500A

FLU / RLU - General 3

TRSP Train Characteristics Template

Class		Number of cars		AC/DC/Dual		Maximum Power Draw	

Tractive effort characteristics - AC

Line Voltage		AC Current Limit	

Speed (km/h)	Tractive effort (kN)	Current (A) including auxiliary load	Efficiency
0			
5			
10			
15			
20			
25			
30			
35			
40			
45			
50			
55			
60			
65			
70			
75			
80			
85			
90			
95			
100			
105			
110			
115			
120			
125			
130			
135			
140			
145			
150			
155			
160			
165			
170			
175			
180			
185			
190			
195			
200			

FLU / RLU - AC TE

TRSP Train Characteristics Template

Class		Number of cars		AC/DC/Dual		Maximum Power Draw	

Tractive effort characteristics - DC

Line Voltage		DC Current Limit	

Speed (km/h)	Tractive effort (kN)	Current (A) including auxiliary load	Efficiency
0			
5			
10			
15			
20			
25			
30			
35			
40			
45			
50			
55			
60			
65			
70			
75			
80			
85			
90			
95			
100			
105			
110			
115			
120			
125			
130			
135			
140			
145			
150			
155			
160			
165			
170			
175			
180			
185			
190			
195			
200			

FLU / RLU - DC TE

TRSP Train Characteristics Template

Class		Number of cars		AC/DC/Dual		Maximum Power Draw	

Braking effort characteristics - AC

Line Voltage		AC Current Limit	

Speed (km/h)	Tractive effort (kN)	Current (A) including auxiliary load	Efficiency
0			
5			
10			
15			
20			
25			
30			
35			
40			
45			
50			
55			
60			
65			
70			
75			
80			
85			
90			
95			
100			
105			
110			
115			
120			
125			
130			
135			
140			
145			
150			
155			
160			
165			
170			
175			
180			
185			
190			
195			
200			

FLU / RLU - AC BE

TRSP Train Characteristics Template

Class		Number of cars		AC/DC/Dual		Maximum Power Draw	

Braking effort characteristics - DC

Line Voltage		DC Current Limit	

Speed (km/h)	Tractive effort (kN)	Current (A) including auxiliary load	Efficiency
0			
5			
10			
15			
20			
25			
30			
35			
40			
45			
50			
55			
60			
65			
70			
75			
80			
85			
90			
95			
100			
105			
110			
115			
120			
125			
130			
135			
140			
145			
150			
155			
160			
165			
170			
175			
180			
185			
190			
195			
200			

FLU / RLU - DC BE

TRSP Train Characteristics Template

Class		Number of cars		AC/DC/Dual		Maximum Power Draw	

Train Resistance

Speed (km/h)	Train resistance (N)
0	
5	
10	
15	
20	
25	
30	
35	
40	
45	
50	
55	
60	
65	
70	
75	
80	
85	
90	
95	
100	
105	
110	
115	
120	
125	
130	
135	
140	
145	
150	
155	
160	
165	
170	
175	
180	
185	
190	
195	
200	

FLU / RLU - Train Resistance

ANNEX J - Thameslink Train Control System Requirements

The following mandatory requirements applicable to the Onboard ETCS/ATO Sub-System have been derived from the Thameslink Train Control Specification (ref: N000 01000-NRT-SPE-EG-000004 V2.10).

When in ATO Mode, the Onboard ETCS/ATO Sub-System shall stop the Unit with the front surface of the driver's cab alongside the appropriate platform stop markers in station areas (with the centre of the Unit positioned at the centre of the platform irrespective of Unit length), and alongside a special stop marker in some intermediate locations.
TTCS-518
TIIS-2107

The Safety Integrity Level assumptions for the ATO, SDO and Power Control functions shall be provided by the TMM, and the safety arguments further developed during the design and development of the Units.
TTCS-525
TIIS-2106

The Onboard ETCS/ATO Sub-System shall consistently support delivery of a platform reoccupation time of not more than 75 seconds in ATO Mode.
TTCS-1026
TIIS-2105

The Onboard ETCS/ATO Sub-System, when operating in ATO Mode, shall consistently support a platform dwell time of not more than 45 seconds and shall be capable of operating at shorter dwell times when required.
TTCS-1027
TIIS-2104

The ATO function shall regulate the speed of the Unit in response to regulation data received from the ATS.
TTCS-536
TIIS-2103

The TMM shall provide a reliability development plan in accordance with EN50126 for the Onboard ETCS/ATO Sub-System.
TTCS-538
TIIS-2102

The TMM shall provide a performance model of ETCS operation in ATO Mode for the Core Area, demonstrating that their proposed solution is capable of supporting 24 tph in the Core Area when integrated into the Thameslink Units and infrastructure.
TTCS-545
TIIS-2101

The TMM shall identify the training needs of the Operator covering the Onboard ETCS/ATO Sub-System equipment and related sub-systems described in this specification and reflect these as appropriate in the Agreed Training Programme.
TTCS-550
TIIS-2100

The Onboard ETCS/ATO Sub-System shall regulate the train speed to optimise energy efficiency, as directed by the ATS.
TTCS-1028
TIIS-2099

The Automatic Train Protection system working through the on-board traction and braking interfaces shall be designed to safely supervise the ATO system while not restricting its performance.
TTCS-561
TIIS-2098

As far as reasonably practicable, the design of level 2 UK onboard ERTMS assemblies shall enable a simple, cost-effective, safe and timely migration path to ETCS Level 3 operations.
TTCS-569
TIIS-2097

The Onboard ETCS/ATO Sub-System shall transition from ETCS Level STM to ETCS Level 2 with a minimum of input and response from the driver.
TTCS-570
TIIS-2096

The Onboard ETCS/ATO Sub-System shall transition from ETCS Level 2 to ETCS Level STM with a minimum of input and response from the driver.
TTCS-1102
TIIS-2095

The TMM shall specify the minimum adhesion required when operating in ATO Mode, to meet the performance specified in TTCS-545.
TTCS-581
TIIS-2094

The Onboard ETCS/ATO Sub-System shall operate to a preset parameterised reduced adhesion level setting, which can be selected by the driver and/or the Trackside ETCS/ATO Sub-System.
TTCS-585
TIIS-2093

The Unit shall provide information to the control centre with the time and location of areas of low wheel/rail adhesion identified by the Unit, as it travels along the route, for use in an adhesion management system.
TTCS-1107
TIIS-2092

The ATO function shall take account of the ETCS adhesion factor when calculating braking demand.
TTCS-1105
TIIS-2091

When in ATO Mode, the Unit shall open all operational doors on the correct side of the Unit automatically as soon as it is safe to do so, based on the speed, braking state and position of the Unit.
TTCS-593
TIIS-2090

The design of driver controls and indications shall facilitate rapid operation by the driver in support of the on-time dispatching of trains.
TTCS-1029
TIIS-2089

A Driver Advisory System shall provide the driver with information on timekeeping compared to the tactical needs of the service which will enable the Unit to meet the system regulation needs as it approaches the Thameslink ETCS Level 2 Area.
TTCS-612
TIIS-2088

The Driver Advisory System shall provide the driver with regulation information that will enable the Unit to be driven at optimum energy consumption when tactical conditions permit.
TTCS-1031
TIIS-2087

The Driver Advisory System on a Unit shall only be available when the Unit is not in ATO Mode.
TTCS-1136
TIIS-2086

The Driver Advisory System shall operate using industry standard timing point locations and definitions, as used in the working timetables.
TTCS-1135
TIIS-2085

The DAS shore based system shall be capable of accepting daily downloads of timetable information in industry standard <.cif > format, sent by the Infrastructure Manager's Train Service Database.
TTCS-1134
TIIS-2084

The onboard DAS function shall start a journey with the latest version of the timetabled timings for that complete journey (origin to destination).
TTCS-1133
TIIS-2083

The onboard DAS function shall accept updated timings for the current journey from the infrastructure at any time.
TTCS-1132
TIIS-2082

The onboard DAS function shall accept an updated stopping pattern for the current journey.
TTCS-1131
TIIS-2081

Updated DAS timings may be based on a switch to a different line on the same route for the current journey.
TTCS-1130
TIIS-2080

The onboard DAS function shall base its advice to the driver on the performance of that Unit against the timetable, using the latest information available.
TTCS-1129
TIIS-2079

The DAS shall be capable of displaying timing advice to the nearest second.
TTCS-1128
TIIS-2078

The driver interface with the DAS including driver controls and content and format of information to be presented shall be agreed with the Operator.
TTCS-1127
TIIS-2077

The information presented to the driver by the DAS shall include advice to the driver on timing and speed of running between timing points including both intermediate timing points and station stops.
TTCS-1126
TIIS-2076

The information presented to the driver by the DAS shall include advice on the desired dwell time at station stops.
TTCS-1125
TIIS-2075

The information presented to the driver by the DAS shall include support for the initiation of the door close sequence at selected station stops, consistent with the desired dwell time.
TTCS-1124
TIIS-2074

The system shall allow the driver to review and confirm their TRN for the journey.
TTCS-1123
TIIS-2073

The information presented to the driver by the DAS for dwell time and door close initiation shall be consistent with that presented when the Unit is operating within the Thameslink ETCS Level 2 Area in ATO Mode.
TTCS-1121
TIIS-2072

When a Unit is operating within the Thameslink Level 2 Area in manual mode, regulation information shall be displayed to the driver through the DAS driver Interface in a format consistent with that displayed outside the Level 2 Area.
TTCS-1120
TIIS-2071

The driver shall be able to inhibit onboard DAS advice at any time.
TTCS-1119
TIIS-2070

The onboard DAS function shall offer no advice to the driver if the timetable information available to it exceeds agreed plausibility limits, compared with the actual location and timing of the train.
TTCS-1118
TIIS-2069

The onboard DAS function shall transmit its location and speed to the infrastructure at each timing point.
TTCS-1117
TIIS-2068

The onboard DAS function shall transmit a message informing the infrastructure on arrival at a station.
TTCS-1116
TIIS-2067

The onboard DAS function shall transmit a message informing the infrastructure on departure from a station.
TTCS-1115
TIIS-2066

The DAS shall be capable of operating over all the public mobile telephone/data networks.
TTCS-1114
TIIS-2065

The onboard DAS function shall continue to provide accurate advice to the driver based on the most recent timetable update available to it when interruptions in communications occur.
TTCS-1113
TIIS-2064

All messages from the onboard DAS function system to the infrastructure shall be stamped with the event time using UTC.
TTCS-1112
TIIS-2063

The Unit shall include a self-test function for the DAS communications with the infrastructure. Faults shall be notified to the driver.
TTCS-1111
TIIS-2062

Data storage for ATO, SDO and Power changeover and current limiting subsystems shall be designed to support early reliability analysis during commissioning stages prior to their full implementation.
TTCS-623
TIIS-2061

The TMM shall agree with the Operator an onboard solution to prevent fitted Units transitioning to ETCS Level 2, for use if the driver has not been passed to operate in ETCS Level 2, following commissioning of the trackside ETCS Level 2 equipment, or if the Unit is for some technical reason not approved to operate in ETCS Level 2.

TTCS-1137

TIIS-2060

The TMM shall provide an Onboard ETCS/ATO Sub-System migration plan that supports the three-stage commissioning approach detailed in the TTCS and will support identification of Onboard ETCS/ATO Sub-System related requirements of the trackside and control centre infrastructure that will be required to support this plan.

TTCS-628

TIIS-2059

The TMM shall support identification of the facilities required to be provided by the Infrastructure Manager to fully support dynamic testing of the ATO/ETCS and associated subsystems at HNIF and in the Core Area.

TTCS-981

TIIS-2058

Relevant ATO performance data, including accurate stopping information, shall be captured automatically by the Onboard ETCS/ATO Sub-System for subsequent analysis.

TTCS-636

TIIS-2057

The TMM shall deliver the Integration Laboratory Train Equipment (ILTE) as defined in the Manufacture & Supply Agreement.

TTCS-1140

TIIS-2056

The TMM shall provide an outline test, validation and integration plan for the Onboard ETCS/ATO Sub-System.

TTCS-645

TIIS-2055

The TMM shall identify the activities that it will need to undertake at the Systems Integration Laboratory, HNIF and the Thameslink route to provide evidence in support of the test, validation, integration and approvals plans.

TTCS-646

TIIS-2054

The TMM shall identify the operations and driver actions that are required to set up a Thameslink cab in preparation for operation in ETCS/ATO.

TTCS-1032

TIIS-2053

Data entry task loading and the time taken shall be reduced as far as reasonably practicable, taking into consideration the fact that the Thameslink trains are fixed formation Units.

TTCS-1038

TIIS-2052

On ETCS 'start-up', failure of one or both EDORs to connect to the GSM-R network shall be indicated to the driver.

TTCS-1145

TIIS-2051

In the event of failure of an EDOR to connect to the GSM-R network at 'start-up', sufficient information shall be presented to enable the driver to determine whether the failure is just one data radio or both data radios.

TTCS-1144

TIIS-2050

When unable to operate in ATO Mode, the driver shall be able to continue operation of the service through the ETCS Level 2 Area in ETCS Level 2 under manual control.

TTCS-1033

TIIS-2049

When unable to operate in ETCS Level 2, the driver shall be able to continue operation of the service through the ETCS Level 2 Area in ETCS Level STM.

TTCS-659

TIIS-2048

If the Onboard ETCS Sub-System transitions to SF (System Failure) mode, the driver shall be able to continue operation of the service through the ETCS Level 2 Area with the ETCS equipment isolated and in IS mode with TPWS/AWS protection.

TTCS-Draft 136

TIIS-2047

It shall be possible for the ATO function of the Onboard ETCS/ATO Sub-System to be disabled by the Trackside ETCS/ATO Sub-System in a specified area, despite all system components being available and functioning correctly.

TTCS-663

TIIS-2046

The Onboard ETCS/ATO Sub-System shall only disable the ATO function on command of the Trackside ETCS/ATO Sub-System when the Unit is stationary.

TTCS-1150

TIIS-2045

The TMM shall, using Human Factors assessment and ergonomic design techniques, design all alarms as an integrated system to correctly alert or advise the driver.

TTCS-692

TIIS-2044

Provision shall be made to connect a "repeater DMI" for the use of trainers during driver training or competence assessment. Any connector provided for this purpose shall be mounted behind a lockable cover, which is locked by a common unique key that will only be issued to the Driver Trainers. This display will be active at the same time as the main DMI.

TTCS-695

TIIS-2043

The TMM shall define the differences between the ATO driving profile and the ETCS permitted speed in the Ceiling Speed, Target Speed and Release Speed Monitoring areas (CSM, TSM and RSM areas).
TTCS-712
TIIS-2042

The ATO function shall regulate the train speed within +/- 2kph of the ATO speed.
TTCS-714
TIIS-2041

The ATO function shall avoid unnecessary transitions in tractive effort and braking.
TTCS-716
TIIS-2040

In case of failure of the automatic traction power changeover, the driver shall be alerted by means of an unambiguous indication and audible annunciation.
TTCS-728
TIIS-2039

If the Unit is carrying out platform duties at the time of failure of the automatic traction power changeover, then ATO shall be disengaged.
TTCS-730
TIIS-2038

If the Unit is travelling to the next station at the time of failure of the automatic traction power changeover, then the Unit shall continue to the next station, open the doors, and then disengage the ATO.
TTCS-732
TIIS-2037

The TMM shall define how regulation instructions received by the Onboard ETCS/ATO Sub-System are displayed to the driver.
TTCS-614
TIIS-2036

The Onboard ETCS/ATO Sub-System shall be able to receive and respond to ATS controls sent from the Trackside ETCS/ATO Sub-System using the ETCS Packet 44 protocol.
TTCS-1034
TIIS-2035

The Onboard ETCS/ATO Sub-System shall be designed such that ATO caused train delays with a duration of 2 minutes or more shall occur less than once every 10,000 train kilometres in ATO Mode.
TTCS-745
TIIS-2034

The Onboard ETCS/ATO Sub-System shall be designed such that ATP (ETCS) caused train delays with a duration of 2 minutes or more shall occur less than once every 250,000 train kilometres.
TTCS-747
TIIS-2033

ETCS commands and controls shall have precedence over commands and controls from the ATO function.
TTCS-749
TIIS-2032

The driver vigilance system on the Unit shall remain active when operating in ATO Mode.
TTCS-1083
TIIS-2031

ATO shall be automatically disabled at, or on approach to, the ETCS Level 2 to ETCS Level STM transition border in a way that enables a safe transition to manual driving.
TTCS-1159
TIIS-2030

The TMM shall support the Operator and Infrastructure Manager in demonstrating that the safety risk associated with the solution chosen for automatically disabling ATO at, or on approach to, the ETCS Level 2 to ETCS Level STM transition border is as low as reasonably practicable.
TTCS-1157
TIIS-2029

The warning limit for the ETCS release speed shall be set in conjunction with the Operator as a fixed parameter as part of the Unit configuration.
TTCS-1155
TIIS-2028

The warning limit for the ETCS release speed shall be either a fixed level below release speed, or a percentage of release speed.
TTCS-1153
TIIS-2027

The TMM shall specify the ETCS braking model that will be used and the corresponding requirements applicable to the Trackside ETCS/ATO Sub-System.
TTCS-503
TIIS-2026

The ATO function shall control the Unit’s arrival time at a platform in response to regulation data received from the ATS.
TTCS-760
TIIS-2025

For station stops the ATO function shall stop the Unit within +/-0.5m of the defined stopping point for 99.99% of station stops at each platform.
TTCS-764
TIIS-2024

The TMM shall identify what additional trackside infrastructure (for instance additional Eurobalise, proximity plates, docking loops etc) will be required to be provided by the Infrastructure Manager in order to achieve the specified stopping accuracy.
TTCS-769
TIIS-2023

The TMM shall plan a stopping accuracy demonstration to validate the stopping accuracy using HNIF and trials in the ETCS Level 2 Area.
TTCS-771
TIIS-2022

The Onboard ETCS/ATO Sub-System shall match its Unit length to the correct stopping position for that length of Unit at each station.
TTCS-773
TIIS-2021

When operating in ATO Mode, Units that stop more than ±5m from the stopping point shall remain in the station with the doors closed. An alarm will alert the driver.
TTCS-780
TIIS-2020

The Onboard ETCS/ATO Sub-System shall skip stop any single station, in response to a command input by the driver before leaving the preceding station.
TTCS-786
TIIS-2019

The driver's controls shall allow automatic door opening to be inhibited at any time prior to the Unit's arrival in a platform.
TTCS-1039
TIIS-2018

The ability of the driver or guard to close the doors, at any time, shall not be limited by the Onboard ETCS/ATO Sub-System.
TTCS-812
TIIS-2017

The Onboard ETCS/ATO Sub-System shall not automatically close the Unit doors, or inhibit the closing of the doors.
TTCS-814
TIIS-2016

The Onboard ETCS/ATO Sub- System shall inhibit the Unit departure until all doors are reported closed and locked.
TTCS-816
TIIS-2015

The driver shall initiate Unit movement by activating the ATO start button at platforms and to restart movement whenever ATO has been disengaged, whether by emergency brake application or otherwise.
TTCS-818
TIIS-2014

The ATO function shall respond to dwell time regulation data received from the ATS by indicating to the driver when it is time to commence the door closure sequence.
TTCS-821
TIIS-2013

The TMM shall provide details of how they have mitigated against single point failures, and how their proposed Onboard ETCS/ATO Sub-System will operate under failure conditions.
TTCS-830
TIIS-2012

The TMM shall identify any elements of trackside infrastructure that it will require to be provided by the Infrastructure Manager in order to operate the Units under degraded modes.
TTCS-832
TIIS-2011

The Driver Machine Interface (DMI) for the ETCS shall conform to the ETCS Driver Machine Interface specification, ERA-ERTMS-015560, at the applicable version referenced in the CCS TSI.
TTCS-845
TIIS-2010

When in STM National (SN) mode, the AWS shall be enabled and operational.
TTCS-850
TIIS-2009

When in STM National (SN) mode, the TPWS shall be enabled and operational.
TTCS-852
TIIS-2008

The DMI speedometer selection shall be automatic according to the following criteria:
NID_C = 2, mph units
NID_C $\neq$ 2, kph units
The mph equivalent values shall be displayed directly without any rounding.
TTCS-855
TIIS-2007

It shall be clear and obvious to the driver which speed unit the DMI is displaying at any particular time.
TTCS-970
TIIS-2006

The speedometer display shall use the same ‘pointer’ position to indicate the speed regardless of which units of measurement are in use.
TTCS-859
TIIS-2005

An alarm and indication shall be provided to advise the driver of the current operating mode.
TTCS-864
TIIS-2004

An indication shall be provided to the driver when the accurate stop feature has been achieved.
TTCS-865
TIIS-2003

An indication shall be provided to the driver to indicate that the Unit has overshot the accurate stop position.
TTCS-1036
TIIS-2002

An indication shall be provided to the driver of any requirements to either skip stop the next station, or that the ATO has applied a station hold control. These indications can be presented to the driver via the text message field of the ETCS DMI.
TTCS-866
TIIS-2001

When in ATO Mode and the Unit is stopped in a station, an indication shall be provided to the driver giving a countdown of the remaining dwell time, and advise on when to select closed door and traction controls.
TTCS-867
TIIS-2000

When ATO is available for the driver to use (i.e. it is operational and communicating with the ATS), the driver is responsible for initiating ATO.
TTCS-870
TIIS-1999

The TMM shall propose the methodology by which the driver engages ATO and initiates train movement under ATO.
TTCS-1167
TIIS-1998

The ATO shall provide the driver with an indication(s) that has three states:
1.) ATO unavailable (the Unit is not in ETCS Level 2, FS mode or ATO is not operating);
2.) ATO available (the Unit is in ETCS Level 2, FS mode, but ATO is not selected);
3.) ATO selected (the Unit is in ATO Mode).
TTCS-1166
TIIS-1997

The ETCS DMI shall be capable of displaying "Pantograph Raise / Lower" indication.
TTCS-873
TIIS-1996

In the case of a screen failure of the ETCS DMI, it shall be possible to continue basic operation.
TTCS-884
TIIS-1995

In the event of an ETCS DMI screen failure, switchover to an alternative means of continuing basic operation shall be made by a simple, deliberate action by the driver.
TTCS-886
TIIS-1994

The application layer for ATO shall be developed to support bi-directional communication such that the Onboard ETCS/ATO Sub-System can be extended to interface with Platform Screen Doors in the future.

TTCS-897

TIIS-1993

The TMM shall advise whether new or novel trackside equipment or updates to existing application rules/standards/procedures must be provided by the Infrastructure Manager to support operation of AWS, TPWS and SDO.

TTCS-978

TIIS-1992

The TMM shall advise the measures necessary (for example, suppression of alarms, provision of “confidence” balises throughout the network etc.) to provide confidence of complete system operation during the migration and staged commissioning of the Units.

TTCS-979

TIIS-1991

The ETCS Packet 44 message constructs defined for ATO, SDO and Power Changeover sub-systems shall contain parameters that define the validity of the messages in order to support staged commissionings.

TTCS-914

TIIS-1990

The Onboard ETCS/ATO Sub-System shall not act on ETCS Packet 44 messages that are identified for commissioning dates and times that are in the future, beyond the current system date and time.

TTCS-916

TIIS-1989

Where time-stamping is used as part of the interface protocol between Unit and trackside, the timestamp shall relate to the time at which the transmitted data becomes valid and be accurate to 3 seconds with respect to UTC.

TTCS-1171

TIIS-1988

The transport, network and data link layers for the ETCS and ATO radio link shall to the EuroRadio Functional Interface Specification, SUBSET-037 at the applicable version referenced in the CCS TSI.

TTCS-930

TIIS-1987

The physical layer for the ETCS and ATO GSM-R radio link shall conform to the EuroRadio Interface Group UIC document reference A 11 T 6001, ‘Radio Transmission FFFIS for EuroRadio’ at the applicable version referenced in the CCS TSI.

TTCS-953

TIIS-1986

The physical layer for the ATO, SDO and Power Control ETCS Packet 44 fixed information shall conform to the 'FFFIS for Eurobalise', document reference SUBSET-036 at the applicable version referenced in the CCS TSI.

TTCS-955

TIIS-1985

The Onboard ETCS/ATO Sub-System shall check train data values against a range of realistic or feasible Unit specific values and shall not accept an entry that is outside of that range.

TTCS-1179

TIIS-1984

The Train Running Number, entered as part of the information provided by the driver to the Onboard ETCS/ATO Sub-System shall be a unique eight-digit numeric or eight-character alpha-numeric code in accordance with the UK Specific Case on TRNs.

TTCS-1178

TIIS-1983

The TMM shall document the requirements for the identification of big metal masses and the rules associated with the placement of balises marking big metal masses.

TTCS-1177

TIIS-1982

SCHEDULE 1.3

Train Technical Description

This Schedule is recorded electronically in accordance with clause 4.19

[][192]

[192] Redaction.

SCHEDULE 1.4

[]

[193]

This Schedule is recorded electronically in accordance with clause 4.19

[][194]

193 Redaction.

194 Redaction.

SCHEDULE 1.5

[]

This Schedule is recorded electronically in accordance with clause 4.19

[][196]

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195 Redaction.

196 Redaction.

SCHEDULE 1.6

TIIS Interface

This Schedule is recorded electronically in accordance with clause 4.19

MSA Schedule 1.6

TIIS Interface

When a term in the column marked "TIIS" in the table below is used in the TIIS, it shall be interpreted to mean the corresponding term in the column marked "MSA".

TIIS	**MSA**
Train Infrastructure Interface Specification	TIIS
European Technical Specifications for Interoperability (TSI)	has the meaning given to it in Schedule 1.4 (*Relevant Laws and Standards*)
Train Manufacturer and Maintainer	TMM
New Thameslink Rolling Stock *or* TL KO2 Stock	Units
Train Operating Company *or* TOC	Train Operator
Train Technical Specification *or* train technical specification	TTS
MSA for Thameslink Units	MSA
Thameslink Units	Units
HMI	human machine interface
SMS	has the meaning given to it in the Safety Regulations
Process for Assessment of Compatibility	the process set out in GE/RT 8270 issue 2
EMC Directives	Directive 2004/108/EC of the European Parliament und of the Council Directive on the

TIIS	MSA
	Approximation of the Laws of the Member States Relating to Electromagnetic Compatibility and Repealing Directive 89/336/EEC
PRM TSI	has the meaning given to it in Schedule 1.4 (*Relevant Laws and Standards*)
Main route (and associated notes in the 'Key' section)	for information purposes only, and shall have no bearing on the interpretation of this Agreement
Depot route (and associated notes in the 'Key' section)	for information purposes only, and shall have no bearing on the interpretation of this Agreement
Feasibility route (and associated notes in the 'Key' section)	for information purposes only, and shall have no bearing on the interpretation of this Agreement
Diversion route (and associated notes in the 'Key' section)	for information purposes only, and shall have no bearing on the interpretation of this Agreement
Deployment route (and associated notes in the 'Key' section)	for information purposes only, and shall have no bearing on the interpretation of this Agreement
Train Technical Description	TTD
FLU	Type 1 Unit
RLU	Type 2 Unit
Thameslink trains *or* Thameslink Units	Units
Manufacture & Supply Agreement	MSA
ILTE	Integration Laboratory Train Equipment
Thameslink Performance Core	Performance Core
Thameslink routes	the routes set out in Annex B of the TIIS
CCS TSI *or* TSIs for Command, Control and Signalling of the High Speed Rail	"CR CCS TSI" as defined in Schedule 1.4 (*Relevant Laws and Standards*)

TIIS	MSA
and Conventional Rail Systems	

SCHEDULE 2

DESIGN

Schedule 2.1: **The Design Review Process**

Schedule 2.2: **CONOPS**

SCHEDULE 2.1

The Design Review Process

[][197]

[197] Redaction.

SCHEDULE 2.2

CONOPS

[][198]

[198] Redaction.

SCHEDULE 3

APPROVALS

Schedule 3.1: **Approvals Plan**

Schedule 3.2: **Stepping Distances: List of Platforms**

SCHEDULE 3.1

Approvals Plan

[][199]

[199] Redaction.

SCHEDULE 3.2

Stepping Distances: List of Platforms

[][200]

[200] Redaction.

SCHEDULE 4

TESTING

Schedule 4.1: **Requirements for Agreed Testing Programme**

Schedule 4.2: **ERTMS/ATO Testing Support**

SCHEDULE 4.1

Requirements for Agreed Testing Programme

[][201]

[201] Redaction.

SCHEDULE 4.2

ERTMS/ATO Testing Support

[][202]

[202] Redaction.

SCHEDULE 5

QUALITY PLAN

Schedule 5: Quality Plan

[][203]

[203] Redaction.

SCHEDULE 6

DELIVERY AND ACCEPTANCE

Schedule 6: Delivery and Acceptance

Appendix 1: []204

Appendix 2: **Form of Provisional Acceptance Certificate**

Appendix 3: **Form of Qualified Provisional Acceptance Certificate**

Appendix 4: **Form of Final Acceptance Certificate**

Appendix 5: **Form of Fleet Acceptance Certificate**

Appendix 6: **Form of Spares Acceptance Certificate**

Appendix 7: **Form of Special Tools Acceptance Certificate**

Appendix 8: **Form of Mock-up Acceptance Certificate**

Appendix 9: **Form of Integrated Laboratory Train Equipment Acceptance Certificate**

Appendix 10: **Form of Simulator Acceptance Certificate**

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204 Redaction.

SCHEDULE 6

Delivery and Acceptance

1. DELIVERY

Contract Programme

1.1 The TMM shall tender the Units, Simulators, Owned Spares, Special Tools, Mock-Up and Integration Laboratory Train Equipment for delivery and acceptance in accordance with the Contract Programme. There shall be no obligation on:

(a) the Owner, acting reasonably, to accept a Unit, Simulator, Owner Owned Spare and/or Special Tool under paragraph 3.1 prior to the Expected Delivery Date for such Unit, Simulator, Owner Owned Spare or Special Tool notwithstanding that the applicable criteria for Acceptance set out in this Schedule 6 have been satisfied in relation to that Unit, Simulator, Owned Spare or Special Tool; or

(b) the Operator, acting reasonably, to:

(i) accept the Mock-Up, any Operator Owned Spares and/or any item of the Integration Laboratory Train Equipment prior to the Expected Delivery Date for such Mock-Up, Operator Owned Spare or Integration Laboratory Train Equipment notwithstanding that the applicable criteria set out in this Schedule 6 have been satisfied in relation to such Mock-Up, Operator Owned Spare or Integration Laboratory Train Equipment; or

(ii) confirm, as required pursuant to this Schedule 6, its satisfaction that the applicable conditions for Acceptance set out in this Schedule 6 have been fulfilled in relation to a Unit, Owner Owned Spare, Special Tool or Simulator prior to the Expected Delivery Date for that Unit, Owner Owned Spare, Special Tool or Simulator, notwithstanding that such conditions have been satisfied in relation to that Unit, Owner Owned Spare, Special Tool or Simulator.

Tendering Units for Provisional Acceptance

1.2 [][205]

1.3 [][206]

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[205] Redaction.

[206] Redaction.

2. []207

3. PROVISIONAL ACCEPTANCE

Provisional Acceptance Conditions

3.1 Subject to paragraph 1.1, the TMM shall tender for Provisional Acceptance each Unit at the specified Designated Depot or such other location as may be agreed in advance between the Parties acting reasonably. Subject to paragraph 5 (*No Obligation to Accept Units with MSA Faults*) and paragraph 2 []208 of Schedule 14 (*Design Life, Warranties and MSA Fault Rectification*), the Owner shall not be obliged to accept a Unit for Provisional Acceptance by issuing a Provisional Acceptance Certificate pursuant to paragraph 3.11 unless:

(a) []209

(b) such Unit has the Relevant Approvals (in accordance with the Approvals Plan) to operate the Train Plan with passengers, including an Authorisation For Placing Into Service;

(c) such Unit's tare load, determined in accordance with clauses 19.10 and 19.11:

(i) in the case of a Type 1 Unit is no more than []210; and

(ii) in the case of a Type 2 Unit is no more than []211;

(d) such Unit is Fit for Purpose (MSA) other than in relation to having the Relevant Approvals for which paragraph 3.1(b) applies;

(e) all requisite Manuals and Delivery Documentation for that Unit have been delivered to the Owner and the Operator;

(f) such Unit complies with Applicable Laws and Standards (save where such compliance is due to the application of any Derogation which is temporary in nature and where the TMM is responsible for resolving the issue which created the requirement for the temporary Derogation);

(g) such Unit has been maintained in accordance with the Pre-Acceptance Maintenance Plan;

(h) the Special Tools, the TMM Owned Spares and the Owned Spares have all been delivered to the relevant Designated Depots or other location agreed between the Parties (acting reasonably), in each case, of the types and quantities specified in the relevant list agreed in accordance with clause 4.5 and the Contract Programme as being due for delivery on or before the Acceptance of the relevant Unit, and in each case, are available for use by the TMM under the TSA, or in the case of the Operator Owned Spares, by the Operator;

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207 Redaction.

208 Redaction.

209 Redaction.

210 Redaction.

211 Redaction.

(i) []212, the TMM is in a position to perform its obligations under the TSA, or where the TSA has been terminated, a Third Party Maintainer (or the Operator, if it has elected to self-maintain the Units in accordance with paragraph 3.11 of schedule 12.2 (*Termination of the TSA*) of the Lease) would be able to perform its equivalent obligations to, amongst other things, maintain, repair and modify the Accepted Units in accordance with all Applicable Laws and Standards, the Maintenance Plan and the Manuals, in each case at the relevant Designated Depot in relation to such Unit;

(j) []213

(k) the testing set out in the Acceptance Testing Matrix has been successfully completed in accordance with the Acceptance Testing Documentation;

(l) the TMM has complied with its obligations under the Agreed Training Programme;

(m) []214

(n) []215

(o) []216

(p) the Operator, acting reasonably, confirms that it is satisfied that the conditions set out in paragraphs 3.1(a) to (o) inclusive have been fulfilled, by countersigning the relevant Provisional Acceptance Certificate and delivering such certificate to the Owner;

(q) []217

(r) []218

MSA Fault Free Running

3.2 Each time a Fault occurs to a Unit during the relevant period of Fault Free running required pursuant to paragraph 1.3 or 1.4 of Schedule 4.1 (*Requirements for Agreed Testing Programme*) which Fault would have caused a Service Failure if such Fault occurred to a Unit had such Unit been delivering a Diagram, other than a Fault resulting from an Excluded Matter, then for the purpose of Fault Free running, the milometer of the relevant Unit shall be re-set to zero and that Unit shall restart that Fault Free running in accordance with the requirements of paragraph 1.3 or 1.4 of Schedule 4.1 (*Requirements for Agreed Testing Programme*), as appropriate.

3.3 The Owner and the Operator may jointly agree to reduce the mileage requirement specified in paragraph 1.4 of Schedule 4.1 (*Requirements for Agreed Testing Programme*)

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212 Redaction.

213 Redaction.

214 Redaction.

215 Redaction.

216 Redaction.

217 Redaction.

218 Redaction.

from no less than []219 consecutive Fault Free miles to any lesser amount where the TMM is able to demonstrate to the Owner's and the Operator's satisfaction that the testing of any Units to which that Fault Free mileage requirement applies will be carried out on infrastructure properly representative of the Thameslink Network.

Consultation

3.4 Following the tender for Provisional Acceptance of any Unit by the TMM pursuant to paragraph 3.1, the Owner and the Operator shall consult (including the TMM in those consultations as appropriate) for such reasonable period as is appropriate for the purpose of determining:

(a) whether or not the conditions set out in paragraphs 3.1(a) to (o) (inclusive) and paragraphs 3.1(q) and (r) have been satisfied; and

(b) if such conditions have not all been satisfied, whether or not a Qualified Provisional Acceptance Certificate could be issued pursuant to paragraph 4 (*Qualified Provisional Acceptance*).

Operator's Confirmation

3.5 If the TMM, acting reasonably, believes that the conditions specified in paragraph 3.1 have been satisfied and the Operator has not issued a confirmation pursuant to paragraph 3.1(p), the TMM may (unless the Owner and/or the Operator has issued an Initial Statement in accordance with paragraph 3.7 or 3.8 that has not been withdrawn, addressed by a plan successfully implemented in accordance with paragraph 3.10 or determined to be incorrect pursuant to paragraph 14 (*Acceptance Disputes*)) issue a written notice to the Operator (which shall be copied to the Owner), requiring the Operator to issue such a confirmation pursuant to paragraph 3.1(p) or to issue an Initial Statement in accordance with paragraph 3.7 to the TMM (which shall be copied to the Owner), setting out the reasons for the Operator withholding its confirmation pursuant to paragraph 3.1(p) in relation to that Unit.

3.6 If within five Working Days of receipt of a notice under paragraph 3.5, the Operator neither issues a confirmation pursuant to paragraph 3.1(p), nor issues an Initial Statement pursuant to paragraph 3.7, the Operator shall be deemed to have (a) issued a confirmation pursuant to paragraph 3.1(p); and (b) countersigned a Provisional Acceptance Certificate in relation to that Unit.

3.7 If the Operator, acting reasonably and having consulted the Owner and/or the TMM in accordance with paragraph 3.4, believes that the conditions specified in paragraphs 3.1(a) to (o) (inclusive) have not been satisfied, the Operator, shall issue an Initial Statement to the TMM on the day of such Unit being rejected for Provisional Acceptance. The Operator shall issue, within two Working Days of the date of the issue of the Initial Statement, a Detailed Statement to the TMM.

3.8 If the Owner, acting reasonably and having consulted the Operator and/or the TMM in accordance with paragraph 3.4, believes that the conditions specified in paragraphs 3.1(a) to (o) (inclusive) and paragraphs 3.1(q) and (r) have not been satisfied, the Owner shall issue an Initial Statement to the TMM on the day of such Unit being rejected for Provisional Acceptance. The Owner shall issue, within two Working Days of the date of the issue of the Initial Statement, a Detailed Statement to the TMM.

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219 Redaction.

Failure to Satisfy Provisional Acceptance Conditions

3.9 If the Owner or the Operator has issued an Initial Statement to the TMM pursuant to paragraph 3.7 or paragraph 3.8, as the case may be that a Unit has failed to comply with any provision of paragraph 3.1 and that the Owner and/or the Operator (as applicable) will not agree to issue a Qualified Provisional Acceptance Certificate in relation to such Unit, and the TMM acting reasonably, agrees that the conditions specified in paragraph 3.1 have not been satisfied, then the TMM shall promptly submit a written plan to the Owner and the Operator confirming the rectification work it plans to carry out to ensure that that Unit meets the requirements of paragraph 3.1.

3.10 The TMM shall implement the plan submitted pursuant to paragraph 3.9 as soon as reasonably practicable thereafter in accordance with its terms. Following such rectification, the TMM shall re-present the relevant Unit for Provisional Acceptance in accordance with paragraph 3.1.

Satisfaction of Provisional Acceptance Conditions

3.11 When the Owner and the Operator agree (or it is determined pursuant to paragraph 14) that the conditions specified in paragraphs 3.1(a) to (o) (inclusive) and paragraphs 3.1(q) and (r) have been fulfilled with respect to a Unit:

(a) the Operator shall (prior to the Owner signing the Provisional Acceptance Certificate pursuant to sub-paragraph (b)) countersign and deliver to the Owner a Provisional Acceptance Certificate with respect to such Unit; and

(b) the Owner shall sign and issue that Provisional Acceptance Certificate to the TMM,

and, upon signature by the Owner of the Provisional Acceptance Certificate, Provisional Acceptance of such Unit shall occur; and

(c) the TMM shall promptly countersign the Provisional Acceptance Certificate by way of acknowledgement and deliver it to the Owner (with a copy to the Operator and the Bond Provider).

3.12 If the Owner and/or the Operator has advised the TMM pursuant to paragraphs 3.7 and/or 3.8 (as applicable) that a Unit has failed to satisfy the conditions specified in paragraph 3.1 and the TMM acting reasonably, does not agree that the conditions specified in paragraph 3.1 remain unsatisfied, then an Acceptance Dispute shall have arisen and paragraph 14 (*Acceptance Disputes*) shall apply.

4. QUALIFIED PROVISIONAL ACCEPTANCE

Right to issue a Qualified Provisional Acceptance Certificate

4.1 Without prejudice to paragraph 5 (*No Obligation to Accept Units with MSA Faults*) and paragraph 2 []²²⁰ of Schedule 14 (*Design Life, Warranties and MSA Fault Rectification*), if:

(a) all of the conditions for Provisional Acceptance set out in sub-paragraphs 3.1(b) (unless such failure relates only to conditions imposed on the Authorisation For Placing Into Service), 3.1(f) (unless such failure relates only to the application of any

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220 Redaction.

Derogation which is temporary in nature where the TMM is responsible for resolving the issue which created the requirement for the temporary Derogation), 3.1(i), 3.1(q) and 3.1(r) have been satisfied;

(b) one or more of the other conditions for Provisional Acceptance set out in paragraph 3.1 has not been satisfied; and

(c) the Operator provides a confirmation to the Owner and the TMM that it would agree to the delivery by the Owner of that Unit for leasing under the Lease in accordance with paragraph 4.2,

then the Owner shall be entitled, but shall not be obliged (save to the extent of its obligation to act reasonably in exercising this discretion following the issue of a Primary Period Termination Notice as provided in paragraph 2.3 of Part 2 (*Owner Default of Lease*) of schedule 2.4 (*Early Termination of the Lease*) of the Umbrella Agreement), to accept a Unit for Qualified Provisional Acceptance, in which case the Owner shall, pursuant to paragraph 4.6, issue a Qualified Provisional Acceptance Certificate which shall contain:

(i) a detailed list of outstanding conditions (as agreed between the Owner, the Operator and the TMM) to be satisfied and tasks to be performed by the TMM in order for full Provisional Acceptance of the Unit to occur (the ***Preconditions***);

(ii) a timetable agreed between the Owner, the Operator and the TMM by which the TMM is required to satisfy the Preconditions in relation to a Unit (the ***Preconditions Timetable***); and

(iii) a statement that all Preconditions must be completed on or before the date on which Final Acceptance of the Unit is scheduled to occur pursuant to the Contract Programme.

4.2 If, following the issue of an Initial Statement pursuant to paragraph 3.7 and/or 3.8, the Operator is satisfied that:

(a) the conditions set out in sub-paragraphs (a) and (b) of paragraph 4.1 (other than the satisfaction of paragraphs 3.1(q) and (r)) apply;

(b) the relevant Unit can be operated safely and in accordance with all Applicable Laws and Standards and the terms of all Relevant Approvals; and

(c) it would (in its absolute discretion) agree to the delivery by the Owner of that Unit for leasing under the Lease,

it shall promptly confirm the same in writing to the Owner and the TMM, including the Operator's opinion as to the relevant Preconditions and Preconditions Timetable that should apply to a Qualified Provisional Acceptance Certificate issued in relation to that Unit.

4.3 If the Operator provides the information referred to in paragraph 4.2 to the Owner and the TMM, the Owner and the TMM shall review such information and, unless the Owner considers that a Qualified Provisional Acceptance Certificate should not be issued in relation to the relevant Unit, the Owner shall promptly notify the TMM (copied to the Operator) of its intention to issue a Qualified Provisional Acceptance Certificate pursuant to paragraph 4.6.

4.4 Promptly following the delivery of a notice pursuant to paragraph 4.3, the Parties shall consult to seek to agree the relevant Preconditions and, subject to paragraph 4.7, the

Preconditions Timetable that should be included in the relevant Qualified Provisional Acceptance Certificate.

4.5 If the Owner and the Operator have agreed to issue a Qualified Provisional Acceptance Certificate in relation to a Unit pursuant to paragraph 4.1 but the Parties are unable to agree upon the relevant Preconditions and Preconditions Timetable within 5 Working Days of commencing consultation in accordance with paragraph 4.4, then an Acceptance Dispute shall have arisen and paragraph 14 (*Acceptance Disputes*) shall apply in relation to the determination of such Preconditions and/or the Preconditions Timetable.

4.6 Once the relevant Preconditions and the Preconditions Timetable have been agreed between the Parties or determined pursuant to paragraph 14:

(a) the Operator shall (prior to the Owner signing the Qualified Provisional Acceptance Certificate pursuant to sub-paragraph (b)) countersign and deliver to the Owner a Qualified Provisional Acceptance Certificate with respect to the relevant Unit; and

(b) the Owner shall sign and issue that Qualified Provisional Acceptance Certificate to the TMM,

and, upon signature by the Owner of the Qualified Provisional Acceptance Certificate, Qualified Provisional Acceptance of such Unit shall occur; and

(c) the TMM shall promptly countersign the Qualified Provisional Acceptance Certificate by way of acknowledgement and deliver it to the Owner (with a copy to the Operator and the Bond Provider).

Taking Units out of service

4.7 The TMM acknowledges and agrees that the Owner and the Operator shall agree the Preconditions Timetable referred to in paragraph 4.1(ii) on the basis that the number of Units of any Unit Type to be taken out of service for the purposes of carrying out work to satisfy the Preconditions at any one time (each a ***Conditional QPAC Unit***) will not result in the number of Units of that Unit Type that will be Available on any day in a Railway Period being less than the Availability Benchmark for that Unit Type for that day, unless the Owner and the Operator otherwise agree.

Implementation of Preconditions Timetable

4.8 The TMM shall implement the Preconditions Timetable in accordance with its terms. Notwithstanding the provisions of paragraph 4.7, following the agreement of the Preconditions Timetable, the TMM shall notify the Owner and Operator promptly if the TMM anticipates that it will not be able to comply with the Preconditions Timetable and shall provide the Operator (with a copy to the Owner) with at least 12 weeks' written notice of the details of any proposed departure from the Preconditions Timetable where:

(a) that departure will involve the TMM taking alternative and/or accelerated steps to complete the Preconditions Timetable on time and, as a result, the TMM will need to take more Conditional QPAC Units of any Unit Type out of service on any day in a Railway Period than permitted by the Preconditions Timetable; and

(b) the number of Units of that Unit Type that will be Available on that day will be:

(i) less than the Availability Benchmark for that Unit Type and that day; or

(ii) where the Preconditions Timetable permits the number of Units that are Available for that Unit Type and that day to be less than that Availability Benchmark, reduced further below the number of Units of that Unit Type that are permitted by the Preconditions Timetable.

4.9 The Owner and the Operator shall respond promptly to any notification by the TMM pursuant to paragraph 4.8.

Availability below benchmark

4.10 Notwithstanding the provisions of paragraph 4.7, if the TMM takes a Conditional QPAC Unit of any Unit Type out of service on any day in a Railway Period and the number of Units of that Unit Type that will be Available on that day is less than the Availability Benchmark for that Unit Type and that day, then the TMM shall pay the Operator liquidated damages (as compensation for loss and not as a penalty):

(a) in respect of each day that such Conditional QPAC Unit is taken out of service, at the rate of [][221] per Vehicle per day from the date that Conditional QPAC Unit is taken out of service up to and including the date on which that Conditional QPAC Unit is returned in a condition which enables the Operator to operate that Conditional QPAC Unit in service; and

(b) in respect of the number of other Units that are less than the Availability Benchmark for that Unit Type in accordance with the terms of the TSA.

Invoicing

4.11 Any amounts payable under paragraph 4.10 shall be invoiced by the Operator at the end of each Railway Period and paid by the TMM within 28 days of receipt by the TMM of such invoice. The payment of liquidated damages by the TMM to the Operator shall be in full and final satisfaction of all the TMM's liability for taking a Conditional QPAC Unit out of revenue-earning passenger service.

Satisfaction of Preconditions

4.12 Upon the Operator and the Owner confirming in writing that the Preconditions have been satisfied, the Owner shall issue a Provisional Acceptance Certificate in respect of that Unit in accordance with paragraph 3.11.

4.13 For all other purposes under this Agreement, including Milestone Payments, a Unit which has been issued with a Qualified Provisional Acceptance Certificate shall be treated as if it has been Accepted pursuant to paragraph 3.11.

Preconditions and Final Acceptance

4.14 Notwithstanding the provisions of paragraphs 4.13 and 6.2, Final Acceptance of a Unit shall not occur until all the Preconditions have been satisfied.

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[221] Redaction.

5. [][222]

6. FINAL ACCEPTANCE

6.1 Following Acceptance of a Unit, the Operator may commence operation of such Unit in revenue-earning passenger service and the TMM shall be entitled to have a representative participating in such operation as an observer (such observer shall at all times comply with the reasonable instructions of the Operator) for the purposes of monitoring compliance with the provisions of paragraph 6.2.

6.2 Final Acceptance of a Unit shall occur when:

(a) the Preconditions attached to any Qualified Provisional Acceptance Certificate under paragraph 4.1 have been resolved to the satisfaction of the Owner and the Operator;

(b) such Unit has successfully completed the test specified in paragraph 1.5 of Schedule 4.1 (*Requirements for Agreed Testing Programme*);

(c) []223

(d) any Mandatory Modification or Modification agreed pursuant to any Authorisation to Vary which was stated:

(i) in any Qualified Provisional Acceptance Certificate for that Unit as a Precondition; or

(ii) in that Authorisation to Vary as being required to be completed prior to Final Acceptance of that Unit,

has, in each case, been completed;

(e) after all of the requirements in paragraphs 6.2(a) to (d) inclusive have been satisfied, the Unit achieves a Fault Free day in revenue-earning passenger service; and

(f) the Operator, acting reasonably, confirms that it is satisfied that the conditions set out in paragraphs 6.2(a) to (e) inclusive have been fulfilled, by countersigning the relevant Final Acceptance Certificate, and delivering such certificate to the Owner.

6.3 Each time a delay of more than three minutes is caused to a Unit due to the occurrence of a Fault (other than a Fault resulting from an Excluded Matter) during the period of operation referred to in paragraph 1.5 of Schedule 4.1 (*Requirements for Agreed Testing Programme*), then for the purposes of the test specified in paragraph 1.5 of Schedule 4.1 (*Requirements for Agreed Testing Programme*), the milometer of that Unit shall be re-set to zero and that Unit shall restart that period of operation.

6.4 When the conditions specified in paragraphs 6.2(a) to (e) (inclusive) have been fulfilled with respect to a Unit:

(a) the Operator shall, as soon as reasonably practicable (and prior to the Owner signing pursuant to sub-paragraph (b)), countersign and deliver to the Owner a Final Acceptance Certificate with respect to such Unit; and

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222 Redaction.

223 Redaction.

(b) the Owner shall sign and issue that Final Acceptance Certificate to the TMM,

and, upon signature by the Owner of the Final Acceptance Certificate, Final Acceptance of such Unit shall occur; and

(c) the TMM shall promptly countersign the Final Acceptance Certificate by way of acknowledgement and deliver it to the Owner (with a copy to the Operator).

7. FLEET ACCEPTANCE

7.1 The TMM shall, subject to the Operator's obligations pursuant to clause 6.14, carry out all action necessary to enable the Operator to run all the Units on all routes on the Thameslink Network, the infrastructure interfaces of which have the technical characteristics specified in the TIIS, including the delivery or deposit (as the case may be) of all Manuals and Delivery Documentation as provided for in this Agreement.

7.2 Fleet Acceptance shall occur when:

(a) the TMM has complied with its obligations under clause 6.15 in order to enable the Operator to obtain an unrestricted Statement of Compatibility (as defined in GM/RT8270) to run the entire Fleet on all routes on the Thameslink Network which have the relevant characteristics specified in the TIIS;

(b) Final Acceptance has occurred in relation to each Initial Unit (excluding the Testing Units provided that the condition in clause 8.22 has been satisfied in relation to those Testing Units); and

(c) following Final Acceptance of all the Initial Units (excluding the Testing Units provided that the condition in clause 8.22 has been satisfied in relation to those Testing Units), the Fleet is operating at the level of performance specified in paragraph 1.6 of Schedule 4.1 (*Requirements for Agreed Testing Programme*).

7.3 The TMM shall use all reasonable endeavours to ensure that the Fleet achieves Fleet Acceptance on or before the Expected Fleet Acceptance Date.

7.4 When the conditions specified in paragraph 7.2 have been fulfilled with respect to each Initial Unit other than the Testing Units and the condition in clause 8.22 has been satisfied in relation to those Testing Units:

(a) the Operator shall, as soon as reasonably practicable (and prior to the Owner signing pursuant to sub-paragraph (b)), countersign and deliver to the Owner a Fleet Acceptance Certificate; and

(b) the Owner shall sign and issue that Fleet Acceptance Certificate to the TMM,

and, upon signature by the Owner of the Fleet Acceptance Certificate, Fleet Acceptance shall occur; and

(c) the TMM shall promptly countersign the Fleet Acceptance Certificate by way of acknowledgement and deliver it to the Owner (with a copy to the Operator).

8. ACCEPTANCE OF OWNED SPARES

8.1 Subject to paragraph 1.1, the TMM shall deliver and tender for Acceptance all of the Owner Owned Spares or Operator Owned Spares, as appropriate, at the Designated Depots

(or any alternative location agreed in advance by the Parties) on the dates set out in the Contract Programme.

8.2 The Owner or the Operator, as appropriate, shall not be obliged to accept any Owner Owned Spares or the Operator Owned Spares, as appropriate, tendered for acceptance by issuing a Spares Acceptance Certificate pursuant to paragraph 8.3 or 8.4 (as applicable) unless:

(a) the Owner or the Operator, as appropriate, has received the relevant Spares Delivery Documentation and Manuals relating to the Spares;

(b) the Owner Owned Spares or Operator Owned Spares, as appropriate, conform with the Specification;

(c) the testing set out in the Acceptance Testing Matrix has been successfully completed in accordance with the Acceptance Testing Documentation; and

(d) the Owner Owned Spares or the Operator Owned Spares, as appropriate, comply with all Applicable Laws and Standards (save where such compliance is due to the application of any Derogation which is temporary in nature and where the TMM is responsible for resolving the issue which created the requirement for the temporary Derogation).

8.3 Where the conditions specified in paragraph 8.2 have been fulfilled in relation to any Owner Owned Spares:

(a) the Operator shall (prior to the Owner signing the Spares Acceptance Certificate pursuant to sub-paragraph (b)) countersign and deliver to the Owner a Spares Acceptance Certificate in respect of such Owner Owned Spares;

(b) the Owner shall sign and issue that Spares Acceptance Certificate to the TMM,

and, upon signature by the Owner of the Spares Acceptance Certificate, Acceptance of those Owner Owned Spares shall occur; and

(c) the TMM shall promptly countersign the Spares Acceptance Certificate and deliver it to the Owner (with a copy to the Operator).

8.4 Where the conditions specified in paragraph 8.2 have been fulfilled in relation to any Operator Owned Spares:

(a) the Operator shall sign and issue a Spares Acceptance Certificate to the TMM and, upon such signature by the Operator of the Spares Acceptance Certificate, Acceptance of those Operator Owned Spares shall occur; and

(b) the TMM shall promptly countersign the Spares Acceptance Certificate and deliver it to the Operator (with a copy to the Owner).

9. ACCEPTANCE OF SPECIAL TOOLS

9.1 Subject to paragraph 1.1, the TMM shall deliver and tender for acceptance all of the Special Tools at the Designated Depots (or any alternative location agreed in advance by the Parties) on the date set out in the Contract Programme.

9.2 The Owner shall not be obliged to accept the Special Tools tendered for acceptance by issuing a Special Tools Acceptance Certificate pursuant to paragraph 9.3 unless:

(a) the Owner has received the Special Tools Delivery Documentation and Manuals relating to the Special Tools;

(b) the Special Tools conform with the Specification;

(c) the testing set out in the Acceptance Testing Matrix has been successfully completed in accordance with the Acceptance Testing Documentation; and

(d) the Special Tools comply with all Applicable Laws and Standards (save where such compliance is due to the application of any Derogation which is temporary in nature and where the TMM is responsible for resolving the issue which created the requirement for the temporary Derogation).

9.3 Where the conditions specified in paragraph 9.2 have been fulfilled in relation to any Special Tool:

(a) the Operator shall (prior to the Owner signing the Special Tools Acceptance Certificate pursuant to sub-paragraph (b)) countersign and deliver to the Owner a Special Tools Acceptance Certificate; and

(b) the Owner shall sign and issue that Special Tools Acceptance Certificate to the TMM,

and, upon signature by the Owner of the Special Tools Acceptance Certificate, Acceptance of that Special Tool shall occur; and

(c) the TMM shall promptly countersign the Spares Acceptance Certificate and deliver it to the Owner (with a copy to the Operator).

9.4 The TMM shall ensure that sufficient numbers of its staff are trained to operate the Special Tools before they are delivered to the Owner pursuant to this Agreement. If the TSA is terminated due to a TSA TMM Event of Default, the TMM shall arrange, at its own cost, for the training required to enable the replacement maintainer's staff to operate the Special Tools.

10. ACCEPTANCE OF MOCK-UP

10.1 Subject to paragraph 1.1, the TMM shall deliver and tender for Acceptance the Mock-up at the location agreed between the TMM and the Operator and on the date set out in the Contract Programme.

10.2 The Operator shall not be obliged to accept the Mock-up tendered for acceptance by issuing a Mock-up Acceptance Certificate pursuant to paragraph 10.3 unless:

(a) the Operator has received the Mock-up Delivery Documentation;

(b) the Mock-up conforms with Schedule 7.3 (*Mock-Up*); and

(c) the Mock-up complies with all Applicable Laws and Standards (save where such compliance is due to the application of any Derogation which is temporary in nature where the TMM is responsible for resolving the issue which created the requirement for the temporary Derogation).

10.3 Where the conditions specified in paragraph 10.2 have been fulfilled in relation to the Mock-Up:

(a) the Operator shall sign and issue a Mock-Up Acceptance Certificate to the TMM, and upon such signature by the Operator of the Mock-Up Acceptance Certificate, Acceptance of the Mock-Up shall occur; and

(b) the TMM shall promptly countersign the Mock-Up Acceptance Certificate and deliver it to the Operator (with a copy to the Owner).

11. ACCEPTANCE OF INTEGRATION LABORATORY TRAIN EQUIPMENT

11.1 Subject to paragraph 1.1, the TMM shall deliver and tender for Acceptance each item of the Integration Laboratory Train Equipment at the location agreed between the TMM and the Operator, and on the dates set out in the Contract Programme.

11.2 The Operator shall not be obliged to accept the Integration Laboratory Train Equipment tendered for acceptance by issuing an Integration Laboratory Train Equipment Acceptance Certificate pursuant to paragraph 11.3 unless:

(a) the Operator has received the relevant Integration Laboratory Train Equipment Delivery Documentation and documentation referred to in Schedule 7.4 (*Integration Laboratory Train Equipment*);

(b) such Integration Laboratory Train Equipment conforms with the requirements set out in Schedule 7.4 (*Integration Laboratory Train Equipment*); and

(c) such Integration Laboratory Train Equipment complies with all Applicable Laws and Standards (save where such compliance is due to the application of any Derogation which is temporary in nature and the TMM is responsible for resolving the issue which created the requirement for the temporary Derogation).

11.3 Where the conditions specified in paragraph 11.2 have been fulfilled in relation to any item of Integration Laboratory Train Equipment:

(a) the Operator shall sign and issue an Integration Laboratory Train Equipment Acceptance Certificate to the TMM, and upon such signature by the Operator of the Integration Laboratory Train Equipment Acceptance Certificate, Acceptance of such Integration Laboratory Train Equipment shall occur; and

(b) the TMM shall promptly countersign the Integration Laboratory Train Equipment Acceptance Certificate and deliver it to the Operator (with a copy to the Owner).

12. ACCEPTANCE OF SIMULATORS

12.1 Subject to paragraph 1.1, the TMM shall deliver and tender for Acceptance the Simulators at the locations agreed between the TMM and the Operator in accordance with clauses 4.13 to 4.15 (inclusive) on the dates set out in the Contract Programme.

12.2 Neither the Owner nor the Operator shall be obliged to accept any Simulator tendered for acceptance by issuing a Simulator Acceptance Certificate pursuant to paragraph 12.3 unless:

(a) the Operator and the Owner have received the Simulator Delivery Documentation and Manuals relating to the Simulators;

(b) that Simulator conforms with the requirements set out in Schedule 7.5 (*Simulators*);

(c) the testing set out in the Acceptance Testing Matrix has been successfully completed in accordance with the Acceptance Testing Documentation;

(d) that Simulator complies with all Applicable Laws and Standards (save where such compliance is due to the application of any Derogation which is temporary in nature and where the TMM is responsible for resolving the issue which created the requirement for the temporary Derogation); and

(e) in relation to the second Simulator to be tendered for Acceptance, all equipment described in the Simulator Specification has been Accepted.

12.3 Where the conditions specified in paragraph 12.2 have been fulfilled in relation to any Simulator:

(a) the Operator shall (prior to the Owner signing the Simulator Acceptance Certificate pursuant to sub-paragraph (b)) countersign and deliver to the Owner a Simulator Acceptance Certificate; and

(b) the Owner shall sign and issue that Simulator Acceptance Certificate to the TMM,

and, upon such signature by the Owner of the Simulator Acceptance Certificate, Acceptance of that Simulator shall occur; and

(c) the TMM shall promptly countersign the Simulator Acceptance Certificate and deliver it to the Owner (with a copy to the Operator).

13. [][224]

14. ACCEPTANCE DISPUTES

14.1 Any Acceptance Dispute shall be determined in accordance with the dispute resolution procedure set out in the Applicable Expert Determination Provisions.

14.2 [][225]

14.3 [][226]

14.4 [][227]

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[224] Redaction.

[225] Redaction.

[226] Redaction.

[227] Redaction.

APPENDIX 1TO SCHEDULE 6

[][228]

[228] Redaction.

APPENDIX 2 TO SCHEDULE 6

FORM OF PROVISIONAL ACCEPTANCE CERTIFICATE

To: [*TMM*]

Date:

Dear Sirs

We refer to the Manufacture and Supply Agreement dated [_____] 2013 (the ***Manufacture and Supply Agreement***) between [_____] the TMM). [_____] (the ***Owner***) and [_____] (the ***Operator***). Words and expressions defined in the Manufacture and Supply Agreement shall, except where otherwise defined herein, bear the same meanings when used herein.

The Owner hereby confirms that it has today taken Provisional Acceptance of the following Unit: [_____] (which is a Type [_____] Unit) pursuant to paragraph 3 (*Provisional Acceptance*) of Schedule 6 (*Delivery and Acceptance*) of the Manufacture and Supply Agreement.

Yours faithfully

For and on behalf of

[*Owner*]

By:
Name:
Title: Director

By countersigning this certificate, the Operator hereby confirms that it is satisfied that the conditions set out in paragraphs 3.1(a) to (o) (inclusive) of Schedule 6 of the Manufacture and Supply Agreement have each been fulfilled and acknowledges that Provisional Acceptance of the Unit may occur in accordance with paragraph 3.11 of Schedule 6 of the Manufacture and Supply Agreement:

For and on behalf of

[*Operator*]

By:
Name:
Title:

Provisional Acceptance of the Unit is hereby acknowledged for and on behalf of:

[*TMM*]

By:
Name:
Title:

APPENDIX 3 TO SCHEDULE 6

FORM OF QUALIFIED PROVISIONAL ACCEPTANCE CERTIFICATE

To: [*TMM*]

Date:

Dear Sirs

We refer to the Manufacture and Supply Agreement dated [_____] 2013 (the ***Manufacture and Supply Agreement***) between [_____] the ***TMM***), [_____] (the ***Owner***) and [_____] (the ***Operator***). Words and expressions defined in the Manufacture and Supply Agreement shall, except where otherwise defined herein, bear the same meanings when used herein.

The Owner hereby confirms that it has today taken Qualified Provisional Acceptance of the following Unit: [_____] (which is a Type [_____] Unit) pursuant to paragraph 4 (*Qualified Provisional Acceptance*) of Schedule 6 (*Delivery and Acceptance*) of the Manufacture and Supply Agreement.

The outstanding conditions to be satisfied and tasks to be performed by the TMM in order for full Provisional Acceptance of the Unit to occur (the ***Preconditions***) are as follows:

[_____]

The TMM shall satisfy the Preconditions as soon as possible and in any event by [_____].

The taking by the Owner of Qualified Provisional Acceptance of the Unit listed above shall not constitute a waiver of any of the rights of either the Owner or the Operator under each of the Manufacture and Supply Agreement, the TSA or the TSSSA, and the obligations of:

(a) the TMM under the Manufacture and Supply Agreement and the TSA, including, but not limited to, performance of the TSA Services in accordance with the terms of the TSA Performance Regime thereunder; and

(b) the Supplier under the TSSSA, including, but not limited to, performance of the TSSSA Services in accordance with the terms of the TSSSA Performance Regime thereunder,

shall, in each case, be unaffected by such Qualified Provisional Acceptance.

Yours faithfully
For and on behalf of

[*Owner*]

By:
Name:
Title: Director

By countersigning this certificate, the Operator hereby confirms that it is satisfied that the conditions set out in paragraphs 4.1(a) (other than the satisfaction of paragraphs 3.1(q) and 3.1(r) of that Schedule 6) and 4.1(b) of Schedule 6 of the Manufacture and Supply Agreement have been fulfilled and agrees that Qualified Provisional Acceptance of the Unit may occur

(on the terms and conditions set out in this certificate) in accordance with paragraph 4.6 of Schedule 6 of the Manufacture and Supply Agreement:

For and on behalf of:

[*Operator*]

By:
Name:
Title:

Qualified Provisional Acceptance of the Unit is hereby acknowledged for and on behalf of:

[*TMM*]

By:
Name:
Title:

APPENDIX 4 TO SCHEDULE 6

FORM OF FINAL ACCEPTANCE CERTIFICATE

To: [*TMM*]

Date:

Dear Sirs

We refer to the Manufacture and Supply Agreement dated [_____] 2013 (the ***Manufacture and Supply Agreement***) between [_____] the ***TMM***), [_____] (the ***Owner***) and [_____] (the ***Operator***). Words and expressions defined in the Manufacture and Supply Agreement shall, except where otherwise defined herein, bear the same meanings when used herein.

The Owner hereby confirms that it has today taken Final Acceptance of the following Unit: [_____] (which is a Type [_____] Unit) pursuant to paragraph 6 (*Final Acceptance*) of Schedule 6 (*Delivery and Acceptance*) of the Manufacture and Supply Agreement.

Yours faithfully

[*Owner*]

By:
Name:
Title: Director

By countersigning this certificate, the Operator hereby confirms that it is satisfied that the conditions set out in paragraphs 6.2(a) to (e) (inclusive) of Schedule 6 of the Manufacture and Supply Agreement have each been fulfilled and acknowledges that Final Acceptance of the Unit may occur in accordance with paragraph 6.4 of Schedule 6 of the Manufacture and Supply Agreement:

For and on behalf of:

[*Operator*]

By:
Name:
Title:

Final Acceptance of the Unit is hereby acknowledged for and on behalf of:

[*TMM*]

By:
Name:
Title:

APPENDIX 5 TO SCHEDULE 6

FORM OF FLEET ACCEPTANCE CERTIFICATE

To: [***TMM***]

Date:

Dear Sirs

We refer to the Manufacture and Supply Agreement dated [_____] 2013 (the ***Manufacture and Supply Agreement***) between [_____] the TMM), [_____] (the ***Owner***) and [_____] (the ***Operator***). Words and expressions defined in the Manufacture and Supply Agreement shall, except where otherwise defined herein, bear the same meanings when used herein.

The Owner hereby confirms that Fleet Acceptance has occurred pursuant to paragraph 7 (*Fleet Acceptance*) of Schedule 6 (*Delivery and Acceptance*) of the Manufacture and Supply Agreement.

Yours faithfully

[*Owner*]

By:
Name:
Title: Director

By countersigning this certificate, the Operator hereby confirms that it is satisfied that the conditions set out in paragraphs 7.2(a) to (c) (inclusive) of Schedule 6 of the Manufacture and Supply Agreement have each been fulfilled and acknowledges that Fleet Acceptance may occur in accordance with paragraph 7.4 of Schedule 6 of the Manufacture and Supply Agreement.

For and on behalf of:

[*Operator*]

By:
Name:
Title:

Fleet Acceptance is hereby acknowledged for and on behalf of:

[*TMM*]

By:
Name:
Title:

APPENDIX 6 TO SCHEDULE 6

FORM OF SPARES ACCEPTANCE CERTIFICATE

To: [***TMM***]

Date:

Dear Sirs

We refer to the Manufacture and Supply Agreement dated [_____] 2013 (the ***Manufacture and Supply Agreement***) between [_____] the ***TMM***), [_____] (the ***Owner***) and [_____] (the ***Operator***). Words and expressions defined in the Manufacture and Supply Agreement shall, except where otherwise defined herein, bear the same meanings when used herein.

The [*Owner*] / [*Operator*] hereby confirms that it has today taken acceptance of the following [*Owner Owned Spares]/[Operator Owned Spares*] pursuant to paragraph 8 (*Acceptance of Owned Spares*) of Schedule 6 (*Delivery and Acceptance*) of the Manufacture and Supply Agreement:

[*List applicable Owned Spares*]

Yours faithfully

[*Owner/Operator*]

By:
Name:
Title: [Director][229]

[*By countersigning this certificate, the Operator hereby confirms that it is satisfied that the conditions set out in paragraph 8.2(a) to (d) (inclusive) of Schedule 6 of the Manufacture and Supply Agreement have each been fulfilled and acknowledges that Acceptance of these Owner Owned Spares may occur in accordance with paragraph 8.3 of Schedule 6 of the Manufacture and Supply Agreement*.

For and on behalf of
[Operator]][230]

Acceptance of the [*Owner Owned Spares/Operator Owned Spares*] specified above is hereby acknowledged for and on behalf of:

[*TMM*]

By:
Name:
Title:

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[229] Required when signed on behalf of the Owner.

[230] This section only required for Owner Owned Spares.

APPENDIX 7 TO SCHEDULE 6

FORM OF SPECIAL TOOLS ACCEPTANCE CERTIFICATE

To: [***TMM***]

Date:

Dear Sirs

We refer to the Manufacture and Supply Agreement dated [_____] 2013 (the ***Manufacture and Supply Agreement***) between [_____] the ***TMM***), [_____] (the ***Owner***) and [_____] (the ***Operator***). Words and expressions defined in the Manufacture and Supply Agreement shall, except where otherwise defined herein, bear the same meanings when used herein.

The Owner hereby confirms that it has today taken acceptance of the following Special Tools pursuant to paragraph 9 (*Acceptance of Special Tools*) of Schedule 6 (*Delivery and Acceptance*) of the Manufacture and Supply Agreement:

[*List applicable Special Tools*]

Yours faithfully

[*Owner*]

By:
Name:
Title: Director

By countersigning this certificate, the Operator hereby confirms that it is satisfied that the conditions set out in paragraph 9.2(a) to (d) (inclusive) of Schedule 6 of the Manufacture and Supply Agreement have each been fulfilled and acknowledges that Acceptance of these Special Tools may occur in accordance with paragraph 9.3 of Schedule 6 of the Manufacture and Supply Agreement.

For and on behalf of
[*Operator*]]

Acceptance of the Special Tools specified above is hereby acknowledged for and on behalf of:

[*TMM*]

By:
Name:
Title:

APPENDIX 8 TO SCHEDULE 6

FORM OF MOCK-UP ACCEPTANCE CERTIFICATE

To: [*TMM*]

Date:

Dear Sirs

We refer to the Manufacture and Supply Agreement dated [_____] 2013 (the ***Manufacture and Supply Agreement***) between [_____] (the ***TMM***), [_____] (the ***Owner***) and [_____] (the ***Operator***). Words and expressions defined in the Manufacture and Supply Agreement shall, except where otherwise defined herein, bear the same meanings when used herein.

The Operator hereby confirms that it has today taken acceptance of the Mock-up pursuant to paragraph 10 (*Acceptance of Mock-up*) of Schedule 6 (*Delivery and Acceptance*) of the Manufacture and Supply Agreement.

Yours faithfully

[*Operator*]

By:

Name:

Title:

Acceptance of the Mock-up is hereby acknowledged for and on behalf of:

[*TMM*]

By:

Name:

Title:

APPENDIX 9 TO SCHEDULE 6

FORM OF INTEGRATION LABORATORY TRAIN EQUIPMENT ACCEPTANCE CERTIFICATE

To: [*TMM*]

Date:

Dear Sirs

We refer to the Manufacture and Supply Agreement dated [_____] 2013 (the ***Manufacture and Supply Agreement***) between [_____] (the ***TMM***), [_____] (the ***Owner***) and [_____] (the ***Operator***). Words and expressions defined in the Manufacture and Supply Agreement shall, except where otherwise defined herein, bear the same meanings when used herein.

The Operator hereby confirms that it has today taken acceptance of [ILTE Phase 1]/[ILTE Phase 2] of the Integration Laboratory Train Equipment (as defined in Schedule 7.4 (*Integration Laboratory Train Equipment*)) pursuant to paragraph 11 (*Acceptance of Integration Laboratory Train Equipment*) of Schedule 6 (*Delivery and Acceptance*) of the Manufacture and Supply Agreement.

Yours faithfully

[*Operator*]

By:

Name:

Title:

Acceptance of [ILTE Phase 1]/[ILTE Phase 2] of the Integration Laboratory Train Equipment is hereby acknowledged for and on behalf of:

[*TMM*]

By:

Name:

Title:

APPENDIX 10 TO SCHEDULE 6

FORM OF SIMULATOR ACCEPTANCE CERTIFICATE

To: [*TMM*]

Date:

Dear Sirs

We refer to the Manufacture and Supply Agreement dated [_____] 2013 (the ***Manufacture and Supply Agreement***) between [_____] (the ***TMM***), [_____] (the ***Owner***) and [_____] (the ***Operator***). Words and expressions defined in the Manufacture and Supply Agreement shall, except where otherwise defined herein, bear the same meanings when used herein.

The Owner hereby confirms that it has today taken acceptance of the Simulator located at [*Name of Designated Depot or other agreed location*] pursuant to paragraph 12 (*Acceptance of Simulators*) of Schedule 6 (*Delivery and Acceptance*) of the Manufacture and Supply Agreement.

Yours faithfully

[*Owner*]

By:

Name:

Title: Director

By countersigning this certificate, the Operator hereby confirms that it is satisfied that the conditions set out in paragraph 12.2(a) to (d)/(e) (inclusive) of Schedule 6 of the Manufacture and Supply Agreement have each been fulfilled and acknowledges that Acceptance of this Simulator may occur in accordance with paragraph 12.3 of Schedule 6 of the Manufacture and Supply Agreement.

For and on behalf of
[*Operator*]

Acceptance of the Simulator is hereby acknowledged for and on behalf of:

[*TMM*]

By:

Name:

Title:

SCHEDULE 7

SPECIAL TOOLS, SPARES AND OTHER EQUIPMENT

Schedule 7.1: **Special Tools**

Appendix: **Form of Special Tools Delivery Documentation**

Schedule 7.2: **Spares**

Appendix: **Form of Spares Delivery Documentation**

Schedule 7.3: **Mock-up**

Appendix: **Form of Mock-up Delivery Documentation**

Schedule 7.4: **Integration Laboratory Train Equipment**

Appendix: **Form of Integration Laboratory Train Equipment Delivery Documentation**

Schedule 7.5: **Simulators**

Appendix: **Form of Simulator Delivery Documentation**

SCHEDULE 7.1

Special Tools

[][231]

[231] Redaction.

APPENDIX TO SCHEDULE 7.1

FORM OF SPECIAL TOOLS DELIVERY DOCUMENTATION

To: [*Owner*]

Copy: [*Operator*]

Date:

Dear Sirs

We refer to the Manufacture and Supply Agreement dated [_____] 2013 (the ***Manufacture and Supply Agreement***) between [_____] (the ***TMM***), [_____] (the ***Owner***) and [_____] (the Operator). Words and expressions defined in the Manufacture and Supply Agreement shall, except where otherwise defined herein, bear the same meanings when used herein.

The TMM hereby confirms that the [*Special Tools*] that have been delivered and tendered for Acceptance today pursuant to paragraph 9 (*Acceptance of Special Tools*) of Schedule 6 (*Delivery and Acceptance*) of the Manufacture and Supply Agreement are in conformance with the relevant parts of the Specification, the Contract Programme, the Quality Plan, the Agreed Testing Programme, all Applicable Laws and Standards and otherwise in accordance with and in compliance with the Manufacture and Supply Agreement.

Yours faithfully

[_____]

By:

Name:

Title:

SCHEDULE 7.2

Spares

[][232]

[232] Redaction.

APPENDIX TO SCHEDULE 7.2

FORM OF SPARES DELIVERY DOCUMENTATION

To: [*Owner*]/[*Operator*]

Copy: [*Operator*]/[*Owner*]

Date:

Dear Sirs

We refer to the Manufacture and Supply Agreement dated [_____] 2013 (the ***Manufacture and Supply Agreement***) between [_____] (the ***TMM***), [_____] (the ***Owner***) and [_____] (the ***Operator***). Words and expressions defined in the Manufacture and Supply Agreement shall, except where otherwise defined herein, bear the same meanings when used herein.

The TMM hereby confirms that the [*Spares*] that have been delivered and tendered for Acceptance today pursuant to paragraph 8 (*Acceptance of Owned Spares*) of Schedule 6 (*Delivery and Acceptance*) of the Manufacture and Supply Agreement are in conformance with the relevant parts of the Specification, the Contract Programme, the Quality Plan, the Agreed Testing Programme, all Applicable Laws and Standards and otherwise in accordance with and in compliance with the Manufacture and Supply Agreement.

Yours faithfully

[_____]

By:

Name:

Title:

SCHEDULE 7.3

Mock-Up

[][233]

[233] Redaction.

APPENDIX TO SCHEDULE 7.3

FORM OF MOCK-UP DELIVERY DOCUMENTATION

To: [*Operator*]

Copy: [*Owner*]

Date:

Dear Sirs

We refer to the Manufacture and Supply Agreement dated [_____] 2013 (the ***Manufacture and Supply Agreement***) between [_____] (the ***TMM***), [_____] (the ***Owner***) and [_____] (the ***Operator***). Words and expressions defined in the Manufacture and Supply Agreement shall, except where otherwise defined herein, bear the same meanings when used herein.

The TMM hereby confirms that the Mock-up that has been delivered and tendered for Acceptance today pursuant to paragraph 10 (*Acceptance of Mock-up*) of Schedule 6 (*Delivery and Acceptance*) of the Manufacture and Supply Agreement is in conformance with the requirements of Schedule 7.3 (*Mock-Up*) of the Manufacture and Supply Agreement, the Contract Programme, the Quality Plan, the Agreed Testing Programme, all Applicable Laws and Standards and otherwise in accordance with and in compliance with the Manufacture and Supply Agreement.

Yours faithfully

[_____]

By:

Name:

Title:

SCHEDULE 7.4

Integration Laboratory Train Equipment

[][234]

[234] Redaction.

APPENDIX TO SCHEDULE 7.4

FORM OF INTEGRATION LABORATORY TRAIN EQUIPMENT

DELIVERY DOCUMENTATION

To: [*Operator*]

Copy: [*Owner*]

Date:

Dear Sirs

We refer to the Manufacture and Supply Agreement dated [_____] 2013 (the ***Manufacture and Supply Agreement***) between [_____] (the ***TMM***), [_____] (the ***Owner***) and [_____] (the ***Operator***). Words and expressions defined in the Manufacture and Supply Agreement shall, except where otherwise defined herein, bear the same meanings when used herein.

The TMM hereby confirms that [ILTE Phase 1]/[ILTE Phase 2] of the Integration Laboratory Train Equipment that has been delivered and tendered for Acceptance today pursuant to paragraph 11 (*Acceptance of Integration Laboratory, Train Equipment*) of Schedule 6 (*Delivery and Acceptance*) of the Manufacture and Supply Agreement [*is/are*] in conformance with the requirements set out in Schedule 7.4 (*Integration Laboratory Train Equipment*) of the Manufacture and Supply Agreement, the Contract Programme, the Quality Plan, the Agreed Testing Programme, all Applicable Laws and Standards and otherwise in accordance with and in compliance with the Manufacture and Supply Agreement.

Yours faithfully

[_____]

By:

Name:

Title:

SCHEDULE 7.5

Simulators

[][235]

[235] Redaction.

APPENDIX TO SCHEDULE 7.5

FORM OF SIMULATOR DELIVERY DOCUMENTATION

To: [*Operator*]

Copy: [*Owner*]

Date:

Dear Sirs

We refer to the Manufacture and Supply Agreement dated [_____] 20[_____] (the ***Manufacture and Supply Agreement***) between [_____] (the ***TMM***), [_____] (the ***Owner***) and [_____] (the ***Operator***). Words and expressions defined in the Manufacture and Supply Agreement shall, except where otherwise defined herein, bear the same meanings when used herein.

The TMM hereby confirms that the Simulator[*s*] that [*has/have*] been delivered and tendered for Acceptance today pursuant to paragraph 12 (*Acceptance of Simulators*) of Schedule 6 (*Delivery and Acceptance*) of the Manufacture and Supply Agreement [*is/are*] in conformance with the Simulator Specification, the Contract Programme, the Quality Plan, the Agreed Testing Programme, all Applicable Laws and Standards and otherwise in accordance with and in compliance with the Manufacture and Supply Agreement.

Yours faithfully

[_____]

By:

Name:

Title:

SCHEDULE 8

KEY SYSTEMS AND APPROVED SUB-CONTRACTORS (MSA)

Schedule 8: Key Systems and Approved Sub-Contractors (MSA)

[][236]

[236] Redaction.

SCHEDULE 9

CONTRACT PROGRAMME

Schedule 9: Contract Programme

[][237]

[237] Redaction.

SCHEDULE 10

PROJECT MANAGEMENT

Schedule 10: Project Management

[][238]

[238] Redaction.

APPENDIX TO SCHEDULE 10 – REQUIRED TRAINING COURSES

1. STAFF TO BE PROVIDED WITH TRAINING

1.1 []239

2. TRAINING COURSES

2.1 The table below sets out the training courses that TMM will provide (to be finalised in Agreed Training Programme and monitored by the Operational training Working Group):

[]240

For each role a specific Operational Training Module has also been developed to set out specific module aims and objectives, attendees and programme duration.

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239 Redaction.

240 Redaction.

3. OVERVIEW ON THE TRAINING COURSES PROVIDED TO THIRD PARTY STAFF WITH REGARD TO THE TRSP

[][241]

[241] Redaction.

SCHEDULE 11

SCHEDULE OF PRICES

Schedule 11: Schedule of Prices

SCHEDULE 11

Schedule of Prices

[][242]

[242] Redaction.

SCHEDULE 12

MILESTONES AND PAYMENTS

Schedule 12: Milestones and Payments

SCHEDULE 12

Milestones

[][243]

[243] Redaction.

SCHEDULE 13

PERMITTED DELAY PROCEDURE

Schedule 13: Permitted Delay Procedure

Appendix 1: Notice of Potential Permitted Delay

Appendix 2: Potential Permitted Delay - Particulars of Claim

Appendix 3: Potential Permitted Delay - Interim Particulars

Appendix 4: Notice of Grant of Permitted Delay

Appendix 5: Notice of Discretionary Grant of Permitted Delay

Appendix 6: Notice of Rejection of Permitted Delay

SCHEDULE 13

Permitted Delay Procedure

1. POTENTIAL PERMITTED DELAYS

Notice of Potential Permitted Delay

1.1 As soon as practicable and, in any event within 14 days, after the TMM becomes aware that there has been or it can reasonably foresee that there will be, a delay or failure in the performance of:

(a) some or all of the TMM's obligations under, and in accordance with, this Agreement and the Contract Programme by reason of any of the matters set out in paragraphs (a) to (g) (inclusive) or (j) of the definition of Permitted Delay;

(b) any Infrastructure Dependent Obligation by reason of the matter set out in paragraph (h) of the definition of Permitted Delay; or

(c) any Depot Dependent Obligation by reason of a Permitted Depot Delay,

(in each case, a ***Potential Permitted Delay***) the TMM shall give written notice (except in cases of emergency, when shorter, oral notice may be given, but which shall be confirmed in writing as soon as reasonably practicable thereafter) to the Owner and the Operator of the details of any Potential Permitted Delay (such written notice to be substantially in the form of the Notice of Potential Permitted Delay set out in 0 (*Notice of Potential Permitted Delay*).

1.2 Any notice given under paragraph 1.1 shall specify whether the TMM is of the view that it is, or may become, entitled to treat such Potential Permitted Delay as a Permitted Delay and shall state the TMM's current estimate (acting reasonably) of the likelihood and probable extent of the delay.

Administration of Potential Permitted Delay claims and extensions granted

1.3 On receipt of any notice under paragraph 1.1, the Owner shall allocate a unique number to the claim (which shall be promptly notified to the TMM and the Operator). The Owner shall maintain a sequentially numbered register of all claims made, and extensions of time granted, under this Schedule 13. All subsequent correspondence between the Parties in relation to any claim made, or extension of time granted, under this Schedule 13 shall bear the relevant allocated number.

2. OBLIGATION TO AVOID OR REDUCE EFFECTS

2.1 The TMM shall use, and continue to use, subject to paragraph 2.2, all reasonable endeavours [][244] in respect of each set of circumstances giving rise to a Potential Permitted Delay) to avoid or reduce the effects or likely effects of any Potential Permitted Delay. Any right of the TMM to pursue a claim for an extension of time and/or additional costs, in each

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[244] Redaction.

case, in respect of the effects of a Potential Permitted Delay shall be conditional on the TMM so using all reasonable endeavours.

2.2 If the TMM becomes aware of any action that the TMM could take to avoid or reduce the effect, or likely effect, of any Potential Permitted Delay, but is of the opinion (acting reasonably) that the taking of such action exceeds the TMM's obligation to use all reasonable endeavours []245 in respect of each set of circumstances giving rise to a Potential Permitted Delay) to do so, the TMM shall notify the other Parties of the cost and likely effect of such action, and provided that:

(a) the Owner and the Operator, acting jointly, have consented to such cost being incurred;

(b) where the Owner is bearing all of such costs pursuant to paragraph (ii) below, the TMM agrees to take such actions, []246;

(c) the TMM incurs such cost solely for the purposes of carrying out such action; and

(d) if requested by the Owner and/or the Operator, the TMM provides satisfactory evidence of the nature and the amount of all cost incurred by the TMM pursuant to this paragraph 2.2 (which shall be calculated in accordance with the principles of transparency and minimal additional cost set out in paragraph 2.1 of schedule 5.1 (*Changes to Equipment Prices*) of the Umbrella Agreement and by reference to the Work Rates set out in the Appendix (*Work Rates*) to that Schedule),

then:

(i) where the reason for the Potential Permitted Delay is:

(A) the reason set out in any of paragraphs (a), (d), (f), (h) or (j) of the definition of Permitted Delay; or

(B) a reason set out in paragraph (i) of the definition of Permitted Delay, other than a Depot Force Majeure Event,

the Operator shall pay such additional expenditure incurred by the TMM in accordance with paragraph 2.3;

(ii) where the reason for the Potential Permitted Delay is the reason set out in paragraph (b) of the definition of Permitted Delay, the Owner shall pay such additional expenditure incurred by the TMM in accordance with paragraph 2.3; and

(iii) where the reason for the Potential Permitted Delay is:

(A) the reason set out in any of paragraphs (c), (e) or (g) of the definition of Permitted Delay; or

(B) a Depot Force Majeure Event,

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245 Redaction.

246 Redaction.

the Owner and the Operator shall share equally such additional expenditure incurred by the TMM.

2.3 Subject to paragraph 2.4, the Owner and/or the Operator shall each pay to the TMM any amount payable by them pursuant to paragraph 2.2 (but not any amounts incurred by the TMM in accordance with paragraph 2.1, which shall (if payable by the Owner or the Operator) be paid in accordance with paragraph 4.5), either:

(a) in the case of the Operator, within 28 days of submission of an invoice by the TMM to the Operator; or

(b) in the case of the Owner, in accordance with paragraph 4.7.

2.4 The Owner or the Operator shall notify the TMM (and the Operator or the Owner (as appropriate)) in writing of any disputed amounts contained in an invoice submitted in accordance with paragraph 2.3, stating the reasons for such dispute within 5 Working Days of receipt of such invoice, and the Applicable Expert Determination Provisions shall apply.

3. PARTICULARS OF CLAIM

Notice of Particulars of Claim

3.1 As soon as practicable, but, in any event, within 28 days after the date by which notice is required to be given under paragraph 1.1, the TMM shall submit further written notice to the Owner and the Operator (to be substantially in the form of the particulars of claim set out in 0 (*Potential Permitted Delay – Particulars of Claim*) giving:

(a) full and detailed particulars of the cause and extent of the delay and the effects of the delay on the TMM's ability to comply with its obligations under this Agreement;

(b) full and detailed particulars of the dates in the Contract Programme that may be affected;

(c) details of the documents that will be relied upon to support any claim of the TMM for an extension of time based on the Potential Permitted Delay; and

(d) details of the measures which the TMM has adopted and/or proposes to adopt to avoid or reduce the effects of the Potential Permitted Delay on its ability to duly comply with its obligations under this Agreement.

3.2 If the relevant cause of delay ends during such 28-day period, the TMM shall submit such further written notice within 14 days after the date on which it ends.

Notice of Interim Particulars

3.3 Where either a Potential Permitted Delay has a continuing effect or the TMM is unable to determine (acting reasonably) whether the effect of the Potential Permitted Delay will actually cause the TMM not to be able to comply with some or all of its obligations under this Agreement, such that it is not practicable for the TMM to submit full and detailed particulars in accordance with paragraph 3.1, then, within 14 days after the date by which notice is required to be given under paragraph 1.1, the TMM shall instead submit to the Owner and the Operator:

(a) a statement to that effect (substantially in the form set out in 0 (*Potential Permitted Delay – Interim Particulars*)) with reasons, together with interim written particulars (including details of the likely consequences of the Potential Permitted Delay on the TMM's ability to comply with some or all of its obligations under this Agreement and an estimate of the likelihood and likely extent of the delay); and

(b) thereafter, at intervals of not more than 14 days, further interim written particulars until the actual delay caused (if any) is finally ascertainable, whereupon the TMM shall as soon as practicable, but in any event within 28 days of the actual delay caused becoming ascertainable, submit to the Owner and the Operator the items referred to in paragraph 3.1.

4. GRANTING PERMITTED DELAYS

Notice of Grant of Permitted Delay

4.1 If there is a delay or failure in the performance by the TMM of its obligations under, and in accordance with, this Agreement and the Contract Programme due to the occurrence of any of the events set out in paragraphs (a) to (j) (inclusive) of the definition of Permitted Delay, then:

(a) subject to the TMM complying with its obligations under paragraphs 1 (*Potential Permitted Delays*), 2 (*Obligation to Avoid or Reduce Effects*) and 3 (*Particulars of Claim*); and

(b) subject to paragraph 6 (*No Relief*),

the TMM shall be fairly entitled in accordance with paragraph 4.2 to an extension of time, as is reasonable in the circumstances, to any date in the Contract Programme, any other date by which the TMM is required to perform its obligations or to any Milestone (as appropriate).

4.2 Any grant of an extension of time to any date in the Contract Programme, any other date by which the TMM is required to perform its obligations or to any Milestone (as appropriate) shall be made by the Owner and Operator (acting jointly and each acting reasonably):

(a) taking into account all the circumstances known to them at that time, including (without limitation) pursuant to paragraph 5.2, and the Owner and the Operator shall not be bound by or limited to the grounds set out in the TMM's claim (if applicable);

(b) by specifying:

(i) the delay that they consider has been suffered by the TMM, on the basis that, where the TMM was already in delay in performing the relevant obligations at the time when the TMM served notice under paragraph 1.1, only the additional delay caused by the Permitted Delay event shall be taken into account;

(ii) under which paragraph of the definition of Permitted Delay the relevant matter has arisen; and

(iii) subject to the conditions set out in paragraph 4.1, the extension of time that the TMM is entitled to in respect of the Contract Programme, the date by

which the TMM is required to perform the relevant obligation under this Agreement or any Milestone (as appropriate);

(c) on a prospective or retrospective and/or on an interim or full basis;

(d) within 14 days of, as appropriate:

(i) receipt of final, full and detailed particulars of the cause and actual effect of any Potential Permitted Delay pursuant to paragraph 3.1;

(ii) receipt of sufficient interim particulars pursuant to paragraph 3.3; or

(iii) where the TMM has not made an application for an extension of time, but the Owner and the Operator have determined that the TMM is nevertheless entitled to an extension of time, that determination; and

(e) in writing:

(i) substantially in the form set out in 0 (*Notice of Grant of Permitted Delay*) where paragraph 4.2(d)(i) or (ii) applies; and

(ii) substantially in the form set out in 0 (*Notice of Discretionary Grant of Permitted Delay*) where paragraph 4.2(d)(iii) applies.

Separate claims

4.3 Any extension of time given by the Owner and the Operator (acting jointly and each acting reasonably) under paragraph 4.2 to a particular Expected Delivery Date, any other date by which the TMM is required to perform its obligations or any Milestone, shall not of itself entitle the TMM to any extension to any other Expected Delivery Date, any other date by which the TMM is required to perform its obligations or any other Milestone. The TMM must make a claim under this Schedule 13 for an extension of time to each date or period to which it considers it is, or may become, entitled under this Schedule 13.

4.4 Notwithstanding paragraph 4.3, nothing in this Schedule 13 shall prevent the Owner and the Operator (acting jointly and each acting reasonably) once they have given an extension under paragraph 4.2 to any Expected Delivery Date, any other date by which the TMM is required to perform its obligations or to any Milestone, from including within that extension (in their absolute discretion) an extension to any other Expected Delivery Date, any other date by which the TMM is required to perform its obligations or to any Milestone, in which case any notice given under paragraph 4.2 will reflect this.

Extension of time sole remedy

4.5 Any extension of time granted by the Owner and the Operator (acting jointly and each acting reasonably), to the TMM shall, except as expressly provided elsewhere in this Agreement, be in full compensation and satisfaction for any loss sustained or sustainable by the TMM in respect of any matter or thing in connection with which that extension is granted, unless the Permitted Delay in respect of which that extension of time has been granted arises:

(a) as a result of the event set out in paragraph (a) of the definition of Permitted Delay, in which case the TMM shall be entitled to claim from the Operator any additional costs reasonably and properly incurred by the TMM as a result of such event (including the costs incurred in mitigating the effects of such Permitted Delay in accordance with

paragraph 2.1 and, where an extension of time is granted to an Expected Delivery Date of any Equipment on which a Milestone Payment is due to be paid, interest on the relevant Milestone Payment(s) at the Default Interest Rate) for the period from the relevant Expected Delivery Date prior to the entitlement to that Permitted Delay until the earlier of the date (i) on which the relevant extension of time expires, (ii) on which the relevant Equipment is Accepted, or (iii) on which the obligations to deliver the relevant Equipment are terminated; or

(b) as a result of the event set out in paragraph (b) of the definition of Permitted Delay, in which case the TMM shall be entitled to claim from the Owner any additional costs reasonably and properly incurred by the TMM as a result of such event (including the costs incurred in mitigating the effects of such Permitted Delay in accordance with paragraph 2.1 and, where an extension of time is granted to an Expected Delivery Date of any Equipment on which a Milestone Payment is due to be paid, interest on the relevant Milestone Payment(s) at the Default Interest Rate) for the period from the relevant Expected Delivery Date prior to the entitlement to that Permitted Delay until the earlier of the date (i) on which the relevant extension of time expires, (ii) on which the relevant Equipment is Accepted, or (iii) on which the obligations to deliver the relevant Equipment are terminated; or

(c) as a result of a breach by the Secretary of State or the Operator as set out in paragraph (a) of the definition of Permitted Depot Delay, in which case the TMM shall be entitled to claim from the Operator any additional costs reasonably and properly incurred by it as a result of such event, including the costs incurred in mitigating the effects of such Permitted Delay in accordance with paragraph 2.1; or

(d) as a result of the event set out in paragraph (h) of the definition of Permitted Delay []247, in which case the TMM shall be entitled to claim from the Operator any additional costs reasonably and properly incurred by the TMM []248, including the costs incurred in mitigation of the effects of such Permitted Delay in accordance with paragraph 2.1, and, []249, interest on the relevant Milestone Payment(s) at the Default Interest Rate) for the period []250 until the earlier of the date (i) on which the relevant extension of time expires, (ii) on which the relevant Equipment is Accepted or (iii) on which the obligations to deliver the relevant Equipment are terminated,

in each case, calculated in accordance with the principles of transparency and minimal additional cost set out in schedule 5.1 (*Changes to Equipment Prices*) of the Umbrella Agreement and by reference to the Work Rates set out in the Appendix (*Work Rates*) to that schedule 5.1 of the Umbrella Agreement.

4.6 Subject to paragraph 4.8, the Operator shall pay any sum due from it pursuant to paragraph 4.5 to the TMM within 28 days of invoice by the TMM.

4.7 Subject to paragraph 4.8, the Owner shall pay any sum due from it to the TMM []251.

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247 Redaction.

248 Redaction.

249 Redaction.

250 Redaction.

251 Redaction.

4.8 The Operator or the Owner shall notify the TMM (and the Owner or the Operator (as appropriate)) in writing of any disputed amounts contained in an invoice submitted in accordance with paragraph 4.6 or 4.7 (as applicable), stating the reasons for such dispute, within 5 Working Days of receipt of such invoice, and the Applicable Expert Determination Provisions shall apply.

5. PERMITTED DELAYS AND DELAYS TO CONSTRUCTION OF THE DEPOTS

5.1 Subject to paragraph 5.2, the TMM shall not be entitled to any Permitted Delay, (unless the reason for such delay constitutes a Permitted Delay under this Agreement), any other relief from its obligations under this Agreement or any Variation in the event that there is any delay in the construction or upgrading of any of the Designated Depots for the provision of the TSA Services or in the event that any of those Designated Depots do not have suitable facilities to carry out the TSA Services.

5.2 In determining any extension pursuant to paragraph 4.2, the Owner and the Operator (acting jointly and each acting reasonably) shall determine whether a Permitted Depot Delay which has been granted under the relevant Depot Agreement for Lease has caused a delay or failure in the performance by the TMM of any of the Depot Dependent Obligations.

6. NO RELIEF

6.1 The TMM shall not be entitled to an extension of time if the exception set out in the definition of Permitted Delay applies.

6.2 The TMM may not make a claim for an extension of time under this Schedule 13 in circumstances where the occurrence of a Potential Permitted Delay has resulted in the Owner, the Operator or the TMM (as the case may be) issuing a Variation Proposal which results in an Authorisation to Vary. In those circumstances, any claim for an extension of time shall be made, and any extension of time shall be granted, in accordance with the Applicable Variation Procedure.

6.3 The TMM shall not be entitled to an extension of time or any other form of relief in connection with the occurrence or remedy of an Endemic Defect or an Epidemic Defect in accordance with paragraph 5 (*Epidemic and Endemic Defects*) of Schedule 14 (*Design Life, Warranties and MSA Fault Rectification*).

7. REJECTION OF POTENTIAL PERMITTED DELAY CLAIMS

If the Owner and the Operator (acting jointly) decide that the TMM is not entitled to an extension of time, the Owner and the Operator (acting jointly) shall notify the TMM accordingly:

(a) within the 14 day period referred to in paragraph 4.2 or such longer period of time as all the Parties agree is reasonable in the circumstances; and

(b) in writing (to be substantially in the form set out in 0 (*Notice of Rejection of Permitted Delay*).

8. DISPUTES

8.1 If:

(a) the Owner and/or the Operator:

(i) do not agree that a Permitted Delay has occurred; or

(ii) if the Owner and the Operator are unable to agree upon the duration of any extension of time to be granted under paragraph 4.2 within the 14 day period referred to in paragraph 4.2; or

(b) if the TMM believes that a decision of the Owner and the Operator (acting jointly) under this Schedule 13 is incorrect or not made in accordance with the terms of this Agreement,

then the Applicable Expert Determination Provisions shall apply.

8.2 Subject to paragraph 8.3, if a Contract Dispute in relation to a Unit, Owner Owned Spare, Special Tool or Simulator as to:

(a) whether a Permitted Delay has occurred; or

(b) the duration of any extension of time to be granted under paragraph 4.2 to the Expected Delivery Date for such Unit, Owner Owned Spare, Special Tool or Simulator,

arises or is continuing at any time on or after the Expected Delivery Date for that Unit, Owner Owned Spare, Special Tool or Simulator, then, unless a Lease Owner Termination Event or an Operator Event of Default has occurred and is continuing (in which case the TMM shall not be under any obligation to pay liquidated damages to the Owner if a Lease Owner Termination Event has occurred and is continuing or the Operator if an Operator Event of Default has occurred and is continuing) the TMM shall continue to pay liquidated damages to the Owner and the Operator in accordance with clauses 19.1 to 19.6 (as applicable) in relation to that Unit, Owner Owned Spare, Special Tool or Simulator.

8.3 If the final determination of a Contract Dispute referred to in paragraph 8.2 is that the TMM was entitled to an extension of time to the Expected Delivery Date for the relevant Unit, Owner Owned Spare, Special Tool or Simulator in accordance with this Schedule 13, the TMM shall be entitled (in addition to any time and costs granted in relation to the Permitted Delay) to reimbursement from each of the Owner and the Operator of all amounts of liquidated damages paid by the TMM to that Party under paragraph 8.2 in relation to the relevant Unit, Owner Owned Spare, Special Tool or Simulator for the period of such extension of time, plus interest for such period at the Default Interest Rate, save that the Owner shall not be required to make such reimbursement if the Permitted Delay was a Permitted Depot Delay caused by an act of terrorism, lightning, earthquake or extraordinary storm or fire and flooding that constitutes a Force Majeure Event (as defined under any Depot Agreement for Leases).

8.4 If the TMM is entitled to reimbursement of liquidated damages pursuant to paragraph 8.3, then clause 7.6 of the Lease shall apply as between the Owner and the Operator.

APPENDIX 1 TO SCHEDULE 13

NOTICE OF POTENTIAL PERMITTED DELAY

To: [*Insert Owner's name* here] (the ***Owner***)
[*Insert Operator's name* here] (the ***Operator***)

From: [*Insert TMM's name here*] (the ***TMM***)

Claim Number: …….. [*To be allocated by the Owner on receipt of this notice*]

In accordance with paragraph 1.1 of Schedule 13 (*Permitted Delay Procedure*) [and paragraph 1.3 of the Schedule 18][252] of the Manufacture and Supply Agreement made between the TMM, the Owner and the Operator dated [_____] (the ***MSA***) the TMM hereby [*gives written notice*] [*in an emergency only – hereby confirms in writing an oral notice given on* [_____] *to the Owner and the Operator*] that the following Potential Permitted Delay (as defined in paragraph 1.1 of Schedule 13 of the MSA) is liable to cause/has caused delay to the TMM's compliance with the MSA as set out below:

Potential Permitted Delay:

Affected Expected Delivery Date:

1. The Potential Permitted Delay mentioned above:

(a) has occurred; and

(b) is foreseen by the TMM (pursuant to paragraph 1.1 of Schedule 13 of the MSA).

This notice is served not later than 14 days after the TMM became aware of the occurrence of such Potential Permitted Delay.

The TMM's view at the date of this notice of the likelihood and probable extent of the delay are as follows:

…….

…….

…….

Capitalised terms used in this notice shall, unless expressly defined in this notice, have the meanings given to them in the MSA.

Signed by [*TMM's representative*]

for and on behalf of [_____]

---

[252] Delete unless the Potential Permitted Delay has arisen as a result of a Force Majeure Event.

…….. Date ……..

APPENDIX 2 TO SCHEDULE 13

POTENTIAL PERMITTED DELAY - PARTICULARS OF CLAIM

To: [*Insert Owner's name* here] (the ***Owner***)
[*Insert Operator's name* here] (the ***Operator***)

From: *Insert TMM's name here* (the ***TMM***)

Claim Number: ……..

In accordance with paragraph 3.1 of Schedule 13 (*Permitted Delay Procedure*) of the Manufacture and Supply Agreement made between the TMM, the Owner and the Operator, dated [_____] (the ***MSA***) and further to the Notice of Potential Permitted Delay served on the Owner and the Operator on ……., the TMM hereby further submits to the Owner and the Operator:

(c) full and detailed particulars of the cause and extent of the delay and the effects of the delay on the TMM's ability to comply with its obligations under the MSA:

……

……

……

……

……

……

(use continuation sheet if necessary)

(d) details of the documents that will be relied upon to support the claim of the TMM for an extension of time based on the Potential Permitted Delay:

……

……

……

……

……

……

(use continuation sheet if necessary)

(e) details of the measures which the TMM has adopted and/or proposes to adopt to avoid or reduce the effects of the Potential Permitted Delay on its ability duly to comply with its obligations under the MSA (including the cost and likely effect):

……

……

……

……

……

……

(use continuation sheet if necessary)

Capitalised terms used in this notice shall, unless expressly defined in this notice, have the meanings given to them in the MSA.

Signed by [*TMM's representative*]

for and on behalf of [_____]

…….. Date ……..

APPENDIX 3 TO SCHEDULE 13

POTENTIAL PERMITTED DELAY - INTERIM PARTICULARS

To: [*Insert Owner's name* here] (the ***Owner***)
[*Insert Operator's name* here] (the ***Operator***)

From: *Insert TMM's name here* (the ***TMM***)

Claim Number: …….

In accordance with paragraph 3.3 of Schedule 13 (*Permitted Delay Procedure*) of the Manufacture and Supply Agreement made between the TMM, the Owner and the Operator dated [_____] (the ***MSA***), and further to the Notice of Potential Permitted Delay served on the Owner and the Operator on ……., the TMM hereby further submits to the Owner and the Operator:

(f) reasons why the TMM is not able to submit full and details particulars to the Owner and the Operator in accordance with paragraph 3.1 of Schedule 13 of the MSA:

……

……

……

……

……

……

(use continuation sheet if necessary)

(g) interim written particulars (including details of the likely consequences of the Potential Permitted Delay on the TMM's ability to comply with its obligations under the MSA and an estimate of the likelihood and likely extent of the delay):

……

……

……

……

……

……

(use continuation sheet if necessary)

OR [_____]

Further interim written particulars [*to follow the interim particulars at intervals of not more than* [_____] *days, until the actual delay caused (if any) is ascertainable, whereupon the TMM's shall as soon as practicable, but in any event within [_____] days, submit to the Owner and the Operator the items referred to in paragraph 3.1 of Schedule 13 of the MSA.*]

Capitalised terms used in this notice shall, unless expressly defined in this notice, have the meanings given to them in the MSA.

Signed by [*TMM's representative*]

for and on behalf of [_____]

…….. Date ……..

APPENDIX 4 TO SCHEDULE 13

NOTICE OF GRANT OF PERMITTED DELAY

To: [*Insert TMM's name here*] (the ***TMM***)

From: [*Insert Owner's name* here] (the ***Owner***)
[*Insert Operator's name* here] (the ***Operator***)

Claim number: ……..

1. The Owner and the Operator give notice in accordance with paragraph 4.2 of Schedule 13 (*Permitted Delay Procedure*) of the Manufacture and Supply Agreement made between the TMM, the Owner and the Operator, dated [_____] (the ***MSA***) of the grant of a Permitted Delay pursuant to paragraph [_] of the definition of Permitted Delay to the TMM in respect of the following Expected Delivery Date …….[253]

2. The extension of time granted by this notice gives the TMM until …….. to achieve the Expected Delivery Date, referred to in paragraph 1. This extension shall amend the Contract Programme accordingly.

3. The TMM shall continue to use, and the right of the TMM to this extension of time is conditional upon the TMM continuing to use, all reasonable endeavours, as required by paragraph 2.1 of Schedule 13 of the MSA, to avoid or reduce the effects of any delays suffered.

4. [*The following costs awarded in accordance with and subject to paragraph 2.2(iii) of Schedule 13 of the MSA shall be split equally between the Owner and the Operator in an amount equal to £*[_____].][254]

5. This extension of time is an interim/final extension.

6. Capitalised terms used in this notice shall, unless expressly defined in this notice, have the meaning given to them in the MSA.

Signed by the Owner

Date

Signed by the Operator

Date

---

[253] Note: the Owner and the Operator may, in their absolute discretion, include in this notice a Permitted Delay to any other Expected Delivery Date.

[254] Include if applicable.

APPENDIX 5 TO SCHEDULE 13

NOTICE OF DISCRETIONARY GRANT OF PERMITTED DELAY

To: [*Insert TMM's name here*] (the ***TMM***)

From: [*Insert Owner's name* here] (the ***Owner***)
[*Insert Operator's name* here] (the ***Operator***)

Claim number: ……..

The Owner and the Operator give notice in accordance with paragraph 4.2 of Schedule 13 (*Permitted Delay Procedure*) of the Manufacture and Supply Agreement between the TMM, the Owner and the Operator, dated [_____] (the ***MSA***) of the Owner's and the Operator's decision to grant the TMM a discretionary extension of time pursuant to paragraph [_] of the definition of Permitted Delay in respect of the following:

Description of relevant Expected Delivery Date:

1. New date set for relevant Expected Delivery Date:[255]

2. This extension shall amend the Contract Programme accordingly.

3. If the TMM has made a claim pursuant to paragraph 1.1 of Schedule 13 of the MSA, the Owner and the Operator are not bound by or limited to the grounds stated in the TMM's claim.

4. This extension of time is an interim/final extension.

5. Capitalised terms used in this notice shall, unless expressly defined in this notice, have the meaning given to them in the MSA.

Signed by the Owner

Date

Signed by the Operator

Date

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[255] Note: the Owner and the Operator may, in their absolute discretion, include within this notice a change to any Expected Delivery Date.

APPENDIX 6 TO SCHEDULE 13

NOTICE OF REJECTION OF PERMITTED DELAY

To: [*Insert TMM's name here*] (the ***TMM***)

From: [*Insert Owner's name* here] (the ***Owner***)
[*Insert Operator's name* here] (the ***Operator***)

Claim, number (if appropriate): ……..

The Owner and the Operator give notice in accordance with paragraph 7 (*Rejection of Potential Permitted Delay Claims*) of Schedule 13 (*Permitted Delay Procedure*) of the Manufacture and Supply Agreement between the TMM, the Owner and the Operator, dated [_____] (the ***MSA***) of the [*Owner's representative's*] and the Operator's decision not to grant an extension of time to the TMM in relation to its claim under paragraph 1.1 of Schedule 13 (*Permitted Delay Procedure*) of the MSA, set out in a notice dated ……

The reasons for the Owner's and the Operator's decision are as follows:

Capitalised terms used in this notice shall, unless expressly defined in this notice, have the meaning given to them in the MSA.

Signed by the Owner

Date

Signed by the Operator

Date

SCHEDULE 14

DESIGN LIFE, WARRANTIES AND MSA FAULT RECTIFICATION

Schedule 14: Design Life, Warranties and MSA Fault Rectification

SCHEDULE 14

Design Life, Warranties and MSA Fault Rectification

1. THIRD PARTY WARRANTIES

In the event of termination of this Agreement, the TMM shall extend to the Owner or the Operator (as appropriate) the benefit of any guarantee, condition or warranty expressly given to the TMM by any Sub-Contractors in respect of each Unit, Vehicle, Part, Owned Spare, Special Tool, the Integration Laboratory Train Equipment, the Mock-Up or the Simulators, and the TMM shall use its best endeavours to extend to the Owner or the Operator (as appropriate) the benefit of any guarantee, condition or warranty which may have been expressly given to the TMM by any other person in respect of each Unit, Vehicle Part, Owned Spare, Special Tool, Integration Laboratory Train Equipment, Mock-up or Simulator.

2. [][256]

3. GENERAL WARRANTY

3.1 The TMM shall, notify the Owner and the Operator in writing as soon as reasonably practicable after it becomes aware of any MSA Fault which occurs in any Unit, Vehicle, Part, Owned Spare, Special Tool, item of Integration Laboratory Train Equipment, Mock-Up or Simulator during the Warranty Period (MSA). Where an MSA Fault is notified by the TMM to the Operator and the Owner in accordance with the Fault Notification Procedure, the TMM shall be deemed to have given notice of that MSA Fault in accordance with this paragraph 3.1.

3.2 The Operator and/or the Owner, shall notify the TMM in writing as soon as reasonably practicable after it becomes aware of any MSA Fault. Without prejudice to the Operator's and the Owner's rights under the TSA Performance Regime, the TMM shall, at its own expense, as soon as is reasonably practicable after becoming aware or being notified of an MSA Fault, make good any MSA Fault which occurs in any Unit, Vehicle, Part, Owned Spare, Special Tool, item of Integration Laboratory Train Equipment, Mock-Up or Simulator during the relevant Warranty Period (MSA).

3.3 Subject to paragraph 5.1, in respect of any MSA Fault, if either:

(a) such MSA Fault is not remedied by the TMM within seven days of being notified to the TMM by the Owner or the Operator (except where such failure to remedy is due to the occurrence of a Force Majeure Event); or

(b) the TMM has not put forward an MSA Fault rectification plan satisfactory to the Owner and the Operator (each acting reasonably) for rectification of such MSA Fault within seven days of the MSA Fault being notified to the TMM by the Owner or the Operator (save where the reason the TMM has not rectified the MSA Fault is due to the occurrence of a Force Majeure Event),

the Owner and the Operator (acting jointly) may proceed to remedy or have remedied the MSA Fault at the TMM's expense.

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[256] Redaction.

3.4 Where it has been determined that an MSA Fault has occurred during the Warranty Period (MSA), any rectification work and any associated costs shall be deemed to have been undertaken and incurred pursuant to this Agreement and not as a Standard Service under the TSA or as part of the TSSSA Services under the TSSSA, save where the relevant limit under clause 25.4 has been reached.

3.5 If the TMM replaces a Part pursuant to paragraph 3.2 during the Warranty Period (MSA), the Part serving as a replacement (the ***Replacement Part***) will be covered by a further warranty period of [][257] (the ***Further Warranty Period (Part)***) commencing on the date that the Replacement Part is fitted to the relevant Unit. If an MSA Fault arises on a Replacement Part during the Further Warranty Period (Part), the TMM shall comply with its obligations to make good such MSA Fault under paragraph 3.2.

3.6 Subject to paragraphs 3.8, 4 (*Design Life*) and 5 (*Epidemic and Endemic Defects*), the TMM shall have no liability and no actions or proceedings shall be commenced against the TMM in respect of any Latent Defect(s) (under paragraph (a) of the definition of Latent Defect) in any Vehicle, Unit, Part, Owned Spare, Special Tool or Simulator after the date falling [][258] after the end of the Warranty Period (MSA) or Further Warranty Period (as appropriate) applicable to such Vehicle, Unit, Part, Owned Spare, Special Tool or Simulator, as the case may be.

3.7 All conditions and warranties which are to be implied by statute or otherwise by general law into this Agreement are hereby excluded to the maximum extent permissible in law.

3.8 The provisions of this paragraph 3 shall not apply for so long as the TMM is appointed to maintain the Units under the TSA or any maintenance agreement entered into on the same, or substantially the same, terms as the TSA.

4. DESIGN LIFE

Units

4.1 The TMM undertakes to the Owner and the Operator that each Unit will have a design life of 35 years from the date of Acceptance of such Unit (the ***Unit Design Life***) subject to:

(a) the operation of such Unit on the Network;

(b) the operation of such Unit in accordance with Applicable Laws and Standards, Relevant Approvals, the Maintenance Plan and the Manuals; and

(c) in the event that the TMM ceases to maintain the Units under the TSA or provide services as Supplier under the TSSSA, the maintenance and overhaul of such Unit in accordance with Applicable Laws and Standards, Relevant Approvals, the Maintenance Plan and the Manuals,

it being acknowledged that Parts on such Units will need to be maintained, overhauled and, in many cases, replaced during the Unit Design Life (including as a result of fair wear and tear) and provided that the Owner's and the Operator's remedies in respect of the undertaking in

[257] Redaction.

[258] Redaction.

this paragraph 4.1 shall, save as provided in paragraph 9 (*MSA Fault Rectification Sole Remedy*), be limited to those set out in the remainder of this paragraph 4. For the purposes of this paragraph 4.1, if and when it applies after the TMM has ceased to either (i) maintain the Units under the TSA, or (ii) provide services as the Supplier under the TSSSA, references to the Manuals or the Maintenance Plan shall be construed as references to such documents as at the date of such TMM cessation, subject only to changes to such documents which the TMM agrees, in its role (if any) as design authority in accordance with clause 10.23, would not be reasonably likely to reduce the Unit Design Life.

[][259]

4.2 [][260]

[][261]

4.3 [][262]

Potential Design Defects in Units or Key Components

4.4 Where any Party believes a Potential Design Defect has occurred, that Party shall, as soon as reasonably practicable after forming such belief, inform the other Parties in writing of such Potential Design Defect, specifying the nature of the Potential Design Defect, providing reasons for forming such belief and providing reasonable supporting evidence.

Determination of Design Defects

4.5 If a notice of a Potential Design Defect is delivered pursuant to paragraph 4.4, the Parties shall consult, each acting reasonably, for a period of 28 days (or such longer period as is reasonable in the circumstances), as to whether such Potential Design Defect is a Design Defect.

4.6 Paragraphs 4.11 to 4.14 (inclusive) shall apply where the Parties agree that a Potential Design Defect is a Design Defect.

Expert determination

4.7 If the Parties fail to reach agreement as to whether a Potential Design Defect is a Design Defect following consultation in accordance with paragraph 4.5, any Party may refer the dispute to an Expert pursuant to the Applicable Expert Determination Provisions.

4.8 If the Expert has failed to make a decision within 30 days of being requested to do so, then the Owner may, after consultation with the Operator, request the TMM to rectify the Potential Design Defect pending determination of whether such Potential Design Defect is a Design Defect and if so requested, the TMM shall implement such rectification work and the Owner shall pay to the TMM, on production of evidence satisfactory to the Owner as to the cost of the TMM performing the rectification work, 50 per cent. of such cost, to be held on account pending the determination of the Expert.

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259 Redaction.

260 Redaction.

261 Redaction.

262 Redaction.

4.9 If the Expert determines, or if the TMM agrees that the reason for the failure of the Units, the Simulators or a Key Component to achieve the Design Life is a Design Defect:

(a) the TMM shall pay all costs and fees of the Expert;

(b) where the Owner has not previously requested the TMM to rectify the Potential Design Defect pursuant to paragraph 4.8, paragraphs 4.11 to 4.14 (inclusive) shall apply; and

(c) where the Owner has requested that the TMM carry out the rectification work pursuant to paragraph 4.8, the TMM shall repay to the Owner any amounts paid by the Owner to the TMM under paragraph 4.8.

4.10 If the Expert determines, or if the Party that notified the relevant Potential Design Defect subsequently agrees that the Potential Design Defect is not a Design Defect, that Party shall:

(a) pay all costs and fees of the Expert;

(b) pay the costs reasonably and properly incurred by the TMM in investigating whether the Potential Design Defect was a Design Defect; and

(c) where the Owner has requested that the TMM perform the rectification work pursuant to paragraph 4.8, pay to the TMM the cost of rectifying such Potential Design Defect, as evidenced to the Owner by the TMM on a fully transparent basis plus a margin of 12 per cent., less any amounts already paid by the Owner to the TMM pursuant to paragraph 4.8.

Rectification or Replacement where Design Defect

4.11 Subject to paragraph 4.13, if the Units, the Simulators or a Key Component fails to achieve the Design Life as a result of a Design Defect, the TMM shall, in each case, as soon as reasonably practicable after it is agreed in accordance with paragraph 4.5 (or determined in accordance with paragraph 4.9) that the Potential Design Defect is a Design Defect but in any event within 30 days of such agreement or determination and subject always to paragraph 5 (*Epidemic and Endemic Defects*):

(a) rectify that Design Defect at the TMM's own expense;

(b) if the Owner (in consultation with the Operator) agrees, at the TMM's own expense, replace:

(i) in the case of a Unit failing to achieve its Unit Design Life, the component and/or Key Component (as appropriate) that has given rise to that failure and to fit that replacement component or Key Component to that Unit; and

(ii) in the case of a Key Component failing to achieve its Design Life, the Key Component that has given rise to that failure and fit that replacement Key Component to the Unit on which that Key Component was fitted; and

(iii) in the case of a Simulator failing to achieve its Simulator Design Life, the component that has given rise to that failure and fit that replacement component to that Simulator;

(c) propose a plan satisfactory to the Owner and the Operator for the rectification of such Design Defect or, if the Owner (in consultation with the Operator) agrees, the replacement of the component(s) and/or Key Component(s) that has given rise to such Design Defect, in each case at the TMM's own expense; or

(d) if the Owner (in consultation with the Operator) agrees, compensate the Owner for the cost of a third party rectifying the Design Defect (provided that such third party is appropriately qualified and experienced),

and the TMM's obligations under this paragraph 4.11 shall apply to all the Units or all the Simulators or all the Key Components of the type that has failed to achieve its Design Life, notwithstanding that the failure may not yet have manifested itself in all Units or all the Simulators or all of the Key Components of that type.

4.12 Where the TMM:

(a) is to replace any component and/or Key Component pursuant to paragraph 4.11(b), the TMM shall supply such replacement component or Key Component (as appropriate) and fit such component or Key Component (as appropriate) to each relevant Unit as soon as reasonably practicable after agreement pursuant to paragraph 4.11(b);

(b) is to implement a rectification or replacement plan pursuant to paragraph 4.11(c), the TMM shall do so in accordance with the terms of that plan; or

(c) is to compensate the Owner for the cost of a third party rectifying the Design Defect pursuant to paragraph 4.11(d), the TMM shall pay the relevant amounts to the Owner on production of invoices or other evidence reasonably satisfactory to the TMM of such costs.

4.13 If the Owner has requested pursuant to paragraph 4.11(b) that the TMM replace Key Components on all the Units in the Fleet towards the end of the Design Life for such Key Component, then, subject to the TMM performing such replacement, the TMM shall be entitled to require the Owner to contribute an appropriate amount in the circumstances towards the costs incurred by the TMM in replacing such Key Components with new Key Components on all such Units. Where the cost of replacement is less than the cost of the rectification by the TMM, the Owner shall not make any contribution to the replacement costs. Any replacement under this Schedule 14 shall be deemed to be a rectification for the purposes of paragraph 4.11(a).

Failure to rectify or replace

4.14 If the TMM fails to:

(a) rectify a Design Defect in accordance with paragraph 4.11(a); or

(b) agree with the Owner (following consultation with the Operator) to replace any component and/or any Key Component that has a Design Defect in accordance with paragraph 4.11(b) or, after having agreed to do so, replace any such component and/or Key Component in accordance with paragraph 4.12(a); or

(c) propose a rectification plan in accordance with paragraph 4.11(c) or implement such a rectification plan in accordance with paragraph 4.12(a),

then the TMM shall, in each case, promptly compensate the Owner or the Operator for the costs of a third party rectifying that Design Defect (provided that any such third party is appropriately qualified and experienced), such cost to be paid promptly following production of invoices or other evidence reasonably satisfactory to the TMM of such costs.

5. EPIDEMIC AND ENDEMIC DEFECTS

5.1 If during the Endemic/Epidemic Protection Period, the Owner and/or the Operator believes that an Endemic Defect or an Epidemic Defect has occurred, the Owner and/or the Operator shall, as soon as reasonably practicable, notify the TMM, specifying the nature of the Endemic Defect or Epidemic Defect, as appropriate. If, following consultation between the Parties (each acting reasonably), it is agreed between the Parties that an Endemic Defect or an Epidemic Defect has occurred, the TMM shall, subject to paragraph 5.5, at its own expense, remedy such Endemic Defect or Epidemic Defect and undertake:

(a) necessary rectification on all Vehicles or Units in respect of which Acceptance has occurred;

(b) necessary rectification on any other Vehicles or Units subsequently tendered for Acceptance or on any Parts; and

(c) such work as may be feasible in order to enable all Vehicles or Units to continue in operation in compliance with the terms of this Agreement pending the rectification work referred to in paragraphs 5.1(a) and (b).

5.2 If the Parties are unable to agree whether an Endemic Defect or an Epidemic Defect has occurred within 30 days of the notification by the Owner and/or the Operator in accordance with paragraph 5.1, the matter shall be treated as a Dispute and shall be referred to an Expert for determination in accordance with the Applicable Expert Determination Provisions.

5.3 As soon as reasonably practicable, but in any event within 30 days of the occurrence of an Endemic Defect or Epidemic Defect being agreed pursuant to paragraph 5.1 or determined in accordance with paragraph 5.2 or the TMM otherwise becoming aware of any such Endemic Defect or Epidemic Defect, the TMM shall submit to the Owner a programme for rectification of such Endemic Defect or Epidemic Defect on all Vehicles, Units or Parts and the Parties shall seek to agree such programme in good faith, within a period of 28 days from the date of submission. If the Parties are unable to agree a programme within 28 days, the matter shall be treated as a Dispute and shall be referred to an Expert for determination in accordance with the Applicable Expert Determination Provisions.

5.4 If an Endemic Defect or an Epidemic Defect is present in any Spares and such Spare has been fitted to Vehicles or Units subsequently tendered for Acceptance, the TMM shall, as soon as reasonably practicable after becoming aware or agreeing pursuant to paragraph 5.1 or determined in accordance with paragraph 5.2, submit to the Owner for approval by the Owner, a programme for rectification of such Endemic Defect or Epidemic Defect on all relevant Spares (or, if necessary, replacement of such Spares) as soon as is reasonably practicable and the Parties shall seek to agree such programme in good faith, within a period of 28 days from the date of submission. If the Parties are unable to agree a programme within 28 days the matter shall be treated as a Dispute and shall be referred to an Expert for determination in accordance with the Applicable Expert Determination Provisions.

5.5 []263

5.6 Subject to paragraph 4 (*Design Life*), the TMM shall have no liability and no actions or proceedings shall be commenced against the TMM in respect of any Endemic Defect or Epidemic Defect that constitutes a Latent Defect (under paragraph (b) of the definition of Latent Defect) after the date falling []264 after the end of the Endemic /Epidemic Protection Period.

6. OWNED SPARES AND SPECIAL TOOLS WARRANTY

6.1 The TMM shall be responsible for rectifying, at its own expense, any MSA Fault which arises within the Warranty Period (MSA) on any Owned Spare or Special Tool as soon as reasonably practicable after having been notified of such MSA Fault by the Owner or the Operator (as the case may be), but in any event within 30 days of notification.

6.2 If the TMM replaces an Owned Spare or Special Tool pursuant to paragraph 6.1 during the Warranty Period (MSA), the replacement Owned Spare or Special Tool (as the case may be) shall be covered by a further warranty period of []265 (the ***Further Warranty Period*** (***Owned Spare or Special Tool***)) commencing on the date that such Owned Spare or Special Tool (as the case may be) is replaced. If an MSA Fault arises on such Owned Spare or Special Tool (as the case may be) during the Further Warranty Period (Owned Spare or Special Tool), the TMM shall comply with its obligations to make good such MSA Fault under paragraph 6.1.

7. TRANSPORTATION COST

The TMM shall arrange and pay for any transportation or movement of any Unit, Vehicle, Part, Owned Spare or Special Tool to and from its own or any third party site for the purposes of any warranty, rectification, remedial or any other work which the TMM is required to undertake pursuant to this Schedule 14.

8. LIQUIDATED DAMAGES

8.1 []266

8.2 The TMM's obligation to pay liquidated damages pursuant to paragraph 8.1 shall be without prejudice to the TMM's obligations to rectify the MSA Fault or Design Defect, and the payment of liquidated damages by the TMM to the Operator shall be in full and final satisfaction of all the TMM's liability for an MSA Fault Unit being out of service.

8.3 Any amounts payable by the TMM under paragraph 8.1 shall be invoiced by the Operator within seven days of the end of each Railway Period and paid by the TMM within 28 days of receipt by the TMM of such invoice.

8.4 The TMM will not be liable under this Schedule 14 to, as appropriate, the Owner or the Operator, to the extent that any MSA Fault in a Unit arises as a result of:

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263 Redaction.

264 Redaction.

265 Redaction.

266 Redaction.

(a) an Excluded Matter;

(b) the use of the Unit other than in accordance with the Permitted Use (MSA);

(c) maintenance by the Operator or a Third Party Maintainer not appointed by the TMM of that Unit, or the failure of a Part supplied by the Operator or a Third Party Maintainer not appointed by the TMM, except where that maintenance has been carried out in accordance with or the relevant Part complies with any relevant provisions of the Maintenance Plan and the Manuals;

(d) the modification of that Unit or Key Component by the Operator or a Third Party Maintainer not appointed by the TMM, except where that modification has been carried out in accordance with the Maintenance Plan and the Manuals;

(e) the negligence, wilful misconduct or failure to observe or perform, respectively the Owner's or the Operator's obligations in or under this Agreement or breach by the Owner or Operator (as appropriate) of statutory duty; or

(f) failure by, respectively, the Owner or Operator to comply with Applicable Laws and Standards affecting the warranties,

provided that the events set out in paragraph 8.4(b) to (f) inclusive did not arise as a result of the act, omission, neglect or default of the TMM, a member of the TMM's Group, or any Sub-Contractor (as defined in respect of this Agreement or the TSA) or agent of the TMM, in which case the TMM shall remain liable in accordance with the provisions of this Schedule 14.

8.5 The TMM acknowledges that when it wishes to take a Unit of any Unit Type out of service to rectify an MSA Fault or Design Defect in accordance with this Schedule 14, it shall not take such Unit out of service unless the Operator, acting reasonably, has agreed the timetable (such timetable to be copied to the Owner) for the work to remedy the MSA Fault or Design Defect (including the maximum downtime each Unit of that Unit Type will be unavailable for service to the Operator) and the TMM:

(a) is able to demonstrate to the Operator that any work required to rectify such MSA Fault or Design Defect can be carried out without the number of Units of that Unit Type that will be Available on any day in a Railway Period being less than the Availability Benchmark for that Unit Type for that day;

(b) in respect of work that will require the relevant Unit to be out of service for up to two weeks, has given at least eight weeks' notice to the Operator in writing of the date on which such work is to begin; or

(c) in respect of work that will require the relevant Unit to be out of service for two weeks or more, has given at least 12 weeks' notice to the Operator in writing of the date on which such work is to begin.

8.6 The Operator agrees that it will co-operate with the Owner and the TMM to make Units available to enable warranty work to be carried out in accordance with this Schedule 14, subject to paragraph 8.5.

9. MSA FAULT RECTIFICATION SOLE REMEDY

The repair, replacement or rectification of any MSA Fault, Endemic Defect, Epidemic Defect, []267 or Design Defect by the TMM in accordance with this Schedule 14 shall be in full and final satisfaction of all the TMM's liability for such MSA Fault, Endemic Defect, Epidemic Defect, []268 or Design Defect (as the case may be) and the consequences thereof under this Agreement, provided that this paragraph 9 shall not affect:

(a) the rights pursuant to paragraph 5 (*No Obligation to Accept Units with MSA Faults*) of Schedule 6 (*Delivery and Acceptance*) (i) of the Owner not to accept a Unit for Acceptance, and/or (ii) the Operator not to provide a confirmation of its satisfaction pursuant to paragraph 3.1(p) or paragraph 4.2, in each case of Schedule 6;

(b) the rights of the Owner and/or the Operator to appoint a third party to remedy a Fault, Endemic Defect, Epidemic Defect, []269 or Design Defect where they are entitled to do so in accordance with this Schedule 14 or the TSA;

(c) the rights of the Owner and/or the Operator to terminate this Agreement in accordance with Schedule 19.1 (*TMM Events of Default*);

(d) the rights of the Owner and/or the Operator to be indemnified by the TMM in accordance with this Agreement; and

(e) the rights of the Operator to claim liquidated damages in accordance with paragraph 8.1 of this Schedule 14.

10. SURVIVAL

This Schedule 14 shall survive the termination of this Agreement, save where such termination occurs:

(a) in accordance with Part 1 (*Consequential Termination Provisions Pre-Minimum Fleet*) of Schedule 19.2 (*Consequential Termination Provisions*); or

(b) in accordance with clause 14.9 of the Umbrella Agreement.

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267 Redaction.

268 Redaction.

269 Redaction.

SCHEDULE 15

PERMITTED CHANGES

Schedule 15: Permitted Changes

[][270]

[270] Redaction.

SCHEDULE 16

TMM MSA INSURANCES

Schedule 16: TMM MSA Insurances

SCHEDULE 16

TMM MSA Insurances

[][271]

[271] Redaction.

SCHEDULE 17

PRICED OPTIONS

Schedule 17: Priced Options

SCHEDULE 17

[][272]

[272] Redaction.

SCHEDULE 18

FORCE MAJEURE

Schedule 18: Force Majeure

SCHEDULE 18

Force Majeure

1. CONSEQUENCES OF FORCE MAJEURE EVENTS

1.1 Save as expressly set out in clause 19.5, where a party to this Agreement is an Affected Party due to the occurrence of a Force Majeure Event:

(a) that Affected Party shall not incur any liability under this Agreement to any other Party for any losses or damage incurred by that other Party under this Agreement as a result of that Affected Party being prevented from performing any of its obligations under this Agreement; and

(b) that other Party shall not be entitled to bring a claim against that Affected Party for non-performance of those obligations,

subject, in each case, to the provisions of Schedule 13 (*Permitted Delay Procedure*) for any Force Majeure Event in respect of which the TMM is the Affected Party.

1.2 No Party shall be entitled to terminate this Agreement for a MSA TMM Event of Default or an MSA Operator Event of Default or an MSA Owner Event of Default if such event of default arises from a Force Majeure Event.

1.3 On the occurrence of a Force Majeure Event, the Affected Party shall notify the other Parties as soon as practicable after its occurrence. The notification shall specify details of the Force Majeure Event, including evidence of its effect on the obligations of the Affected Party and any action proposed to mitigate its effect. If the TMM is the Affected Party, the notification shall be by way of the notice delivered pursuant to paragraph 1.1 of Schedule 13 in relation to that Force Majeure Event.

2. OBLIGATION TO MITIGATE FORCE MAJEURE EVENTS

2.1 As soon as practicable following notification pursuant to paragraph 1.3, the Parties shall consult with each other in good faith and use all reasonable endeavours to agree appropriate terms to mitigate the effects of the Force Majeure Event and facilitate the continued performance of the affected obligations.

2.2 The Parties shall at all times following the occurrence of a Force Majeure Event, both during the continuation of the relevant event and thereafter:

(a) use all reasonable endeavours to prevent and mitigate the effects of any delay (in accordance with the provisions of Schedule 13 (*Permitted Delay Procedure*) where applicable); and

(b) take all steps in accordance with good industry practice to overcome or minimise the consequences of that Force Majeure Event upon the performance of their respective obligations under this Agreement and upon the Contract Programme.

3. CONTINUING FORCE MAJEURE EVENTS

3.1 If, during the period prior to Acceptance of the Last Unit, any Force Majeure Event that prevents an Affected Party from carrying out its obligations under this Agreement (or a Depot Force Majeure Event that prevents the TMM from carrying out its Depot Dependent Obligations) continues or its effects are continuing such that the Affected Party is unable to comply with substantially all of its then outstanding obligations under this Agreement for a continuous period of more than 180 days, any Party may, subject to the provisions of schedule 2.6 (*Termination of Contracts for Force Majeure*) of the Umbrella Agreement, terminate the TMM's obligation to provide any further Equipment for Acceptance in accordance with this Agreement.

3.2 [][273]

3.3 If, during the period prior to Acceptance of the Last Unit, any Force Majeure Event or a Depot Force Majeure Event occurs and is continuing and either:

(a) [][274]

(b) [][275]

then the relevant Party shall notify the other Parties and the Secretary of State and the provisions of paragraphs 2 (*Long Term Force Majeure Events under MSA or DAfL*) and 3 (*Termination of the MSA*) of schedule 2.6 of the Umbrella Agreement shall apply.

3.4 No Party shall be entitled to terminate this Agreement as the result of the occurrence of a Force Majeure Event or Depot Force Majeure Event except as provided in paragraph 3.1 of schedule 2.6 of the Umbrella Agreement.

Force Majeure – Pre-Minimum Fleet

3.5 If the Secretary of State or any Party to this Agreement delivers a notice for the termination of this Agreement pursuant to paragraph 3.1 of schedule 2.6 of the Umbrella Agreement at any time before Units comprising the Minimum Fleet have been Accepted or such a notice is deemed to have been delivered pursuant to paragraph 10.1 of schedule 2.6 of the Umbrella Agreement then, with effect from the date set out in the relevant termination notice (or, where paragraph 10.1 of schedule 2.6 of the Umbrella Agreement applies, with effect from the date of the notice which is deemed to have been delivered pursuant to that paragraph):

(a) all the rights and obligations of the Parties under this Agreement shall, subject to any express provision in this Agreement or the Umbrella Agreement to the contrary, terminate;

(b) the Owner shall, if required by the TMM in accordance with clause 11.32(i)(B), pay the amount standing to the credit of the Bond Proceeds Account to the TMM (or, if the TMM so directs in writing, to the Bond Provider in respect of the Owner Bond);

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[273] Redaction.

[274] Redaction.

[275] Redaction.

(c) the provisions of paragraph 4 (*Circumstances where Lease and TSA are Terminated following MSA Force Majeure Event*) of schedule 2.6 of the Umbrella Agreement shall apply; and

(d) the provisions of paragraph 3 (*Novation of MSA Warranties*) of schedule 2.8 (*Transfer of Rolling Stock and Contracts upon Termination*) of the Umbrella Agreement shall, as between the TMM, the Operator and the New Owner (if any) to whom the Train Assets are transferred following such termination, apply following such termination.

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3.6 [][277]

[][278]

3.7 [][279]

4. CESSATION OF FORCE MAJEURE EVENTS

The Affected Party shall notify the other Parties as soon as practicable after any Force Majeure Event or Depot Force Majeure Event ceases or no longer causes the Affected Party to be unable to comply with its obligations under this Agreement. Following such notification, and subject to the provisions of this Schedule 18, this Agreement shall continue to be performed on the terms existing immediately prior to the occurrence of such Force Majeure Event or Depot Force Majeure Event, subject to the terms of any Permitted Delay granted in accordance with Schedule 13 as a result of such Force Majeure Event or Depot Force Majeure Event.

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[276] Redaction.

[277] Redaction.

[278] Redaction.

[279] Redaction.

SCHEDULE 19

TERMINATION

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[280] Redaction.

[281] Redaction.

SCHEDULE 19.1

TMM Events of Default

1. EVENTS OF DEFAULT

1.1 It shall be a MSA TMM Event of Default if any of the following occurs:

(a) an Insolvency Event occurs in relation to the TMM, []282;

(b) the TMM fails to achieve Acceptance in respect of at least one Unit within []283 of the first Expected Delivery Date set out in the Contract Programme, as that date may be extended from time to time pursuant to the operation of the Applicable Variation Procedure or by a Permitted Delay;

(c) the TMM fails to achieve Acceptance in respect of any Unit (other than the First Accepted Unit) within []284 of the Expected Delivery Date set out in the Contract Programme for such Unit, as such dates may be extended from time to time pursuant to the operation of the Applicable Variation Procedure or by a Permitted Delay;

(d) the TMM fails to supply the Owner with the Minimum Fleet by the Minimum Fleet Date;

(e) []285

(f) the TMM:

(i) breaches any material obligation under this Agreement (other than as referred to in paragraphs 1.1(a) or (h) to (k) inclusive); or

(ii) persistently breaches any other obligation under this Agreement,

except to the extent that such breach results from a Force Majeure Event or is a breach for which Liquidated Damages are payable under this Agreement, and if such breach is capable of remedy, the TMM fails to remedy the breach after having been required to do so by notice from the Owner to the TMM by such date as is specified in the notice, which shall not be less than 30 days from the TMM's receipt of such notice in accordance with clause 34.4;

(g) []286

(h) []287

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282 Redaction.

283 Redaction.

284 Redaction.

285 Redaction.

286 Redaction.

287 Redaction.

(i) []288

(j) []289

(k) []290

(l) []291

(m) []292

(n) []293

(o) []294

(p) []295

(q) []296

(r) []297

(s) []298

(t) []299

1.2 Where:

(a) an MSA TMM Event of Default listed in paragraph 1.1(b) or 1.1(c) has occurred and the relevant delayed Unit is Accepted under this Agreement before a MSA TMM Termination Notice is issued to the TMM; or

(b) the MSA TMM Event of Default listed in paragraph 1.1(d) has occurred and the fourteenth Unit is Accepted under this Agreement before an MSA TMM Termination Notice is issued to the TMM,

the relevant MSA TMM Event of Default shall be deemed to have been remedied upon the date of such Acceptance.

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288 Redaction.

289 Redaction.

290 Redaction.

291 Redaction.

292 Redaction.

293 Redaction.

294 Redaction.

295 Redaction.

296 Redaction.

297 Redaction.

298 Redaction.

299 Redaction.

2. NOTICE OF MSA TMM EVENT OF DEFAULT

Upon becoming aware of the occurrence of an MSA TMM Event of Default, the relevant Party shall promptly notify the other Parties, providing a reasonably detailed description thereof, and the provisions of paragraphs 1.2 and 1.3 of Part 1 (*TMM Default of MSA*) of schedule 2.2 (*Early Termination of the MSA*) of the Umbrella Agreement shall apply.

3. TERMINATION

Termination prior to Minimum Fleet

3.1 If any MSA TMM Event of Default (other than the MSA TMM Event of Default in paragraph 1.1(d)) occurs and is continuing prior to Acceptance of the Minimum Fleet, then the provisions of paragraph 2 (*MSA TMM Event of Default (other than Minimum Fleet Default*) *occurring prior to Delivery of the Minimum Fleet*) of Part 1 (*TMM Default of MSA*) of schedule 2.2 (*Early Termination of the MSA*) of the Umbrella Agreement shall apply, and either the Owner or the Operator may terminate this Agreement by issuing an MSA TMM Pre-Minimum Fleet Termination Notice to the TMM pursuant to and in accordance with those provisions.

3.2 If the MSA TMM Event of Default in paragraph 1.1(d) occurs and is continuing, then the provisions of paragraph 3 (*Minimum Fleet Default*) of Part 1 of schedule 2.2 of the Umbrella Agreement shall apply and either the Owner or the Operator may terminate this Agreement by issuing an MSA TMM Pre-Minimum Fleet Termination Notice to the TMM pursuant to and in accordance with those provisions.

3.3 [][300]

Termination post delivery of Minimum Fleet

3.4 If an MSA TMM Event of Default occurs and is continuing after the Units comprising the Minimum Fleet have been Accepted and before all the Initial Units and the Associated Equipment have been Accepted, then the provisions of paragraph 5 (*MSA TMM Event of Default after supply of Minimum Fleet*) of Part 1 of schedule 2.2 of the Umbrella Agreement shall apply, and either the Owner or the Operator may issue an MSA TMM Post-Minimum Fleet Termination Notice to the TMM pursuant to and in accordance with those provisions.

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[300] Redaction.

APPENDIX 1 TO SCHEDULE 19.1

FORM OF MSA TMM PRE-MINIMUM FLEET TERMINATION NOTICE

Private & Confidential

From: [***Owner***] / [***Operator***]

To: [***TMM***]

Dated: [_____]

Terms defined in this notice shall have the same meaning as in the Manufacture and Supply Agreement dated [_____] 2013 and entered into between [*TMM*], [*Owner*] and [*Operator*] (the ***MSA***).

We hereby give you notice that with effect from the date of this notice, the MSA is terminated as a consequence of an MSA TMM Event of Default under paragraph 1 of Schedule 19.1 (*TMM Events of Default*) of the MSA which has occurred and is continuing before the Minimum Fleet has been Accepted, namely:

[*specify MSA TMM Event of Default*]

The Owner and the Operator reserve the right to make a claim for any loss, expense or liability incurred by reason of such termination pursuant to paragraph 2.3 of Part 1 (*Consequential Termination Provisions Pre-Minimum Fleet*) of Schedule 19.2 (*Consequential Termination Provisions*) of the MSA. No claim pursuant to this notice shall prejudice the rights and liabilities of the Parties under paragraph 2.3 of Part 1 of Schedule 19.2 of the MSA.

Signed by

For and on behalf of

[***Owner***] / [***Operator***]

…….. ……..

Director: Director

APPENDIX 2 TO SCHEDULE 19.1

FORM OF MSA TMM POST-MINIMUM FLEET TERMINATION NOTICE

Private & Confidential

From: [***Owner***] / [***Operator***]

To: [***TMM***]

Dated: [_____]

Terms defined in this notice shall have the same meaning as in the Manufacture and Supply Agreement dated [_____] 2013 and entered into between [*TMM*], [*Owner*] and [*Operator*] (the ***MSA***).

We hereby give you notice that with effect from the date of this notice, your obligations under the MSA to manufacture and deliver for Acceptance [any further Equipment, in particular [*list Equipment – Units 55 – 115, the second delivery of Spares*]] is terminated as a consequence of an MSA TMM Event of Default under paragraph 1 of Schedule 19.1 (*TMM Events of Default*) of the MSA which has occurred and is continuing after the Minimum Fleet has been Accepted, namely:

[*specify MSA TMM Event of Default*]

The Owner and the Operator reserve the right to make a claim for any loss, expense or liability incurred by reason of such termination pursuant to paragraph 2.3 of Part 2 (*Consequential Termination Provisions Following MSA TMM Event of Default Post-Minimum Fleet*) of Schedule 19.2 (*Consequential Termination Provisions*) of the MSA. No claim pursuant to this notice shall prejudice the rights and liabilities of the Parties under paragraph 2.3 of Part 2 of Schedule 19.2 of the MSA.

Signed by

For and on behalf of

[***Owner***] / [***Operator***]

…….. ……..

Director Director

SCHEDULE 19.2

Consequential Termination Provisions

Part 1

Consequential Termination Provisions Pre-Minimum Fleet

1. CONSEQUENCES OF MSA TMM PRE-MINIMUM FLEET TERMINATION NOTICE

If either the Owner or the Operator issues an MSA TMM Pre-Minimum Fleet Termination Notice, then this Agreement and all rights and obligations of the Parties hereunder will, save as expressly provided to the contrary in this Agreement or in the Umbrella Agreement, terminate with effect from the date of the MSA TMM Pre-Minimum Fleet Termination Notice and the provisions of paragraph 4 (*Termination of MSA upon TMM Default prior to Supply of Minimum Fleet*) of Part 1 (*TMM Default of MSA*) of schedule 2.2 *(Early Termination of the MSA*) of the Umbrella Agreement shall apply.

2. TERMINATION SUM

Contract Price

2.1 If either the Owner or the Operator issues an MSA TMM Pre-Minimum Fleet Termination Notice, the TMM shall pay to the Owner an amount equal to the aggregate of:

(a) all instalments of Contract Price previously paid by the Owner to the TMM under this Agreement in relation to any Unit, such payment to be made upon the same Working Day that the first Unit is returned to the TMM;

(b) all instalments of the Owner Owned Spares Price, Special Tools Price and Simulators Price paid by the Owner to the TMM under this Agreement in relation to any Owner Owned Spares, Special Tools and Simulators (as appropriate), such payment to be made upon the same Working Day that the first Unit is returned to the TMM;

(c) []301

(d) []302

(e) []303

(f) all other relevant Supply Losses of the Owner; and

(g) []304

and this paragraph 2.1 shall survive the termination of this Agreement.

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301 Redaction.

302 Redaction.

303 Redaction.

304 Redaction.

2.2 If either the Owner or the Operator issues an MSA TMM Pre-Minimum Fleet Termination Notice then, promptly after termination of the MSA, the TMM shall pay to the Operator an amount equal to the aggregate of:

(a) an amount that is equal to all instalments of Operator Owned Spares Price and the Integration Laboratory Train Equipment Price previously paid by the Operator to the TMM under this Agreement in relation to any Operator Owned Spares and/or Integration Laboratory Train Equipment (as appropriate), such payment to be made upon the same Working Day that the Operator Owned Spares and/or Integration Laboratory Train Equipment are returned to the TMM; and

(b) []305

and this paragraph 2.2 shall survive the termination of this Agreement.

Other losses and expenses

2.3 If either the Owner or the Operator issues an MSA TMM Pre-Minimum Fleet Termination Notice then, promptly after termination of the MSA, the TMM shall promptly pay to the Operator an amount equal to any loss, expense or liability to be incurred by reason of such termination, including:

(a) the amount by which the cost of performing, or having performed by others, any work which, but for such termination would have been carried out by the TMM under this Agreement exceeds the amount which would have been payable under this Agreement in respect of that work;

(b) []306

(c) all other relevant Supply Losses of the Operator,

and this paragraph 2.3 shall survive the termination of this Agreement.

Funds recovered under any Performance Bonds or Guarantees

2.4 Following the issue of an MSA TMM Pre-Minimum Fleet Termination Notice, the Owner shall be entitled to make calls upon the Advance Payment Bond and/or Owner Guarantee and, to the extent that any sums are recovered pursuant to such Advance Payment Bond or Owner Guarantee, the TMM's liability to pay sums under this Agreement to the Owner shall be reduced by the amount so recovered.

2.5 Following the issue of an MSA TMM Pre-Minimum Fleet Termination Notice, the Operator shall be entitled to make calls upon the Operator Bond and/or Operator Guarantee and, to the extent that any sums recovered pursuant to such Operator Bond or Operator Guarantee, the TMM's liability to pay sums under this Agreement to the Operator shall be reduced by the amount so recovered.

2.6 Paragraphs 2.4 and 2.5 shall survive the termination of this Agreement, however arising.

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305 Redaction.

306 Redaction.

3. ACCESS AND TITLE TRANSFER

3.1 Upon confirmation from the Owner and the Operator that the TMM has paid in full the amounts referred to in paragraph 2 (*Termination Sum*), the Operator shall, following reasonable notice from the TMM during working hours, permit the TMM to enter any premises under the control of the Operator to take possession of any Owned Spares and/or the Special Tools and/or any Simulators it has possession of.

3.2 Title and risk in each Vehicle, Unit, Special Tool, Owned Spare, Simulator and the Integration Laboratory Train Equipment shall be transferred to the TMM (with full title guarantee (save in respect of any encumbrance created by or attributable to the TMM)) on the date on which the corresponding payment is made by the TMM to the Owner or the Operator of all amounts referred to in paragraph 2.

Part 2

Consequential Termination Provisions Following MSA TMM Event of Default Post-Minimum Fleet

1. CONSEQUENCES OF MSA TMM POST-MINIMUM FLEET TERMINATION NOTICE

If either the Owner or the Operator issues an MSA TMM Post-Minimum Fleet Termination Notice, then with effect from the date of that notice:

(a) the obligations of the TMM under this Agreement and all rights and obligations of the Parties under this Agreement shall, subject to any express provision in this Agreement or the Umbrella Agreement to the contrary, continue other than in relation to any Equipment that has not been Accepted at such date; and

(b) the provisions of paragraphs 6 (Continuing Arrangements following MSA TMM Post-Minimum Fleet Termination Notice) to 11 (TMM Default Partial Termination: Elected Units) (inclusive) and either paragraph 12 (Termination of Owner Participation) or paragraph 13 (TMM Default Partial Termination), in each case of Part 1 (TMM Default of MSA) of schedule 2.2 (Early Termination of the MSA) of the Umbrella Agreement, shall apply.

2. OWNER'S AND OPERATOR'S RIGHTS FOLLOWING MSA TMM EVENT OF DEFAULT AFTER MINIMUM FLEET

Termination Sum

2.1 If either the Owner or the Operator issues an MSA TMM Post-Minimum Fleet Termination Notice, the TMM shall, in respect of paragraphs 2.1(a) and 2.1(b), no later than the date specified in paragraph 8.1 of Part 1 (*TMM Default of MSA*) of schedule 2.2 (*Early Termination of the MSA*) of the Umbrella Agreement, and in respect of paragraph 2.1(c), as set out in paragraph 8.2 of Part 1 of schedule 2.2 of the Umbrella Agreement, pay to the Owner an amount equal to the aggregate of:

(a) all instalments of the Contract Price, Owner Owned Spares Price, Special Tools Price and Simulators Price (or the relevant proportion of such instalments which relates to the Units, Owner Owned Spares, Special Tools and/or Simulators which have not been Accepted) which has been previously paid by the Owner (or the Secretary of State, as the case may be) to the TMM in respect of any Unit, Owner Owned Spare, Special Tool and/or Simulator which has not been Accepted as at the date of such notice;

(b) []307

(c) []308

[]309

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307 Redaction.

308 Redaction.

309 Redaction.

2.2 If the Owner or the Operator issues an MSA TMM Post-Minimum Termination Notice, the TMM shall promptly pay to the Operator an amount equal to the aggregate of:

(a) all instalments of Operator Owned Spares Price and the Integration Laboratory Train Equipment Price previously paid by the Operator to the TMM which relates to any Operator Owned Spares and/or Integration Laboratory Train Equipment which have not been Accepted as at the date of such notice; and

(b) []310

Other losses and expenses

2.3 If the Owner or the Operator issues an MSA TMM Post-Minimum Fleet Termination Notice, the TMM shall promptly pay to the Owner and the Operator an amount equal to any loss, expense or liability to be incurred by reason of such termination by each of them respectively, including:

(a) the amount by which the cost of performing, or having performed by others, any work which, but for such termination would have been carried out by the TMM under this Agreement exceeds the amount which would have been payable under this Agreement in respect of that work;

(b) []311

(c) all other relevant Supply Losses of the Owner and/or the Operator, which []312:

(d) if the Owner delivers a TMM Default Termination Election Notice terminating the Owner's participation in the Project in accordance with paragraph 10.1 of Part 1 (*TMM Default of MSA*) of Schedule 2.2 (*Early Termination of the MSA*), an amount equal to the Shareholder Contributions,

and this paragraph 2.3 shall survive the termination of this Agreement however arising.

Funds recovered under any Performance Bonds or Guarantees

2.4 Following the issue of an MSA TMM Post-Minimum Fleet Termination Notice, the Owner shall be entitled to make calls upon the Owner Bond and/or Owner Guarantee and, to the extent that any sums are recovered pursuant to such Owner Bond or Owner Guarantee, the TMM's liability to pay sums under this Agreement to the Owner shall be reduced by the amount so recovered.

2.5 Following the issue of an MSA TMM Post-Minimum Fleet Termination Notice, the Operator shall be entitled to make calls upon the Operator Bond and/or Operator Guarantee and, to the extent that any sums are recovered pursuant to such Operator Bond or Operator Guarantee, the TMM's liability to pay sums under this Agreement to the Operator shall be reduced by the amount so recovered.

2.6 Paragraphs 2.4 and 2.5 shall survive the termination of this Agreement, however arising.

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310 Redaction.

311 Redaction.

312 Redaction.

SCHEDULE 19.3

Owner Events of Default

1. EVENTS OF DEFAULT

It shall be an MSA Owner Event of Default if any of the following occur:

(a) []313

(b) []314

(c) []315

(d) an Insolvency Event occurs in relation to the Owner.

2. NOTICE OF OWNER EVENT OF DEFAULT

Upon becoming aware of the occurrence of an Owner Event of Default, the relevant Party shall promptly notify the other Parties and the Secretary of State of the Owner Event of Default, providing a reasonable description thereof, and the provisions of:

(a) clause 3 (*Notification of Lease Owner MR/EFV Termination Event*) to clause 12 (*Novation*) (inclusive) of the Lenders' Direct Agreement; and

(b) Part 2 (*Lease Owner Termination Events*) of schedule 2.4 (*Early Termination of the Lease*) of the Umbrella Agreement,

shall each apply.

3. TERMINATION OF EXISTING OWNER'S PARTICIPATION

General

3.1 If, at any time after a Primary Period Termination Notice has been issued and remains outstanding, the SoS Control Date occurs in accordance with paragraph 6.2 of Part 2 (*Lease Owner Termination Events*) of schedule 2.4 (*Early Termination of the Lease*) of the Umbrella Agreement, then the provisions of paragraph 2 (*Novation of Contracts*) of schedule 2.8 (*Transfer of Rolling Stock and Contracts upon Termination*) of the Umbrella Agreement shall, as between the TMM, the Operator and the New Owner (if any) to whom the Train Assets are transferred following the termination of the Existing Owner's participation in the Project, apply following such termination in accordance with paragraph 3.2, 3.3 or 3.4 (as applicable).

Continuation of the Project

3.2 If, at any time after the SoS Control Date, the TMM receives a Proposed Owner Succession Notice from the Secretary of State in accordance with paragraph 2.6 of schedule

313 Redaction.

314 Redaction.

315 Redaction.

2.8 (*Transfer of Rolling Stock and Contracts upon Termination*) of the Umbrella Agreement that does not include a Fleet Reduction Notice, then:

(a) all the rights and obligations of the Existing Owner under this Agreement shall, subject to any express provision in this Agreement or in the Umbrella Agreement to the contrary, terminate with effect from the relevant Lease Primary Period Termination Date; and

(b) any rights and obligations under this Agreement of the TMM, the Operator and the New Owner to whom the Train Assets are transferred shall continue, with effect from the relevant Owner Succession Date, in accordance with the relevant New Owner Accession Arrangement.

Fleet Reduction

3.3 If, at any time prior to the Acceptance of the Last Unit when the SoS Control Date has occurred, the Secretary of State delivers a Proposed Owner Succession Notice that includes a Fleet Reduction Notice in accordance with paragraph 2.6(c) of schedule 2.8 (*Transfer of Rolling Stock and Contracts upon Termination*) of the Umbrella Agreement:

(a) all the rights and obligations of the Existing Owner under this Agreement shall, subject to any express provision in this Agreement or the Umbrella Agreement to the contrary, terminate with effect from the relevant Lease Primary Period Termination Date;

(b) the obligations of the TMM under this Agreement in relation to any Equipment that has not been Accepted shall, subject to any express provisions of this Agreement or of the Umbrella Agreement to the contrary, terminate in accordance with paragraph 2.17(b) of schedule 2.8 (*Transfer of Rolling Stock and Contracts upon Termination*) of the Umbrella Agreement;

(c) any rights and obligations under this Agreement of the TMM, the Operator and the New Owner to whom the Train Assets are transferred shall, with effect from the relevant Owner Succession Date and subject to any express provision in this Agreement or in the Umbrella Agreement to the contrary, continue other than in relation to any Equipment that has not been Accepted at such date in accordance with the relevant New Owner Accession Agreement; and

(d) as between the TMM and the Existing Owner, paragraph 4 (*Termination Sum upon Existing Owner Termination Fleet Reduction Event*) shall apply.

Termination of the Project

3.4 If, at any time after the SoS Control Date, the Secretary of State delivers an SoS OPT Project Termination Notice in accordance with paragraph 2.2 of schedule 2.8 (*Transfer of Rolling Stock and Contracts upon Termination*) of the Umbrella Agreement:

(a) all rights and obligations of the Parties under this Agreement shall, save as expressly provided to the contrary in this Agreement or the Umbrella Agreement, terminate with immediate effect;

(b) the Owner shall, if required by the TMM in accordance with clause 11.32(i)(B), pay the amount standing to the credit of the Bond Proceeds Account to the TMM (or, if

the TMM so directs in writing, to the Bond Provider in respect of the Owner Bond); and

(c) as between the TMM and the Existing Owner, paragraph 4 (*Termination Sum upon Existing Owner Termination Fleet Reduction Event*) shall apply.

4. TERMINATION SUM

If, at any time prior to the Acceptance of the Last Unit, a Primary Period Termination Notice has been issued and is outstanding and either:

4.1 an OPT Fleet Reduction Event occurs in accordance with paragraph 3.3; or

4.2 the Secretary of State issues an SoS OPT Project Termination Notice in accordance with paragraph 3.4,

then the Existing Owner shall pay to the TMM the sum of:

(a) any losses, expense, liability and costs incurred by the TMM as a direct result of the termination of this Agreement in accordance with paragraph 3.4 or a termination of the Existing Owner's participation in this Agreement in accordance with paragraph 3.3, including:

(i) any materials or goods ordered or subcontracts placed in relation to the Equipment in relation to which the TMM's obligations are terminated;

(ii) any expenditure incurred in anticipation of the completion of works in relation to the terminated Equipment in the future;

(iii) the cost of demobilisation, including the cost of any relocation of equipment used in connection with the Project;

(iv) such sum as represents the reasonable cost of labour and materials already incurred or committed by the TMM at the date of the Partial Termination in respect of work in respect of the design and manufacture of Units and Associated Equipment;

(v) payments in respect of the redundancy of employees; plus

(b) []316; plus

(c) all other direct costs, losses and claims []317; less

(d) any payments of the Contract Price made under this Agreement in respect of the terminated Equipment.

316 Redaction.

317 Redaction.

SCHEDULE 19.4

Operator Events of Default

1. EVENTS OF DEFAULT

It shall be an MSA Operator Event of Default if any of the following occur:

(a) any amount payable by the Operator to the TMM under this Agreement (and which is not the subject of a bona fide Contract Dispute) remains unpaid from whatever source for a period of 20 Working Days after the due date for payment of that amount, provided the TMM has notified the Operator in writing of the non-receipt of that amount on or after its due date and the Operator has failed to pay the TMM within 20 Working Days of that notification;

(b) an Insolvency Event occurs in relation to the Operator;

(c) the Franchise Agreement expires or is terminated for any reason other than effluxion of time;

(d) a Lease Operator Termination Notice is issued by the Owner;

(e) a notice of the occurrence of a TSA Operator Event of Default is issued by the TMM under paragraph 2 (*Notice of TSA Operator Event of Default*) of schedule 13.2 (*Operator Events of Default*) of the TSA;

(f) the Operator is not obliged to make any payment under this Agreement because the aggregate limit specified in clause 25.12 has been reached; or

(g) [][318]

2. NOTICE OF OPERATOR EVENT OF DEFAULT

Upon becoming aware of the occurrence of an MSA Operator Event of Default, the relevant Party shall promptly notify the other Parties and the Secretary of State of the Operator Event of Default, providing a reasonably detailed description thereof, and:

(a) the provisions of paragraphs 3 (*Termination*) and 4 (*Replacement of Defaulting Operator*) shall apply;

(b) if that event occurs prior to the expiry or termination of the Umbrella Agreement:

(i) paragraph 1 (*Notification of Secretary of State*) of Part 3 (*Operator default of MSA*) of schedule 2.2 (*Early Termination of the MSA*) of the Umbrella Agreement; and

(ii) paragraph 1 (*Notification of Secretary of State*) of Part 1 (*Operator default*) of schedule 2.4 (*Early Termination of the Lease*) of the Umbrella Agreement,

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[318] Redaction.

shall each apply; or

(c) if that event occurs after the expiry or termination of the Umbrella Agreement, the provisions of the Maintenance Direct Agreement shall apply.

3. TERMINATION

If any MSA Operator Event of Default occurs and is continuing, then;

(a) if that event occurs prior to the expiry of termination of the Umbrella Agreement, subject to paragraph 2 (*Secretary of State's Rights Following Operator Default*) of Part 1 (*Operator default*) of schedule 2.4 (*Early Termination of the Lease*) of the Umbrella Agreement; or

(b) if that event occurs after the expiry or termination of the Umbrella Agreement, subject to the terms of the Maintenance Direct Agreement,

the TMM may deliver notice in writing to the Operator terminating the Operator's participation in this Agreement (an ***MSA Operator Termination Notice***) (with the effect that the defaulting Operator shall, save as provided in paragraph 7 (*Liability*) of schedule 2.1 (*Section 54 Undertakings*) of the Umbrella Agreement (or, if applicable, paragraph 5 (*Liability*) of schedule 2 (*Terms of Secretary of State Undertaking) of the Maintenance Direct Agreement*), cease to accrue any further obligations and cease to benefit from any further rights, in each case under this Agreement), such termination to occur with immediate effect or from such later date as is specified in the MSA Operator Termination Notice. If, prior to the date of such termination, but following service of an MSA Operator Termination Notice, the relevant MSA Operator Event of Default is remedied (or, in the case of either of the MSA Operator Events of Default in paragraphs 1(d) and (e), the relevant notice is withdrawn) then the applicable MSA Operator Termination Notice will be deemed to have been withdrawn and will no longer be outstanding.

4. REPLACEMENT OF DEFAULTING OPERATOR

4.1 The Parties acknowledge that, if such termination occurs prior to the expiry or termination of the Umbrella Agreement, the provisions of schedule 2.1 (*Section 54 Undertakings*) of the Umbrella Agreement shall apply upon the termination of a defaulting Operator's participation in this Agreement, subject to the limitations set out in paragraph 1.5 of schedule 2.1 of the Umbrella Agreement.

4.2 The Parties acknowledge that, if such termination occurs after the expiry or termination of the Umbrella Agreement, the provisions of paragraph 1.3 of schedule 2 (*Terms of Secretary of State Undertaking*) of the Maintenance Direct Agreement shall apply upon the termination of a defaulting Operator's participation in this Agreement.

SCHEDULE 19.5

[][319]

[319] Redaction.

SCHEDULE 19.6

[][320]

[320] Redaction.

SCHEDULE 19.7

Secretary of State Voluntary Termination Right

1. EVENT

1.1 The Parties acknowledge and agree that the Secretary of State may require termination of this Agreement at any time pursuant to schedule 2.7 (*Voluntary Termination of Contracts by the Secretary of State*) of the Umbrella Agreement.

1.2 Upon receipt of a notice from the Secretary of State under paragraph 1(a) of schedule 2.7 of the Umbrella Agreement, the Parties agree that this Agreement shall terminate on the date specified in the notice.

2. CONSEQUENCES OF TERMINATION

On the date of termination of this Agreement in accordance with paragraph 1.2:

(a) all rights and obligations of the Parties under this Agreement will, save as expressly provided to the contrary in this Agreement (including paragraph (c)) or in the Umbrella Agreement, terminate with effect from the date specified in the notice delivered pursuant to paragraph 1.2;

(b) the provisions of paragraphs 2 (*Operator Rights upon Voluntary Termination by the Secretary of State*) to 4 (*Compensation payable to TMM*) (inclusive) of schedule 2.7 of the Umbrella Agreement shall apply;

(c) the Owner shall, if required by the TMM in accordance with clause 11.32(i)(B), pay the amount standing to the credit of the Bond Proceeds Account to the TMM (or, if the TMM so directs in writing, to the Bond Provider in respect of the Owner Bond); and

(d) the provisions of paragraph 3 (*Novation of MSA Warranties*) of schedule 2.8 (*Transfer of Rolling Stock and Contracts upon Termination*) of the Umbrella Agreement shall, as between the TMM, the Operator and any New Owner to whom the Owner Assets are transferred following such termination, apply following such termination.

SCHEDULE 19.8

Uninsurability

1. EVENT

1.1 The Parties acknowledge and agree that the Secretary of State may require termination of this Agreement at any time pursuant to clause 14.6(d) of the Umbrella Agreement.

1.2 Upon receipt of a notice from the Secretary of State under clause 14.6(d) of the Umbrella Agreement, the Parties agree that this Agreement shall terminate on the date specified in the notice.

2. CONSEQUENCES OF TERMINATION

On the date of termination of this Agreement in accordance with paragraph 1.2:

(a) all rights and obligations of the Parties under this Agreement will, save as expressly provided to the contrary in this Agreement or in the Umbrella Agreement, terminate with effect from the date specified in the notice delivered pursuant to paragraph 1.2; and

(b) the provisions of clause 14.9 of the Umbrella Agreement shall apply.

SCHEDULE 20

FORM OF BONDS

Schedule 20.1: **Agreed Form of Operator Bond**

Schedule 20.2: **Agreed Form of Advance Payment Bond**

Schedule 20.3: **Agreed Form of Owner Bond**

Schedule 20.4: [][321]

Schedule 20.5: [][322]

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[321] Redaction.

[322] Redaction.

SCHEDULE 20.1

Agreed Form of Operator Bond

[][323]

[323] Redaction.

SCHEDULE 20.2

Agreed Form of Advance Payment Bond

[][324]

[324] Redaction.

SCHEDULE 20.3

Agreed Form of Owner Bond

[][325]

[325] Redaction.

SCHEDULE 20.4

[][326]

[326] Redaction.

SCHEDULE 20.5

[][327]

[327] Redaction.

SCHEDULE 21

FORM OF GUARANTEES

Schedule 21.1: **Form of Owner Guarantee**

Schedule 21.2: **Form of Operator Guarantee**

SCHEDULE 21.1

Form of Owner Guarantee

[][328]

[328] Redaction.

SCHEDULE 21.2

Form of Operator Guarantee

[][329]

[329] Redaction.

SCHEDULE 22

FORM OF ESCROW AGREEMENT

Schedule 22: Form of Software Escrow Agreement

Appendix 1: Definitions

Appendix 2: Escrow Release Event

Appendix 3: Escrow Agent's Fees

Appendix 4: Confidentiality Undertaking

SCHEDULE 22

Form of Software Escrow Agreement

Dated [_____] 20[___]

[***TRAIN MANUFACTURER AND MAINTAINER***]

[***OWNER***]

[***OPERATOR***]

[***ESCROW AGENT***]

ESCROW AGREEMENT

THIS AGREEMENT is made on 20[_____]

BETWEEN

(4) [***TRAIN MANUFACTURER AND MAINTAINER***] (Registered number [____]), a company incorporated in [_____] whose registered office is [_____] (the ***TMM***);

(5) [***OWNER***] (Registered number [____]), a company incorporated in [_____] whose registered office is [_____] (the ***Owner***);

(6) [***OPERATOR***] (Registered number [____]), a company incorporated in [_____] whose registered office is [_____] (the ***Operator***); and

(7) [***ESCROW AGENT***] (Registered number [____]), a company incorporated in [_____] whose registered office is [_____] (the ***Escrow Agent***).

WHEREAS:

(A) The Owner wishes to buy a new fleet of trains and associated spares, special tools and simulators. The Owner wishes to lease these trains, associated spares, special tools and simulators to the Operator. The Operator wishes to buy certain spares, integration laboratory train equipment and a mock-up.

(B) The Owner and the Operator have contracted with the TMM for the purchase of a new fleet of trains and associated spares, special tools, simulators, integration laboratory train equipment and mock-up on and subject to the terms set out in the MSA.

(C) The Owner and the Operator have contracted with the TMM for the subsequent maintenance of the trains, associated spares, special tools and simulators on and subject to the terms set out in the TSA and the TSSSA.

(D) The Escrow Materials relating to the trains, associated spares, special tools, simulators, integration laboratory train equipment and mock-up would be required by the Owner and the Operator for certain aspects of the operation, maintenance and modification of the Units.

(E) The TMM acknowledges that, in certain circumstances, the Owner and the Operator may require possession of the Escrow Materials.

IT IS AGREED:

1. DEFINITIONS AND INTERPRETATION

Definitions

1.1 Words and expressions which are given a meaning in 0 (*Definitions*) shall have that meaning when used in this Agreement.

Construction

1.2 In this Agreement, save where the contrary is indicated:

(a) the headings and sub-headings in this Agreement do not affect its interpretation;

(b) a statutory provision includes a reference to the statutory provision as modified or re-enacted or both from time to time whether before or after the date of this Agreement and any subordinate legislation made under the statutory provision before or after the date of this Agreement;

(c) a person includes a reference to a body corporate, association or partnership;

(d) a person includes a reference to that person's legal and personal representatives, successors, transferees and permitted assignees;

(e) a Recital, clause or Appendix, unless the context otherwise requires, is a reference to a clause or Recital or Appendix to this Agreement;

(f) a document, including this Agreement, is a reference to that document as from time to time supplemented, novated or varied;

(g) a word denoting the singular shall include the plural, and vice versa;

(h) the masculine shall include a reference to the feminine and neuter, the feminine shall include reference to the masculine and neuter and neuter shall include reference to the masculine and feminine, as appropriate; and

(i) this Agreement shall include the Recitals and Appendices which Recitals and Appendices form part of this Agreement.

2. WARRANTY

The TMM warrants that it is validly incorporated and has the power, capacity and legal right to execute this Agreement and perform its obligations and exercise its rights hereunder.

3. THE ESCROW AGENT DUTIES

3.1 The Escrow Agent shall:

(a) be bound by the terms of this Agreement;

(b) hold the Escrow Materials in a safe and secure environment;

(c) inform the Operator and the Owner of the receipt of any copy of the Escrow Materials;

(d) in accordance with the terms of clause 9.2 apply the Integrity Testing Service to the Escrow Materials from time to time;

(e) at all times retain a copy of the latest verified deposit of the Escrow Materials; and

(f) notify the TMM if it becomes aware at any time during the term of this Agreement that the copy of the Escrow Materials held by it has been lost, damaged or destroyed.

3.2 The Escrow Agent shall not be responsible for procuring the delivery of the Escrow Materials in the event of failure by the TMM to do so.

4. DEPOSIT AND ESCROW MATERIALS

4.1 Subject to the remainder of this clause 4, the TMM shall deliver two copies of the Escrow Materials to the Escrow Agent within [_____] days of the date of this Agreement. The TMM shall ensure that the Escrow Materials delivered pursuant to this clause 4.1 are:

(a) full, true and accurate; and

(b) contain all information in human readable form and on suitable media to enable a suitably skilled programmer or analyst to understand, maintain and correct the Software.

4.2 For any Escrow Materials pertaining to the rights of persons other than the TMM or any member of its corporate group (the ***Third Party Escrow Materials***), the TMM will use its reasonable endeavours to procure the right to place such Third Party Escrow Materials in escrow under the terms of this Agreement at the TMM's cost. The TMM shall deliver two copies of the Third Party Escrow Materials to the Escrow Agent within [*30*] days of the date of obtaining the right to do so from the relevant third party.

4.3 The TMM shall ensure that it updates as necessary as soon as reasonably practical the Escrow Materials such that all relevant and up to date versions of the Escrow Materials are delivered to the Escrow Agent. For those Escrow Materials not in existence as at the date of this Agreement, the TMM shall deliver any such Escrow Materials in respect of which it owns the Intellectual Property Rights no later than the last day of the month following the month in which the relevant item was signed off or approved by the TMM. For any Third Party Escrow Materials not in existence at the date of this Agreement or updated versions, the TMM will use its reasonable endeavours to procure the right to place such Third Party Escrow Materials in escrow under the terms of this Agreement at the TMM's cost, and deliver the same no later than the last day of the month in which the right to deposit material was obtained from the relevant third party.

4.4 The TMM shall ensure that all updates to the Escrow Materials delivered to the Escrow Agent comply with the requirements of clause 4.1 and correspond to the most recent versions of the Escrow Materials. The TMM shall accordingly deliver two copies of all amended or updated Escrow Materials to the Escrow Agent as and when necessary within the deadlines set out in this clause 4 (provided that this obligation shall not apply to any Escrow Materials that have been released in accordance with this Agreement). The obligations of the TMM under this clause 4.4 shall continue until termination of this Agreement in accordance with clause 8.

4.5 The Escrow Materials shall be delivered to the Escrow Agent by the TMM. The Escrow Materials shall be supplied with details of the following (where relevant):

(a) details of the deposit, full name and version details, number of media items, media type and density, file or archive format, list or retrieval commands, archive hardware and operating system details;

(b) name and functionality of each module/application of the Escrow Materials;

(c) names and versions of the development tools etc.;

(d) readily available documentation describing the procedures for building/ compiling/executing/using the software (technical notes, user guides);

(e) hard copy directory listings of the contents of the media; and

(f) name and contact details of the owners of the Escrow Materials,

and the TMM shall provide the above information to the Owner and, during the term of the relevant Lease, to the Operator at the same time as supplying it to the Escrow Agent.

4.6 The Escrow Agent will inform the TMM, the Owner and the Operator as soon as possible after receipt of any copy of any Escrow Materials, of the deposit of those Escrow Materials.

4.7 The Escrow Materials shall remain the confidential property of the TMM and/or its licensors. In the event that the Escrow Agent provides a copy thereof to the Owner or the Operator, such Party shall be permitted to use, copy and modify such copy of the Escrow Materials, and to grant sub-licenses to others to do the same, only in accordance with clause 26 (*Intellectual Property Rights*) of the MSA and not further or otherwise. In the event that the Escrow Agent provides a copy of the Escrow Materials to a Competent Authority pursuant to clause 5.5, the requesting party shall inform the Competent Authority that the Escrow Materials should only be used for the purpose of the Applicable Requirement Event. Copyright and all other Intellectual Property Rights in the Escrow Materials will remain with the TMM and/or its licensors, and the release of the Escrow Materials to the Owner or the Operator or a Competent Authority will not act as an assignment of any Intellectual Property Rights in the Escrow Materials to the Owner or the Operator or any Competent Authority.

4.8 In the event of any of the Escrow Materials which have been deposited with the Escrow Agent being destroyed or damaged, the Escrow Agent shall so notify the TMM. The TMM shall then, within [_____] days of such notice and subject to receipt from the Escrow Agent of the TMM's reasonable costs in so complying, deliver a further copy of the relevant Escrow Materials to the Escrow Agent. The TMM shall comply with all other terms of this Agreement in relation to this further copy of the Escrow Materials.

5. RELEASE OF ESCROW MATERIALS

5.1 The meaning of ***Escrow Release Event*** is set out in 0 (*Escrow Release Event*).

5.2 If an Escrow Release Event occurs then the Escrow Agent will, following receipt of a written request (which is not subsequently withdrawn pursuant to clause 5.4) in the form described in this clause 5.2 from the Owner or the Operator (the ***Requesting Party***) together with the Release Fee specified in 0 (*Escrow Agent's Fees*), release a copy of the Escrow Materials (or such part of the Escrow Materials as is identified in the request) to the Requesting Party. The written request shall consist of a statutory declaration sworn by a director of the Requesting Party, identifying the Escrow Release Event, stating that all of the events which together constitute that Escrow Release Event have occurred and stating that the Requesting Party is entitled pursuant to clause 26.3 of the MSA to receive such Escrow Materials and specifying the Escrow Materials to be released, together with a signed Confidentiality Undertaking.

5.3 A copy of the statutory declaration referred to in clause 5.2 (together with the accompanying Confidentiality Undertaking if relevant) shall be sent contemporaneously by the requesting party to each other Party to this Agreement.

5.4 The Operator and the Owner each agree with the TMM that:

(a) the Requesting Party will serve on the TMM a copy of any written request that it serves on the Escrow Agent pursuant to clause 5.2;

(b) if the Requesting Party is notified by the TMM that the TMM disputes whether an Escrow Release Event has occurred, it will withdraw any such notice and not reissue it unless or until such dispute is resolved in accordance with clause 11 or another Escrow Release Event has occurred; and

(c) no Third Party Escrow Materials will be specified in any such written request unless the Escrow Release Event is a request from a Competent Authority or an Insolvency Event occurring in relation to the owner of such Third Party Escrow Materials. If requested by the Operator or the Owner, the TMM shall provide to the requesting Party contact details for such third party owner and, if it is aware of the same, confirmation as to whether an Insolvency Event has occurred in relation to such third party owner.

5.5 If an Applicable Requirement Event occurs, then clauses 5.2 and 5.3 shall apply as if references in them to an Escrow Release Event were references to an Applicable Requirement Event and as if the following variations were made to those clauses:

(a) the statutory declaration referred to in clause 5.2 shall in addition identify the relevant Competent Authority and, instead of stating the Requesting Party's entitlement to receive the Escrow Materials, shall state that the Escrow Agent is obliged to release the same to the named Competent Authority;

(b) the Escrow Agent shall release the Escrow Materials in question directly to the relevant Competent Authority (as opposed to releasing them to the requesting party);

(c) only the Escrow Materials which are the subject of the relevant request by the Competent Authority shall be released;

(d) the Competent Authority shall not be required to enter into a Confidentiality Undertaking;

(e) the requesting party shall inform the Competent Authority that the Escrow Materials should only be used for the subject matter of the relevant request and that they should be returned to the Escrow Agent as soon as they are no longer required for the purposes of the Applicable Requirement Event; and

(f) the Release Fee shall be paid by the TMM.

6. CONFIDENTIALITY

6.1 The Escrow Material shall remain the confidential property of the TMM and, in the event that the Escrow Agent provides a copy of all or part of the Escrow Material to the Requesting Party, the Requesting Party shall be permitted to use the Escrow Material only in accordance with the MSA and the Confidentiality Undertaking.

6.2 The Escrow Agent agrees to maintain all information and/or documentation coming into its possession or to its knowledge under this Agreement in strictest confidence and secrecy, not to make use of it other than for the purposes of this Agreement and not to disclose or release it other than in accordance with terms of this Agreement.

6.3 Termination of this Agreement will not relieve the Escrow Agent or its employees from the obligations of confidentiality contained in this clause 6 or the Confidentiality Undertaking.

7. FEES

7.1 The TMM shall be responsible for payment of the Initial fee as specified in 0 (*Escrow Agent's Fees*).

7.2 The Owner shall be responsible for payment of the Storage Fees, the Update Fee and the Annual Fee as specified in 0, unless the Owner terminates this Agreement pursuant to clause 8, in which case the Operator shall pay such fees. Save as provided in clause 5.5(f), the Party requesting release shall pay the relevant Release Fee to the Escrow Agent.

8. TERMINATION

8.1 This Agreement may be terminated by the Escrow Agent giving not less than [*60*] days prior written notice (the ***Agent Notice***) to each of the TMM, the Owner and the Operator. In that event, the TMM, the Owner and the Operator shall appoint a new custodian for the Escrow Materials, by agreement between them, prior to the expiry of the Agent Notice. If however they fail to reach such an agreement within [30] days of receipt by the Owner of the Agent Notice, the appointment shall instead be made by the Owner alone, prior to the expiry of the Agent Notice, in which event the TMM and the Operator shall be obliged to execute a new escrow agreement with the new custodian prior to the expiry of the Agent Notice on the terms specified in clause 8.2.

8.2 Any new custodian appointed under clause 8.1 shall be neither a member of the group of companies of the Owner nor a member of the group of companies of the TMM or a member of the group of companies of the Operator nor a person who is a manufacturer of trains, or a member of a group which includes companies that manufacture trains. Further, any such appointment of a new custodian shall be on terms which are identical to those contained herein in relation to the definition of the Escrow Release Events, and shall be on terms no more onerous to the TMM than the terms of this Agreement and shall otherwise be on terms as nearly identical to those contained herein as is possible.

8.3 The Owner and the Operator shall notify the Escrow Agent of the identity and address of any new custodian appointed under this clause 8.1 prior to the expiry of the Agent Notice and the Escrow Agent shall be obliged forthwith to release the Escrow Materials directly to the new custodian, without requiring any payment for so doing.

8.4 If no new custodian is appointed and notified to the Escrow Agent under this clause 8.1 prior to the expiry of the Agent Notice, the Escrow Agent shall instead release the Escrow Materials to the TMM upon expiry of the Agent Notice, without requiring payment for so doing.

8.5 The Operator and the Owner may each separately terminate this Agreement at any time with immediate effect in relation to its respective rights and obligations, in each case without penalty, by giving notice to the Escrow Agent, the Operator or Owner (as appropriate) and the TMM. Any such termination shall not affect the continued operation of this Agreement in relation to the remaining Parties.

8.6 The TMM may not terminate this Agreement in relation to the Owner and the Operator, unless:

(a) a copy of all the Escrow Materials has been released to the Operator and the Owner under clause 5 (*Release of Escrow Materials*);

(b) the Operator and the Owner have both given their prior written consent to termination of this Agreement; or

(c) have each terminated this Agreement in relation to their own rights and obligations.

8.7 This Agreement shall terminate on the later of:

(a) the date falling 35 years from the date of Acceptance of the Last Unit to be delivered;

(b) the expiry of the TSA or termination of the TSA by the TMM; and

(c) where a TSSSA Requirement Notice has been served by the Operator in accordance with the terms of the TSA, the expiry of the TSSSA or termination of the TSSSA by the Supplier.

8.8 If both the Operator and the Owner terminates their rights and obligations by giving notice under clause 8.5 or if this Agreement terminates pursuant to clause 8.7 then the Escrow Agent shall release all copies of the Escrow Materials in its possession to the TMM.

8.9 Termination of this Agreement will not relieve the Escrow Agent or its employees from the obligations of confidentiality in clause 6 (*Confidentiality*).

8.10 Termination of the MSA, the TSA or the TSSSA shall not affect the continued existence of this Agreement unless and until this Agreement is terminated under this clause 8. Termination or expiry of the Lease shall not result in a termination of this Agreement.

8.11 Where any part of the Escrow Materials have been voluntarily released from escrow (as described in the definition of Escrow Release Event) by the TMM to each of the Owner and the Operator, this Agreement shall cease to have effect in respect of those parts that have been released.

8.12 If the TMM fails to pay any sums due under this Agreement, the Escrow Agent shall notify the Owner in writing and the Owner shall have [_____] days to pay such sum on behalf of the TMM. If the Owner fails to pay the Escrow Agent may terminate this Agreement. The TMM shall be liable to the Owner for any sums paid by the Owner on its behalf. The Escrow Agent may terminate this Agreement following a failure by the Owner to comply with not less than [_____] days' prior written notice to pay any fees due to be paid by the Owner to the Escrow Agent in accordance with clause 7 (*Fees*) and not paid to it by the Owner. In the event of termination of this Agreement under this clause 8.12, the provisions of clause 8.1 shall apply.

8.13 If the Initial Operator ceases to lease the Units, the TMM and the Owner shall notify the Escrow Agent in writing and thereafter, the Parties shall take such steps as may be required to ensure that:

(a) the Initial Operator ceases to have any rights under this Agreement with immediate effect and is removed as a party to this Agreement; and

(b) any replacement Operator shall become a party to this Agreement in place of the Initial Operator and the replacement Operator may exercise and enjoy all the rights of the Initial Operator arising under this Agreement.

9. VERIFICATION

9.1 Subject to the provisions of clauses 9.2 and 9.3, the Escrow Agent shall bear no obligation or responsibility to any person, firm, company or entity whatsoever to determine the existence, relevance, completeness, accuracy, effectiveness or any other aspect of the Escrow Materials.

9.2 Upon the Escrow Materials being lodged with the Escrow Agent, the Escrow Agent shall perform those tests in accordance with the Integrity Testing Services and shall provide a copy of the test report to the other Parties to this Agreement.

9.3 The Owner and the Operator shall each be entitled to require that the Escrow Agent carries out a Full Verification no more frequently than following each update to the Escrow Materials. The costs of Full Verification on deposit of the Escrow Materials and following each update will be paid by the Owner. Otherwise, the costs of Full Verification will be paid by the Party requiring the Escrow Agent to carry out a Full Verification. In the event that the Owner terminates this Agreement pursuant to clause 8 (*Termination*), the costs of a Full Verification shall be paid by the Operator.

9.4 If the Integrity Testing Services or Full Verification service identify any loss of data, corruption of data or incompleteness of data the TMM shall provide correct and complete replacement data within [_____] days of notification of any such loss, corruption or incompleteness at its cost, save where such loss, corruption or incompleteness is due to any act or default of the Escrow Agent in which event the Escrow Agent shall pay the TMM's reasonable costs in complying with its obligation under this clause.

10. NOTICES

10.1 All notices under, or in connection, with this Agreement will, unless otherwise stated, be given in writing by:

(a) hand or recorded delivery or sent by pre-paid first class post to the relevant party at the address for service set out below, or to such other address in the United Kingdom as each Party may specify by notice in writing to the other Party; or

(b) by electronic data transfer,

10.2 The address and electronic data transfer details of the TMM, Operator and Owner are as follows (or such other address or electronic mail details which may be subsequently notified by the relevant party):

TMM:	Address:	[_____]
	Name:	[_____]
	Email:	[_____]
Owner:	Address:	[_____]
	Name:	[_____]
	Email:	[_____]
Operator:	Address:	[_____]

	Name:	[_____]
	Email:	[_____]
Escrow Agent:	Address:	[_____]
	Name:	[_____]
	Email:	[_____]

10.3 Any such notice or other communication shall be deemed to have been received by the Party to whom it is addressed as follows:

(a) if sent by hand or recorded delivery, when delivered;

(b) if sent by pre-paid first class post, from and to any place within the United Kingdom, three Working Days after posting unless otherwise proven; and

(c) if sent by electronic data transfer, upon sending, subject to receipt by the sender of a "delivered" confirmation (provided that the sender shall not be required to produce a "read" confirmation).

11. GOVERNING LAW AND JURISDICTION

11.1 This Agreement and any non-contractual obligations arising out of or in relation to this Agreement are governed by English law.

11.2 The English courts shall have exclusive jurisdiction in relation to all disputes arising out of or in connection with this Agreement (including claims for set-off and counterclaims), including, disputes arising out of or in connection with:

(a) the creation, validity, effect, interpretation, performance or non-performance of, or the legal relationships established by, this Agreement; and

(b) any non-contractual obligations arising out of or in connection with this Agreement,

and each Party irrevocably submits to the jurisdiction of the English courts and waives any objection to the exercise of such jurisdiction.

12. TRANSFER

12.1 The Escrow Agent shall have no right to assign, transfer or novate its rights and/or obligations under this Agreement or any part thereof.

12.2 The TMM shall be entitled to assign, transfer or novate its rights and/or obligations under this Agreement or any part thereof to any Party to whom it assigns, transfers or novates its rights and/or obligations as permitted under the MSA.

12.3 Each of the Owner and the Operator shall be entitled to assign, transfer or novate its respective rights and/or obligations under this Agreement or part thereof to any Party to whom it assigns, transfers or novates its rights and/or obligations as permitted under the MSA.

12.4 Notwithstanding any of the foregoing provisions of this clause 12, each of the TMM, Owner and Operator agrees that it may only assign, transfer or novate its rights and/or objections under this Agreement to a third party to whom it has also assigned, transferred or novated its rights and obligations under the MSA, the TSA and the TSSSA.

13. VARIATIONS

A variation to this Agreement is valid only if it is in writing and is signed by or on behalf of each Party.

14. COUNTERPARTS

This Agreement may be executed in counterparts, each of which when executed and delivered shall be an original, and together constitute the same document.

15. DELIVERY

This Agreement is unconditionally signed and delivered on the date first above written.

16. ESCROW AGENT'S LIABILITY

16.1 The Escrow Agent shall not be liable for any loss caused to the TMM or the Owner either jointly or severally except for loss or damage to the Escrow Materials to the extent that such loss or damage is caused by the negligent acts or omissions of the Escrow Agent, its employees, agents or sub-contractors and in such event, the Escrow Agent's total liability in respect of all claims arising under or by virtue of this Agreement shall not (except in the case of claims for personal injury or death) exceed the sum of £[____].

16.2 The Escrow Agent shall in no circumstances be liable to the TMM or the Owner for indirect or consequential loss of any nature whatsoever whether for loss of profit, loss of business or otherwise.

16.3 The Escrow Agent shall be protected in acting upon any written request, waiver, consent, receipt or other document furnished to it pursuant to this Agreement, not only in assuming its due execution and the validity and effectiveness of its provisions but also as to the truth and acceptability of any information contained in it, which the Escrow Agent in good faith believes to be genuine and what it purports to be.

17. GENERAL

17.1 This Agreement and the MSA, the TSA and the TSSSA represents the whole agreement relating to the escrow arrangements between the TMM and the Owner and the Operator for the Escrow Materials and supersedes all prior arrangements, negotiations and undertakings.

17.2 This Agreement represents the whole agreement relating to the escrow arrangements for the Escrow Materials as far as the Escrow Agent is concerned and supersedes all prior arrangements, negotiations and undertakings.

17.3 The provisions of the Contracts (Rights of Third Parties) Act 1999 shall not apply to this Agreement and this Agreement shall not confer any right on a Third Party whether under that Act or otherwise.

IN WITNESS whereof this Agreement has been executed by the TMM, Owner, Initial Operator and the Escrow Agent on the day and date referred to above.

SIGNED FOR AND ON BEHALF OF
[*TRAIN MANUFACTURER AND MAINTAINER*]

DIRECTOR:

……..

DIRECTOR/SECRETARY:

……..

}

…….

……..…….…….

SIGNED FOR AND ON BEHALF OF
[*OWNER*]

DIRECTOR:

……..

DIRECTOR/SECRETARY:

……..

}

…….

……..…….…….

SIGNED FOR AND ON BEHALF OF
[***OPERATOR***]

DIRECTOR:

……..

DIRECTOR/SECRETARY:

……..

}

…….

……..…….…….

SIGNED FOR AND ON BEHALF OF
[**ESCROW AGENT**]

DIRECTOR:

……..

DIRECTOR/SECRETARY:

……..

}

…….

……..…….……

APPENDIX 1 TO SCHEDULE 22

DEFINITIONS

Terms defined in the MSA shall bear the same meaning when used in this Agreement, unless otherwise stated in this 0.

Agent Notice has the meaning set out in clause 8.1;

Applicable Requirement Event means that the TMM refuses or fails to comply with a request, made by a Competent Authority acting under Applicable Requirements, to provide access to any of the Escrow Materials, within the time required by the Competent Authority or the Applicable Requirements;

Applicable Requirements means (as the context may require) any law, statute, act, regulation, code, ordinance, rule, judgment, order, decree, directive or requirement or any similar form of decision or determination (or any official interpretation or administration of any of the foregoing) by any Government Authority applicable to the Parties in connection with the performance by the Parties of their obligations under this Agreement and shall include Industry Standards, Railway Group Standards but shall not otherwise include standards or voluntary codes of practice not having the force of law;

Competent Authority means the Department of Transport, ORR, Network Rail or its successor (in its capacity as the person responsible for (a) the issue of Railways and Other Guided Transport Systems (Safety) Regulations 2006, (b) Railway Group Standards and (c) the giving of other relevant consents under the Applicable Requirements), the Health and Safety Executive and any other local or national agency, authority, department, inspectorate, minister, ministry, official or public or statutory person (whether autonomous or not) of, or of the government of, the United Kingdom or the European Community;

Confidentiality Undertaking means the confidentiality undertaking set out in 0 (*Confidentiality Undertaking*);

Dispute means any difference, controversy, claim or dispute of whatever between any of the Parties arising under, out of or in connection with this Agreement;

Escrow Materials means those materials held or to be held by the Escrow Agent under the terms of this Agreement, namely all Source Codes (and any updates thereto);

Escrow Release Event has the meaning set out in 0 (*Escrow Release Event*);

Full Verification means those bespoke tests to be agreed between the Owner and the Escrow Agent for the verification of the Escrow Materials;

Integrity Testing Services means those tests detailed in the Integrity Testing Service (formerly known as the Standard Verification Service) published by the Escrow Agent from time to time, in so far as they apply to the Escrow Materials;

MSA means the manufacture and supply agreement between the TMM, the Owner and the Operator dated [_____];

Operator means, in the first instance, the Initial Operator for so long as it is leasing the Units, and subsequently any operator of railway passenger services on the Thameslink Network which may take the Units on lease from the Owner;

Party means a party to this Agreement;

Requesting Party has the meaning given to it in clause 5.2;

Software means all computer programmes:

(a) specifically produced by the TMM, any member of the TMM's Group or any Sub-Contractor pursuant to the MSA or which is proprietary to the TMM or to a Sub-Contractor and, in each case, which is installed in, or on a Unit, Vehicle, Simulator, Part, Spare or Special Tool; and

(b) specifically produced by the TMM, any member of the TMM's Group or any Sub-Contractor pursuant to the TSA and the TSSSA or which is proprietary to the TMM or to a member of the TMM's Group (but excluding the software comprising the Technical Records Database) and, in each case, used to maintain or diagnose problems or perform the TSA Services in respect of Units, Vehicles, Parts, Spares, Special Tools or Simulators and without which a replacement maintainer of the Units would be unable to perform services equivalent to the TSA Services;

Source Code means the source code version of Software which is supplied in a form capable of being read and interpreted by humans, together with related interpretative documentation and materials;

Third Party Escrow Materials means any Escrow Materials that are owned by any person other than the TMM or any member of the TMM's Group;

TSA means the train services agreement between the TMM, the Owner and the Operator dated [_____];

TSSSA means the technical support and spares supply agreement between the TMM (as Supplier), the Owner and the Operator dated [_____];

TSSSA Requirement Notice means a notice issued by the Operator to the TMM and the Owner in accordance with the terms of the TSA;

TSSSA Supplier Event of Default means a ***Supplier Event of Default***, as defined in the TSSSA; and

Working Day means a weekday (other than a Saturday or Sunday) on which banks are open for domestic business in the City of London.

APPENDIX 2 TO SCHEDULE 22

ESCROW RELEASE EVENT

Escrow Release Event shall be deemed to have occurred in the following circumstances:

[][330]

[330] Redaction.

APPENDIX 3 TO SCHEDULE 22

ESCROW AGENT'S FEES

Initial Fee: £[_____] payable upon invoice by the Escrow Agent.

Annual Fee: £[_____] payable upon invoice by the Escrow Agent and on each anniversary thereafter during the continuation in force of this Agreement.

Update Fee: £[_____] per update plus £[_____] per duplicate deposit, after the first update in any one year.

Storage Fee: such reasonable sum, based on the Escrow Agent's standard rates for such services as is agreed between the TMM and the Escrow Agent following the Escrow Agent's receipt of the first deposit of the Escrow Materials.

Release Fee: £[_____] for each release of any Escrow Materials plus copying and other reasonable expenses.

APPENDIX 4 TO SCHEDULE 22

CONFIDENTIALITY UNDERTAKING

1. We shall keep confidential the Escrow Material and save as provided in clauses below, we shall not reveal that Escrow Material to any third party save with the prior written consent of the TMM.

2. We shall require our employees who have access to the Escrow Material to be subject to appropriate confidentiality undertakings. We shall be responsible to the TMM for any abuse by the recipient employee of such Escrow Materials.

3. Where we are entitled to use the Intellectual Property Rights in the Escrow Materials in accordance with clause 26 (*Intellectual Property Rights*) of the MSA and in order to do so wish to disclose the Escrow Materials to a third party, the following provisions shall apply:

(a) we shall reveal the Escrow Materials only as reasonably necessary and shall at all times seek to minimise both the number of such third party recipients and the amount of Escrow Materials passed to such third parties as is reasonably necessary;

(b) we shall obtain an appropriate undertaking of confidentiality from all third party recipients of the Escrow Materials; and

(c) we shall not require any consent of the TMM to disclose the Escrow Materials where permitted to do so under clause 26 of the MSA.

4. The restrictions in paragraph 2 shall not apply in respect of the disclosure of an item of Escrow Material referred to above:

(a) to ORR or to the [_____] or the Financial Services Authority or the London Stock Exchange or the Bank of England where that item is required to be disclosed by law or by any written requirements of any taxation authority;

(b) to:

(i) any solvent member of our group companies; or

(ii) any financier or lawyers, accountants, insurers or others providing professional services other than any engineering or design services to us; or

(iii) any of our financiers provided that in any such case:

(A) we, acting reasonably, need to disclose that item in order to run our business, and

(B) (save with respect to lawyers or accountants) we have obtained an appropriate undertaking of confidentiality from persons

referred to in 4(b)(i), (ii) and 4(b)(iii) to whom disclosures are made;

(C) where the item is required in connection with any litigation provided that the disclosing party shall review only such Escrow Material as is reasonably necessary for such litigation; and we shall seek to minimise both the number of third party recipients of such Escrow Material and the amount of Escrow Material disclosed;

(D) where the item is in the public domain other than as a result of the breach of any obligation of confidentiality;

(E) where the item is required in connection with an assignment, transfer or other disposition of rights permitted hereunder where the proposed assignee or transferee has agreed in writing to be bound by the provisions of this Confidentiality Undertaking;

(F) where the item is required in connection with a sale or other disposition of shares in us or our parent company provided always that any recipient of such information has provided an undertaking of confidentiality in substantially the same form as this undertaking; and

(G) where the item was made available to us on a non-confidential basis.

5. In fulfilling our obligations under this Confidentiality Undertaking, we shall be required to use a proper standard of care, which shall in no event be less than the same degree of care to prevent unauthorised disclosure of the Escrow Material as we would use to prevent the disclosure of our own commercial and financial information of the same or similar nature and which we consider proprietary or confidential.

SCHEDULE 23

DESIGN AUTHORITY

Schedule 23 Design Authority

SCHEDULE 23

Design Authority

1. EFFECTIVENESS

The application of this Schedule 23 is subject to the issue by the Secretary of State of an Authorisation to Vary adjusting the Rental that is payable to the Owner under the Lease.

2. CONCEPT OF THE DESIGN AUTHORITY

2.1 In accordance with the Railway Group Guidance Note GE/GN8565, the TMM and the Owner have agreed to create a role with connected obligations to act as a design authority in respect of each item of Equipment required to be delivered to the Owner and/or Operator under this Agreement.

2.2 The key elements of the role of the design authority are to:

(a) maintain an authoritative design information repository relating to the Equipment;

(b) operate and maintain a system that tracks changes to the original designs (Managing the Design Authority) and changes to the configuration of the Equipment (Management of the Configuration level), provided that such changes implemented by the Operator or Owner have been notified to the TMM; it being understood that any changes required by the Operator or the Owner to the original documentation will have been implemented by the Operator or the Owner (as applicable);

(c) operate a system that can provide the "know why" (factors which influenced the choice of the design) in relation to design information relating to the Equipment; and

(d) operate a system that facilitates validation of technical changes to the current design of the Equipment.

2.3 [][331]

2.4 [][332]

3. DESIGN INFORMATION REPOSITORY

3.1 The TMM shall maintain the Technical Library in accordance with the terms of this Agreement.

3.2 In addition to the Technical Library, the TMM shall maintain a library of copies of all information which it creates (or is created on its behalf) or which is provided to it by the Owner or Operator and/or their agents and subcontractors (but with no obligation to verify such information at the time it is provided to it) relating to changes of configuration, modification or addition to any item of Equipment (***Equipment Changes***).

3.3 The Technical Library shall continue to be readily accessible in a location within the United Kingdom and will be sufficiently indexed (such indices to be made available to Owner

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[331] Redaction.

[332] Redaction.

and Operator upon their request) so that information contained in them is readily accessible. All information in the Technical Library and the indices relating thereto shall be maintained in the English language.

3.4 The TMM shall ensure that the Technical Library is adequately maintained, that the integrity and security is preserved at all times, and that sufficient measures are established to ensure the Technical Library is suitably protected and insured against loss, damage, destruction and theft.

3.5 The Owner or Operator and their agents and/or subcontractors (including the TSSSA Supplier) shall have unlimited access to the Technical Library at any time on reasonable notice and may take a reasonable number of copies of the Licensed Design Documents for the purpose of exercising their rights in the Licensed Design Documents under clause 26.10.

3.6 The TMM warrants that the contents of the Technical Library may be transferred to a third party design authority subject to clause 26 (*Intellectual Property Rights*) and clause 30 (*Confidentiality of Information*) but otherwise without infringing the rights of any third party.

4. DESIGN AUTHORITY MEETINGS

4.1 During each year of the Design Authority Term and on provision by the Owner of at least 28 days' written notice to the other Parties, the TMM, the Operator, the Owner and any other relevant Parties stipulated by the Owner, shall hold a meeting to discuss the impact of Equipment Changes on the documentation and information held within the Technical Library (***Design Authority Meeting***).

4.2 Each Design Authority Meeting shall be chaired by the Owner and attendance by one or more representatives of each of the Owner and the TMM shall be compulsory. If the Owner or the TMM is unable to attend the proposed meeting the Owner shall propose an alternative meeting date by giving at least 7 days written notice to the TMM, the Operator and any other relevant Parties. The Owner shall take the minutes for the Design Authority Meeting and shall provide the other Parties with draft and agreed minutes.

4.3 The agenda for each Design Authority Meeting shall include, in relation to Equipment Changes made in the preceding 12 month period:

(a) the value and merits of updating documentation and information held within the Technical Library in connection with any Equipment Changes in respect of which updates to the Technical Library have not been made, and the risks posed by not updating such information during the following 12 month period;

(b) any proposed changes to the documentation within the Technical Library in relation to such Equipment Changes;

(c) further improvements which could be made to the Equipment; and

(d) any other items relevant to the Technical Library and the TMM's activities as design authority.

4.4 At the end of the Design Authority Meeting and in any event no later than 5 days following it, the Parties shall decide the extent to which the TMM will update the Technical Library.

4.5 The Owner and the Operator shall be free to add materials to the Technical Library, provided these are in readable format when presented. Save as expressly provided otherwise in the MSA or the TSA, the TMM shall have no responsibility for the content of, or for up-dating any such materials added to the Technical Library by the Owner or the Operator, other than:

(a) at the request of the Owner or the Operator, replacing such materials with up-dated or new information or materials provided by the Owner or Operator; or

(b) converting or otherwise up-dating the format of the materials as reasonably necessary to ensure they continue to be accessible with the rest of the Technical Library.

4.6 Without prejudice to the TMM's obligations in respect of design in accordance with the MSA, the TMM will for the Design Authority Term, in respect of an amendment to the Applicable Specification, up-date all relevant documents in the Technical Library, subject to the TMM's receipt of an Authorisation to Vary (issued by the Secretary of State pursuant to schedule 4.3 (*Secretary of State Authorisation of Variations*) of the Umbrella Agreement (or, after the expiry or termination of the Umbrella Agreement, schedule 5.3 (*Secretary of State Authorisation of Variations*) of the Maintenance Direct Agreement) from the Party who has initiated such amendment.

5. PROVISION OF KNOW WHY AND VALIDATION OF TECHNICAL CHANGES

[][333]

6. INDEXATION

Indexation Adjustments

6.1 The Parties acknowledge and agree that, for each Railway Year during the Design Authority Term, the Design Authority Fee shall be subject to adjustment in accordance with the following formula:

[][334]

6.2 [][335]

Changes to the Indices

6.3 If the index referred to in paragraph 6.1 ceases to be published, or there is a material change in the basis of the index or if, at any relevant time, there is a delay in the publication of the index, then any Party may make a Variation Proposal as to an alternative appropriate index to apply with each Party bearing its own costs in respect of the preparation and review of such Variation Proposal.

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[333] Redaction.

[334] Redaction.

[335] Redaction.

Base Date of Indices

6.4 If the index specified in paragraph 6.1 is superseded by an index with a base date which is later than the base date of the index specified in paragraph 6.1, the superseding index shall be used or an index with a later base date, as the case may require.

Provisional Indices

6.5 Where an index is published as "provisional" and is subsequently amended:

(a) the calculation of any applicable adjustment may be undertaken using the published provisional index and invoices may be rendered accordingly;

(b) any published amendment to the provisional index shall result in recalculation of any application adjustment; and

(c) such recalculation shall be retrospective for the relevant period, and the Party disadvantaged by the amendment to the provisional index shall be entitled to recover the difference in the value of any invoice calculated on the basis of an amended provisional index.

Calculation of Indexation Adjustments

6.6 The indexation adjustments to be made to the Design Authority Fee during the Design Authority Term shall be calculated prior to the start of the Railway Year in which they will apply, and the TMM shall prepare an initial calculation of such adjustments no later than 1 March in the immediately preceding Railway Year.

Decimal Places, Rounding

6.7 All calculations pursuant to this paragraph 5 shall be to two decimal places rounding up at 0.xx5 or above and rounding down otherwise (for example, 99.995 = 100.00 and 99.994 = 99.99).